The Middle Paleolithic and Early Upper Paleolithic of Eastern Crimea

Edited by

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The Paleolithic of Crimea, III

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Cover: Environs of Buran-Kaya. Photo by Anthony E. Marks.

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Preface

This is the third volume of final reports produced by the Crimean Paleolithic Expedition that began joint field investigations ten years ago. After years of excavations at Middle Paleolithic sites in the western part of Crimea (Marks and Chabai, eds. 1998; Chabai and Monigal, eds. 1999), it became obvious that the study of Middle Paleolithic variability in Eastern Crimea was necessary to put the initial work into a broader geographic perspective. In addition, the test excavations of Buran-Kaya III rockshelter, being carried out by Dr. A. A. Yanevich, provided a rare possibility to study both Middle and Early Upper Paleolithic industries in a single stratigraphic sequence. In 1996, A. E. Marks and A. A. Yanevich began joint excavations at Buran-Kaya III, with Yanevich concentrating on the Upper Paleolithic deposits and Marks on what was then thought to be wholly Middle Paleolithic deposits. These excavations produced both unexpected and significant results: the Upper Paleolithic occupation of Levels C and E were found stratigraphically below the Middle Paleolithic, Micoquian Kiik Koba facies occupation of Layer B. This was the first time in Europe where a single stratigraphic sequence proved that a Middle Paleolithic occupation was absolutely and undeniably younger than early Upper Paleolithic occupations.

In the course of a survey carried out during the same field season, V. P. Chabai and A. I. Yevtushenko found the new Middle Paleolithic site of Karabi Tamchin, as well as confirming the presence of in situ Pleistocene sediments at the famous site of Chokurcha I, which had been excavated during the late 1920s and early 1930s. As a result of this work, these three sites Figure 1) became the main focus of activity for the Crimean Paleolithic Expedition for the next four years. The reports contained in this volume are the product of this work.

Over time, our understanding of Crimean Middle Paleolithic variability has shifted. When we began work, the accepted framework for the Crimean Middle Paleolithic included four different industries: the Ak-Kaya, the Kiik Koba, the Staroselian, and the Western Crimean Mousterian. By 1998, however, based on work in western Crimea, it seemed clear that only two Middle Paleolithic traditions existed, a Western Crimean Mousterian and a Micoquian with three facies (Ak-Kaya, Kiik Koba, and Staroselian). Our more recent work in eastern Crimea has certainly reinforced the perception that the Micoquian consists of these three facies, the variability of which were determined by a combination of site activities, distance from raw material, and occupational intensity. In addition, the presence of Western Crimean Mousterian in eastern Crimea, at Karabi Tamchin, suggests that, at the very least, its name is not fully appropriate. Here, as with the other excavations, it is apparent now that the traditional distinction between eastern and western Crimea has little meaning for Middle Paleolithic site distributions and Crimea may best be considered as a single geographic area, at least during the Middle Paleolithic.

Aside from the necessary descriptive reports on recovered paleoenvironmental data, lithic assemblages, absolute and relative chronology, economic adaptations of the different occupations, this volume also includes a number of studies of artifact and site use, based not only on traditional microwear analyses but also on new, quite creative interpretations of the meaning of intra-assemblage technological and raw material variability. These add another dimension to local Paleolithic studies, proposing many provocative

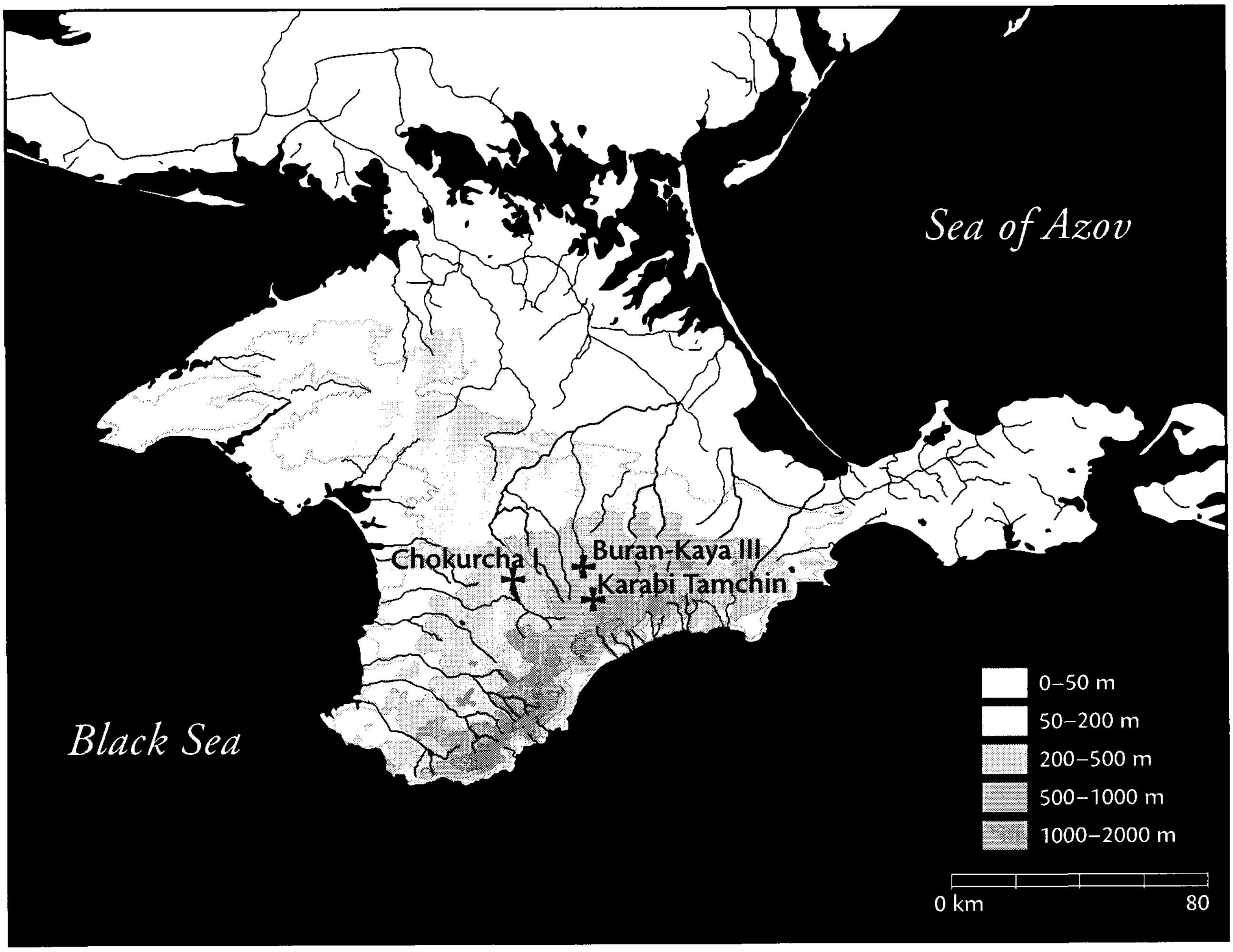

Figure 1—The western Crimean sites of Buran-Kaya III, Karabi-Tamchin, and Chokurcha I.

interpretations. As always, time will tell whether these new perceptions will permit new and more meaningful analyses and understanding of the Middle Paleolithic. At the very least, they are truly thought-provoking.

The final chapter attempts to place our Crimean work into the larger context of Eastern Europe. At best, it is an initial formulation and, as work progresses in Crimea and other areas of Eastern Europe, our understanding of inter-regional relationships will undoubtedly change. Such is the nature of archaeological research.

Six different sources supported the field and laboratory investigations published in this volume, including a grant to A. E. Marks from the National Science Foundation for the 1996 work at Buran-Kaya III, Karabi Tamchin, and Chokurcha I (SBR-9506091) and a grant from the International Association for the Promotion of Cooperation with Scientists from the New Independent States of the Former Soviet Union (INTAS-93-203-ext) to M. Otte and V. P. Chabai for the 1997–1998 work at Buran-Kaya III. Additional support came from an anonymous donor to A. E. Marks for the 2001 field season at Buran-Kaya III, with a small contribution from the *Deutsche Forschungsgemeinschaft* (DFG) project ZI 276/7-1 to J. Richter and A. E. Marks. This same DFG project funded the 1999 excavations at Karabi-Tamchin. During 2000 and 2001, the excavations at Karabi Tamchin were made possible by a grant to A. Burke from the Social Sciences and Humanities Research Council of Canada (SSHRC). Funding from the DFG to J. Richter and T. Uthmeier for the project entitled "Funktionale Variabilität im späten Mittelpaläolithikum der Halbinsel Krim, Ukraine" (grant numbers ZI 276/7-2 and RI 936/3-3) permitted continued field work at Chokurcha I and the analyses of the recovered lithic and medium/large faunal material at that site (Chapters 21, 22, 24), as well as supporting the ornithological analysis by Gavris and Taykova (Chapter 6) and secondary analyses by Richter, Uthmeier, and Kurbjuhn (Chapters 11–14) of the Middle Paleolithic material at Buran-

Kaya III. Aside from supporting actual field work, all these grants supported the needed specialist studies and the laboratory work following the field seasons, which made this volume possible. Both the editors and the numerous authors whose reports are found in this volume are deeply appreciative of this complex of international support, without which none of this work would have been possible.

Some additional support needs to be mentioned. V. Laroulandie and F. d'Errico's study of the Buran-Kaya III Level C worked bone assemblage was supported by the CNRS program "Paléoenvironnement et évolution des hominidés" and the OMLL/ESF program "Origin of Man, Language, and Languages." Helpful discussions with Joao Zilhão, Cedric Beauval, Marian Vanhaeren, and Jean-Luc Guadelli improved the paper, while they give special thanks to François Lévèque who kindly shared with them unpublished data from Saint-Césaire. Lithic illustrations in Chapters 4 and 5 are by Katherine Monigal, in Chapter 9 by Vitale Usik, in Chapter 20 by Katherine Monigal and Alexander Yanevich, and in Chapter 24 by Alexander Yanevich. Christian Smith provided aesthetic advice and technical support during the design and production of this volume. The publication of the volume was made possible by the anonymous donor fund to A. E. Marks.

The authors of this volume excavated the sites together with their friends and colleagues. Each of them deserves our gratitude:

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Part I:
Buran-Kaya III

1

Introduction to the Site of Buran-Kaya III

Katherine Monigal

Buran-Kaya, an archaic Tatar name meaning "nose rock," is a steep bluff about 10 m high and 40 m wide on the eastern bank of the Burulcha River. The bluff is among the gentle rolling hills and broad valleys that typify this part of the Belogorsk region on the northern side of the Internal (Second) Range of the Crimean Mountains. The surrounding landscape forms part of the New Euxinian forest sub-province of the Crimean Mountains, characterized by wide meadow grass steppes and thin oak forests in the river valleys (Barbarych 1977).

Three Stone Age sites were discovered here in 1936 by O. N. Bader: Buran-Kaya I Cave, Buran-Kaya II Rockshelter, and Kilse-Koba (Bader 1957). These contained Mesolithic and Neolithic cultural remains and were excavated by Bader and M. D. Gvozdover in 1957–1958 (Bader 1976). Buran-Kaya III, a partially collapsed rockshelter with a southwestern exposure, was discovered and named by A. A. Yanevich in 1990. This site, 45°00'N, 34°25'E is located about 10 m above the present-day level of the Burulcha, 314 m above sea level, 4 km southwest of the village Aromatnoye and 20 km east by northeast of Simferopol. Presently, the area sheltered by the cliff face encompasses an area roughly 5 m east to west and 3 north to south.

The first test excavations at Buran-Kaya III were carried out in 1990 and consisted of a 4 m² sondage in squares Д10–11 and E10–11 with a depth of 2.5 m, and extended in square Д10 to just above bedrock (Yanevich et al. 1996) (Figure 1-1). Thirteen archeological layers were recognized in the 3.5 m deep sondage, ranging in age from late Bronze Age through Middle Paleolithic. Excavations at the site were continued in 1994, with the collaboration of M. Yamada of the Institute de Paléonotologie Humaine, Paris, who took the responsibility of studying the Middle Paleolithic layers of the site, layers 7–10. The 1994 excavations consisted of a 2 × 3 m trench adjoining the north wall of the initial sondage (Yamada and Yanevich 1997) (Figure 1-1). Yamada's study of the Middle Paleolithic material (Yamada 1996) led him to suggest that the layers be grouped into two phases. The lower phase (layers 10–9) was characterized by bifacial tools and

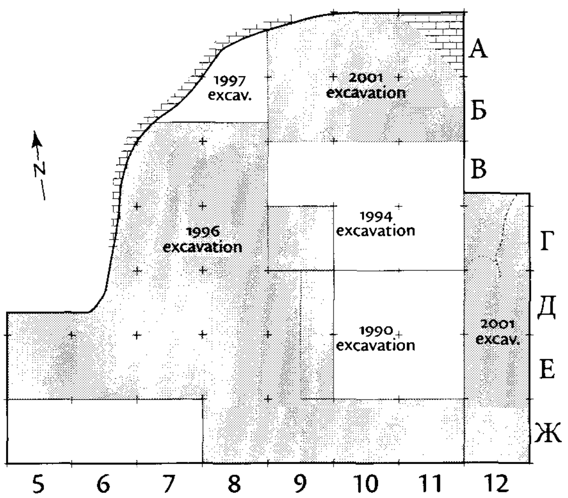


Figure 1-1—Site plan of Buran-Kaya III showing excavations by year.

foliated points, and the upper phase (layers 8–7) was characterized by Mousterian points and sidescrapers, Kiik-Koba type points, centripetal and bifacial reduction, and an absence of large bifacial tools (Yamada 1996:16). He also noted that the upper part of layer 7 was intermediate between the Middle and Upper Paleolithic, where Kiik-Koba points disappeared and forms such as nosed and carinated endscrapers appeared.

Under an agreement between Yanevich and the Joint Ukrainian/American Project and with the participation of M. Otte from the Université de Liège, excavations at Buran-Kaya III were continued in 1996, 1997, and 2001 with A. E. Marks taking responsibility for the excavation and analyses of all Middle Paleolithic layers, and A. A. Yanevich taking responsibility for the excavation and analyses of more recent materials. The 1996 excavations concentrated on the area to the west and south of the previous excavations, and reached bedrock or the sterile sands overlying bedrock in most squares (Figure 1-1). In addition, to obtain in situ Aurignacian and Gravettian materials, a 20 cm portion of the north wall along squares Б6–9 was excavated by a team from the Université de Liège. Excavations in 1997 were conducted to continue the U.Lg. project (concerned with the Upper Paleolithic of CIS countries), and were limited to the northwesternmost corner of the site. In an effort to enlarge the samples of lithic material from the lowermost layers, excavations in 2001 concentrated on the other extant portion of the site, to the north and to the east of previous fieldwork (Figure 1-1). It is these most recent excavations, 1996–2001, that provided the data for the analyses presented in Chapters 2–14 of this volume.

Excavation Methodology

By the time the Joint Ukrainian/American team began work at the site, Yanevich and his collaborators had recognized six geologically-defined strata containing Middle Paleolithic cultural layers (strata 7–12, cultural layers 7–10), which were subdidvided into at least 15 artificial 5–10 cm-thick spits that followed natural geological contours, but which were occasionally defined as "fireplaces," "lens," etc. (horizons 24–38). All of these proved fairly impossible to recognize on the ground at the beginning of the 1996 field season in the east-west baulk along line B–E8/9, in the north profile along line B/Б7–9, or in the east profile of Г–Ж11. Owing to the lack of a coherently published geological description and excavation methodology of the site for 1990–1994, is was even impossible to tell whether the distinctive sediments of what would later be called Level B1 were part of Yanevich et al.'s layer 8, or a continuation of their layer 7. It was therefore decided to renumber, alphabetically, the Middle Paleolithic layers visible at the start of the 1996 season based on their sedimentological characteristics. This resulted in Levels A, B, B1 (Levels B and B1 are grouped as Layer B), C, D, and E, all of which contained distinct cultural material, and which were sometimes separated by (unnamed) sterile deposits (Figure 1-2). Although geologic units (Roman numerals I–VIII) were identified for the entire depositional sequence at the end of the 1996 field season and have been noted in previous publications (e.g., Marks 1998; Monigal 2001), no comprehensive description by a professional geologist has been conducted for Buran-Kaya III, and those geological units are eschewed in the description below.

The alphanumeric grid system (1-m^2-units) and datum point established by Yanevich during his first season of excavation were also used during subsequent excavations of Buran-Kaya III in 1996, 1997, and 2001. Excavations of the lower sequence (Level A through Level E) followed the natural stratigraphy of the deposits. Sterile sediments were removed with the aid of picks and shovels, while the excavations of the cultural layers were conducted with trowels, knives, and brushes. The occasional recalcitrant boulder or limestone slab was broken up by a sledgehammer in order to remove it from the excavation area. All excavated sediments were sieved; during the 1996 and 1997 seasons by dry screening through 5 mm mesh, and during the 2001 season by water screening through two to three nested screens (5 mm, 3 mm, 1.5 mm).

Plans of each cultural level were drawn at a scale of 1:10. These maps, drafted by a professional artist using the notational system common to Crimean Paleolithic excavations, included major features such as boulders or large rocks, burned sediments, pebbles (potential hammerstones), and special samples for palynological and radiometric analyses. Animal bone that was rabbit-sized or larger and had a maximum dimension greater than 3 cm, and all flint artifacts, including chips as small as 1 cm, were mapped and most of their elevations were recorded both on the plans and on the artifacts themselves. In addition, any item that appeared (in its still unwashed state) to be a tool or core was given a unique identifying number specific to the square and level. This field number was noted on the plan and on the artifact. In the event that a tool was not recognized as such in the field, its grid position could usually be reconstructed by its depth measurement. It should be noted that the prodigious density of the Layer B material in the central portion of the site during the 1996 excavations—up to 2,000 pieces per square meter—rendered mapping of all material unreasonable. Instead, only lithics more than 3 cm in largest dimension and bones greater than 5 cm were mapped.

Deviations from this methodology occurred in 2001 for squares Г12–Ж12. Before these were excavated, it was noted that Levels B, B1, and C, clearly visible in the wall of Г11/12, stopped partway into Д11/12 and from here to the south wall, the entire lower sequence appeared disturbed. All deposits along this line also had a 26° north to south inclination. Levels B, B1, C were intact in the northwest quadrant of square Г12, but there was a washed area in the western sector towards a pit in the southwest quadrant (see Figure 1-6). All cultural remains were therefore bagged separately as intact, washed, or from the pit; Swiderian, Azillian, and Gravettian type artifacts occasionally appeared in the latter two. Sediments in part of Г12 were cemented, all bone was in poor condition due to water damage, and artifacts were frequently on edge as well. The remaining squares, Д12–Ж12, containing obviously disturbed deposits, were dug with a trowel, water screened, and mapped as long as artifacts were present, and were numbered as sub-levels of Layer 5 for the upper sequence, and as levels 10 and 11 for the lower sequence, based on changes in lithology, color, and gravel content. Despite the care taken, no intact cultural layers were found in this section of the site; levels 10 and 11 contain Kiik-Koba points, distal tips of foliates reminiscent of Level C, *Theodoxus* shells, Azillian points, Epi-Gravettian points, bladelets, microliths, and debitage derived from a minimum of five unrelated reduction strategies, including prepared flake core, bladelet core, non-volumetric blade core, and *façonnage*. Sterile alluvial sands were found at the base of these western deposits and presumably overlie bedrock.

Stratigraphic Description

A total of 50 m² has been excavated at Buran-Kaya III, of which about 8 m² are mostly mixed and redeposited sediments (easternmost and western most lines). The main stratigraphic sequence at the rear of the shelter (Figure 1-3A) is 3.1 m deep and covers an interval of time from the Medieval Ages to the late Middle Paleolithic. Owing to the steep slope of the bedrock at this north profile, Level C is very thin and immediately overlies over bedrock; Levels D and E did not extend this far north. The west profile (Figure 1-3B) shows what remained of the sediments of the lower part of the sequence when the joint Ukrainian/American excavations began in 1996; the true thickness of Level B is not show in this representation. The collapse of the shelter ceiling, along with levels D and E and the alluvial sediments at the base of the sequence only occur from line Г southwards toward the rear wall. The stratigraphy seen the profiles of Figure 1-3 is summarized below.

1 — Loose dark brown silty clay with poorly sorted *éboulis* and large limestone blocks. Contains Medieval Age remains.

2 — Loose, grey sandy loam sediment with a significant content of limestone debris, which is medium to large in size and slightly rounded. Contains Bronze Age material.

2a — Identical to level 2, only the limestone debris becomes smaller and less dense. Culturally sterile.

3 — Slightly cemented yellow loamy sediment with medium to large clasts and some ash. Near the west wall, there is a travertine and the limestone debris is larger in size and more dense. Contains Bronze Age material.

3a — Concreted light grey loamy sand and scattered ash with small, angular *éboulis*. Contains Neolithic material.

4 — Dark grey loam with medium and fine angular *éboulis* that becomes denser towards the east. Contains Swiderian (Final Paleolithic) material.

4a — Dark grey loam with a negligible amount of fine angular limestone debris. Contains Swiderian cultural material.

5 — Relatively loose pale yellow loess with fine to medium sized *éboulis*, which is slightly rounded. Contains Shan-Koba (Final Paleolithic) material.

6 — Loess with a significant amount of fine and some medium sized slightly rounded *éboulis*. This level is subdivided into several sublevels based on differences in color and the size and amount of *éboulis*. Sublevel 6a is relatively loose brownish-yellow sediment with medium and small slightly rounded *éboulis* and larger, isolated limestone blocks, and contains cultural level 6-1. Sublevel 6b is relatively loose dark grey sediment with a lens of lighter brown sandy sediment and slightly rounded *éboulis* and isolated larger limestone blocks, and contains cultural level 6-2. Sublevel 6c is slightly concreted light brown loamy fill with poorly sorted and slightly rounded *éboulis*, containing cultural layer

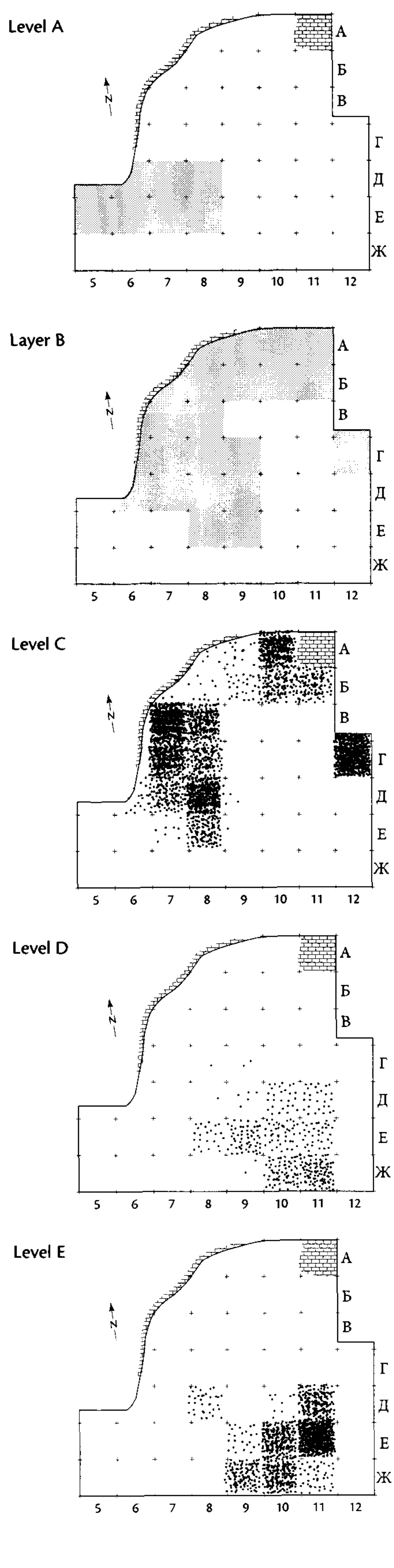


Figure 1-2—Relative spatial distribution of all lithic material from the Middle Paleolithic levels. Counts unavailable for Level A and Layer B.

6-3. Sublevel 6d is slightly concreted dark grayish brown to dark grey loamy fill with slightly rounded, poorly sorted *éboulis* and isolated larger limestone cobbles and contains cultural layer 6-4. Sublevel 6e is relatively concreted light brown fill with poorly sorted, slightly rounded *éboulis* and contains cultural layer 6-5. Levels 6-5, 6-4, and 6-3 have been attributed to the Aurignacian and levels 6-2 and 6-1 to the Gravettian (Janevic 1998).

A — Loose, light tan silty-sand sediment with poorly sorted *éboulis* ranging from very fine to large platy rubble. This layer is in secondary position and was only present in the western part of the 1996 excavations (Figure 1-2). Contains material of unknown provenience and age, although mostly of a late Middle Paleolithic character.

B — Slightly cemented yellowish-brown clayey sand sediment with small (2 cm) and medium (5–8 cm) sized flat angular *éboulis* that are horizontally bedded and relatively dense throughout the matrix. Contains Kiik-Koba material.

B1 — Dark grey to black clayey sand sediment with small (2 cm) to medium (5–8 cm), as well as frequent larger-sized (8-12 cm) flat, angular *éboulis*. Differs from Level B in color—the dark grey to black appears to have been the result of several, now-destroyed, hearth areas—and in having slightly more dense *éboulis*. Contains Kiik-Koba material.

Sterile sediments between B1 and C — Wet, clayey, dark brown sediments interspersed with very fine (0.2–1 cm) gravels. Contains no archeological material and varies in thickness from 1–10 cm.

C — Fine, sandy silt deposits in pea gravels, tan in color, 10–25 cm in depth, with relatively little *éboulis* that does not exceed 5 cm in size. Contains Eastern Szeletian (Streletskaya) cultural remains.

Rockfall — Coarse yellow to buff-colored *éboulis* with poorly sorted angular to subangular limestone fragments 0.5–40 cm in size, in a very pale brown sandy silt matrix. It is thickest (75 cm) at the southern limit of excavations and progressively thins out northwards to line Г. This is assumed to be related to a significant spalling of the shelter's ceiling during a cold period.

D — Brown fine sandy silt with small (< 4 cm) angular limestone rubble and cobble clasts. Contains a culturally-unattributed lithic assemblage, which has some slightly damaged edges, suggesting that the material has been moved.

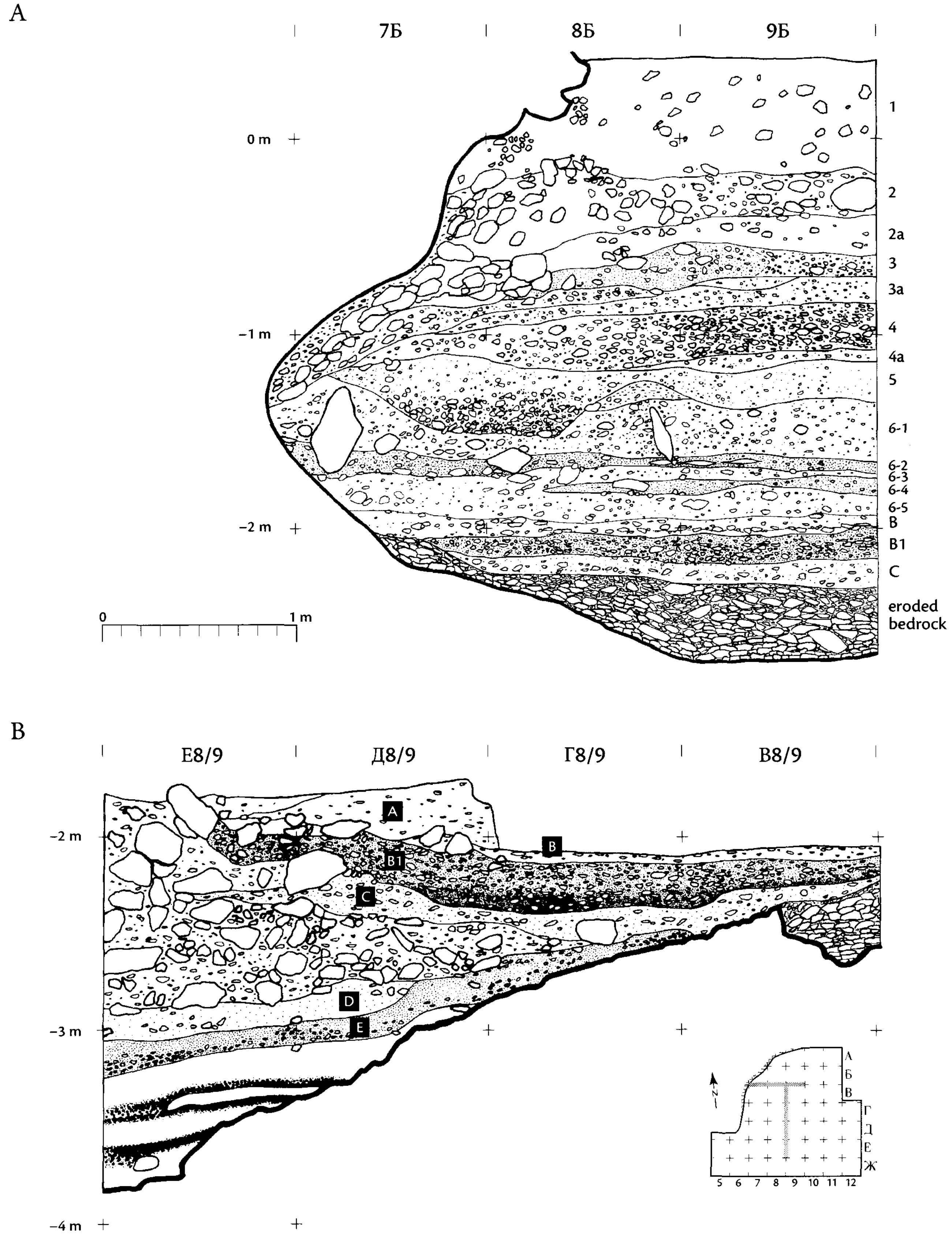


Figure 1-3—Sectional profiles of Buran-Kaya III: A–north profile line В/Б 7–9; B–west profile line В–Е 8/9. Inset shows locations of profiles on a plan of the site.

E — Light yellowish brown sandy silt with very small (< 3 cm) angular *éboulis* and root clasts. Contains a culturally-unattributed lithic assemblage (unrelated to Level D) with blades.

Alluvial deposits — Directly below Level E, there is a series of horizontally bedded alluvial deposits. The beds are soft orange sand sediments with round 0.2–3 cm quartz gravels, alternating with soft, very fine yellow-orange sands with round quartz gravels smaller than 0.5 cm. There are no other alluvial sediments in the shelter; they are limited to the base of the archeological sequence, before human inhabitation of the shelter.

The bedrock supporting the site dips abruptly north to south: there is an approximately one meter difference in its depth between the northern and southern walls of the excavation (Figure 1-3B). The alluvial sediments were banked in against the bedrock, and thereby leveled off the floor of the shelter. As a result, the levels of the lower part of the sequence (B–E) are fairly horizontal, and other than Level D, show no evidence of having been moved, cut, or redeposited.

The stratigraphic sequence of Buran-Kaya III is very complex, with about twenty lithologically and archeologically distinct levels within nearly 4.5 m of deposits. There are very few sterile horizons; those that do occur are quite thin and/or variable in thickness across the site. The Pleistocene part of the sequence (Level 5 and below), furthermore, is less than 1.5 m in depth, which suggests very slow sedimentation rates and thin, non-ruderal occupations. Yet, Crimean Paleolithic sites have generally been characterized as having high sedimentation rates (e.g. Chabai et al. 1999), and this would naturally be assumed to be the case in a south/southwest facing shelter at the base of a bluff where colluvium and exfoliation would be exacerbated by seasonal variations in temperatures and humidity, and what appears to have been only a thin vegetational cover due to the overall aridness of the period in which the lower sequence was deposited.

Absolute Dating of Buran-Kaya III

A total of sixteen AMS dates have been obtained on material from the Buran-Kaya III sequence, all carried out by the Radiocarbon Accelerator Unit, Oxford University, Great Britain (Table 1-1). Additional attempts at absolute dating have been unsuccessful. No substantial concentrations of charcoal were found, at least in the lower part of the Buran-Kaya III sequence. Wood residue, discovered on a tool from Level C and submitted to the Oxford Laboratory, could not be dated, while bird bone from the same level failed assays due to low collagen content. Two dosimeters for ESR and U-series dating were placed in Layer B and Level C in the north profile of the 1996 excavations (squares 7–9Б), but these were stolen by local vandals over the ensuing year.

The first series of five dates that was run (OXA-4126–4130) were submitted to the Oxford Laboratory in 1993–1994 by P. Allsworth-Jones as part of a dating program of Paleolithic sites in the CIS (Hedges et al. 1996; Allsworth-Jones 2000). The material in this series had been collected during the first test excavation (1990) by Yanevich before the archeological sequence was well understood. The samples originated from squares 2–3 meters from the north profile uncovered in 1994 (line B) to which they were later correlated based on their elevations. Since the sediments have a slight inclination southwestwards towards the river in this area, their positional extrapolation some years later to the cultural layers visible in the wall was problematic. Two very consistent dates of ca. 11.9 kyr (OXA-4126, -4127) were obtained from square Д11, Level 6/horizon 8 and Level 6/horizon 9. These horizons, however, contained Aurignacoid material. Yanevich has suggested that perhaps they related to the Shan-Koba culture (with which the dates are compatible): although no material of this type was found in this square, this was an area where

TABLE 1-1
Absolute dates from Buran-Kaya III

Level	*Industry*	*Lab #*	*Date*
3A	Neolithic	?[1]	5,070 ± 40
3A	Neolithic	?[1]	5,180 ± 50
4A	Swiderian	?[1]	10,580 ± 60
4A	Swiderian	?[1]	10,920 ± 65
6-3 (horizon 6:8)	Aurignacian	OXA-4126[2]	11,900 ± 150
6-4 (horizon 6:9)	Aurignacian	OXA-4127[2]	11,950 ± 130
6-5 (horizon 6:10)	Aurignacian	OXA-4128[2]	28,700 ± 620
7 (horizon 7:1)	Kiik-Koba	OXA-4129[2]	33,210 ± 900
7 (horizon 7:2)	Kiik-Koba	OXA-4130[2]	32,710 ± 940
6-2	Gravettian	OXA-6882[3]	30,740 ± 460
6-5	Aurignacian	OXA-6990[3]	34,400 ± 1,200
B1	Kiik Koba	OXA-6673[3]	28,840 ± 460
B1	Kiik Koba	OXA-6674[3]	28,520 ± 460
C	"Streletskaya"	OXA-6672[3]	32,350 ± 700
C	"Streletskaya	OXA-6869[3]	32,200 ± 650
C	"Streletskaya	OXA-6868[3]	36,700 ± 1,500

1 Gerasimenko, Chapter 2, sample type unknown; 2 Hedges et al. 1996, AMS on bone; 3 Pettitt 1998a, AMS on bone.

the layers began to more steeply slope to the south and east (Yanevich in Hedges et al. 1996).

The date from level 6 horizon 10, OXA-4128, pertained to the base of the Upper Paleolithic layers. The initial sondage of 1990 yielded some bifacially worked points among the early Upper Paleolithic material and the layer was likened to the Streletskaya culture (Hedges et al. 1996:189). (N.B. this likening did not pertain to the material from Level C, now often referred to as Streletskaya, which occurred deeper in the sequence.) At ca. 28 kyr, this date was within expectations, and subsequently corroborated by dates of a similar age from the Aurignacian at Siuren I (Chabai 1996).

The two dates from the Kiik-Koba layer 7/horizon 1 and layer 7/horizon 2 were very consistent (ca. 32 kyr), but inverted. These have often been considered untenable, because of the inversion and questions about the provenience of the samples (Marks and Monigal 2000). Alternatively, it has been claimed that the dated material was from mixed (during Yanevich's excavations) material of Layer B and Level C (Chabai et al. 2001:63), although this seems highly unlikely given the lithology of the deposits and Yanevich's penchant for recognizing even very localized lenses of darkened sediments as new horizons.

Subsequent dating assays on material from the 1996 excavations, the proveniences of which were certain, were not consistent with the first set of AMS dates. As a result, the first set has often been selectively dismissed or gone unreported in publications (e.g., Marks 1998; Monigal 2001; Marks and Monigal 2003). A sample from the Gravettian level 6-1 (OXA-6882) provided a date of 30,740 ± 460, while the sample from the "Aurignacian" level 6-5 (OXA-6990) provided a date of 34,400 ± 1,200. This latter date was considerably older than that obtained from the lowermost Aurignacian in the first AMS series, although both of these dates fall within traditional expectations of the time range for the Gravettian and Aurignacian industries.

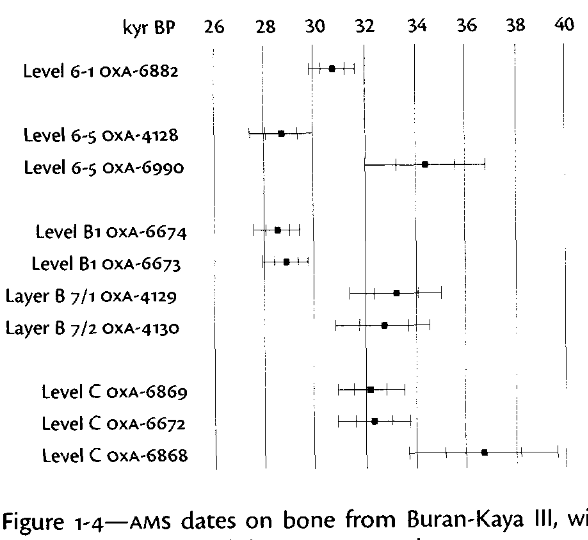


Figure 1-4—AMS dates on bone from Buran-Kaya III, with one and two standard deviations. Not shown are OXA-4126 and OXA-4127 at ca. 11.9 kyr BP.

The two dates obtained on material from the 1996 excavations of the Kiik-Koba Level B1 (OXA-6673 and -6674, ca. 28 kyr), which are internally consistent, are younger than the above-quoted two dates for the Gravettian and Aurignacian, and considerably younger than the dates from the first AMS series obtained for layer 7. While the Kiik-Koba dates of ca. 32 kyr were initially thought to be problematic, since this industry was conventionally assumed to date around 50,000 years ago, the dates of ca. 28 kyr for the same level were more easily accepted. Investigations at sites such as Kabazi II and Siuren I have recently indicated that the Middle Paleolithic lasted an exceptionally long time, and the Upper Paleolithic made a rather tardy appearance in Crimea. Thus, these remarkably late dates for Buran-Kaya III Kiik-Koba—which only a few years ago would have been viewed as aberrant—appear to fit comfortably within the newly emerging picture of Crimean occupation by multiple, migratory groups of peoples.

Dates from the immediately underlying Level C appear reasonable, being older than the Kiik-Koba dates and within the expected time range for a lithic industry of this type. Two of these are statistically the same and around 32 kyr BP. One of these, OXA-6869, was from a bone haft collected in the 1994 excavations and correlated to this level (see Figure 5-19: *8*). The third date from Level C, run on a bone tube whose provenience is unquestionable, is somewhat older at 36,700 ± 1,500 BP and barely overlaps the other dates at two standard deviations (Figure 1-4).

Rather than selectively choosing among the dates of the first and second series of AMS assays, all of these dates are better viewed with caution until the calibration of the radiocarbon chronology is refined. The extreme variations in atmospheric radioisotope production and deposition during OIS 3 suggest that ^{14}C dates may be six thousand, and up to ten-thousand, years younger than the actual time of occupation (Beck et al. 2001; Van der Plicht 2002; Voelker et al. 2000). Radioisotope concentrations in archeological material show even more fluctuations due to the reservoir effect, resulting in inconsistently young/old dates for material that was deposited simultaneously (Richards and Beck 2001). The anomalous, inverted, and/or inconsistent dates in the lower levels of Buran-Kaya III might therefore be entirely the result of fluctuations in atmospheric ^{14}C and its deposition rather than any disturbance of cultural levels or excavation error.

In the absence of independent chronometric controls, the apparent ambiguity of the radiocarbon dates may find verification, at least partially, in the paleoecological studies that have been carried out at the site, summarized below.

Overview of Occupations in Levels A–E

Level A was present only in the western sector of excavations in squares E5–8 and Д6–8. It was assumed during excavations that the material and matrix were derived *en masse* from above and to the west of the rockshelter, although it seems post-depositional erosion played a part as well. Lithics from the westernmost squares (line 5: figure 1-2) were often on edge and show edge damage, but the remainder of the material does not; in fact, many pieces are in pristine condition. Very small chips were also present in the eastern squares of Level A. At the easternmost extension of Level A, the level lies directly on top of B1 sediments, as seen in Figure 1-3B (Level B was not present in this area) and the faunal material, which was scattered among large boulders, had the same appearance and condition of the underlying level. In a few instances, large faunal remains, the upper parts of which were clearly in Level A sediments, were found to belong to the underlying Level B1. Hence, the Level A was deposited after there had been some erosion of Layer B sediments in the front of the rockshelter.

The lithic material of Level A, which has not been analyzed, is, without a doubt, mixed, but much of the material shares enough distinctive technological and typological traits to more or less define the assemblage while rejecting other pieces as intrusive. Unifacial points are the most characteristic feature in Level A. These are all off axis, frequently cortical, often ventrally thinned, and in cross-section are flat and fairly thick (the ventral profiles in Figure 1-5 appear twisted and incurvate because they are drawn according to the axis of the tool, not the axis of debitage). They are fairly large, ranging in size between 3.5–6 cm (about twice as large as typical Kiik-Koba points) and have thick, roughly faceted platforms with unlipped, very salient bulbs of percussion. In the few instances of non-cortical points, the scar patterns are unidirectional, but since most of the points are on thick primary pieces, all of their scars are the result of tool shaping/retouch. The retouch on the points is very fine, flat, and regular. Most have a tertiary retouch and the edges appear to have been ground. There are, in addition, transversal scrapers made on the same raw material as the points and that have similar technological and retouch characteristics. There are six cores in the assemblage—these are all single surface, non volumetric and unidirectional or bidirectional, with rough platform preparation. Debitage in the assemblage is mainly consistent with such cores, with large platforms, thick, flat cross-sections, and averaging 3–4 cm in length.

Aberrant in the assemblage are two large bifacially worked pieces (8.5 cm long), one of which is rolled, which most closely resemble adzes. The pieces are symmetrical, flat in cross-section, shaping retouch is very fine and flat, and the edges are ground. A small portion of debitage in the assemblage is typical of bifacial reduction flakes and are probably related to these pieces. An extremely well-made, long, crested blade, burins, and denticulates also appear aberrant. In sum, none of these characteristics can link the Level A material with any known Middle Paleolithic or Upper Paleolithic Crimean industry. It is most likely a true core reduction technology without bifacial work, thereby distancing it from the Crimean Micoquian. The superb retouch technique is similar to that see in Level C, but is otherwise typologically and technologically distinct from that industry.

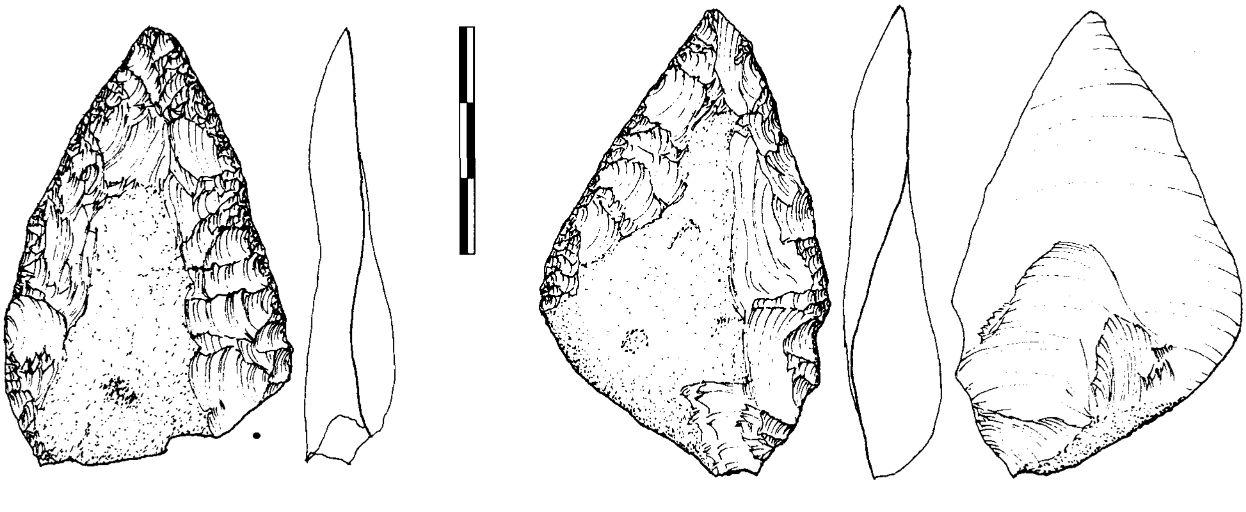


Figure 1-5—Typical points from Buran-Kaya III Level A.

The heaviest concentrations of Levels B and B1 material appeared in the central portion of the site. In the north, along lines A and Б, Level B was fairly thin (ca. 10 cm) and sloped due to the bedrock configuration. Near the back wall, Level B1 was only present in thin pockets in squares Б10 and Б11.

The Layer B micro- and macro-faunal assemblage has very good preservation with little spalling, chemical alteration, or climato-edaphic damage. The presence of small and/or fragile bones like carpals, sesamoids, and costal cartilage suggests that the assemblage was protected from prevailing winds by a shelter and quickly covered by sediments. The lithic material is likewise in excellent condition, without evidence of rolling or edge damage. Patinated artifacts were mainly limited to the northern sector of the site where the clay content of the sediments was slightly higher and where the matrix in which the lithics were embedded would have had seasonal saturation from cliff runoff.

There are no constructed features such as pits, hearths, or bone heaps in either Level B or B1. They are presumed to have been present, however, accounting for the dark grey color of the B1 sediments (Demidenko, Chapter 9), although it is not at all clear how they were destroyed given the quick burial and subsequent lack of sediment churning or movement seen in these levels. Palynological (Gerasimenko, Chapter 2) and microfaunal (Markova, Chapter 3) evidence point to a temperate climate with mesophytic species and open steppe during the deposition of this layer; based on the absolute dates, probably the Denekamp (Bryansk) Interstadial. Patou-Mathis (Chapter 8) suggests that Layer B was a seasonal camp with repeated occupations geared towards the hunting and initial processing of *Saiga tatarica*. Use-wear analyses conducted on the tools of Layer B (Giria, Chapter 10) further corroborates this, with evidence for carcass butchery and initial hide treatment.

The main concentration of the Level C lithic and faunal material occurred in squares Д–E9, with lithic concentrations from tool resharpening in Д7 and B7 (Figure 1-6). There was no specific concentration of bone; it was generally fragmented and small in size throughout the excavated area. In the northern sector of the site, the cultural remains of Level C thin out as the bedrock forms a hump in squares B7–8 and A11 and as it rises abruptly near the back wall. The richness of the cultural remains in the eastern sector (B–Г12) appears concomitant with that of the eastern sector, suggesting that there was probably a uniform distribution of remains across the whole area. Unfortunately, most of this area was excavated in 1990 and 1994 without having been recognized as a discrete cultural layer, and the southwest corner of the site (E12, Д12, and part of Г12) was destroyed by post-depositional churning. The occupation of Level C does not appear to have extended southwards past line E, owing to the collapse of the shelter ceiling.

The Level C macro-faunal assemblage is quite small (eight times smaller than that of Layer B) and highly fragmented, especially in comparison to that of Layer B. Climato-edaphic and plant damage was quite severe—most fragments in Level C showed weathering damage, versus only 0.08% in Layer B (Laroulandie and d'Errico, Chapter 7; Patou-Mathis, Chapter 8). There is also substantially more evidence of carnivores in Level C versus Layer B, unexpected in light of Layer B having more hunting and butchering remains, and presumably more attractive to scavengers. Carnivore tooth marks and gastric acid damaged 17% of the macrofaunal assemblage of Level C, versus only 0.14% of carnivore damage in Layer B (Laroulandie and d'Errico, Chapter 7; Patou-Mathis, Chapter 8). Coprolites are also present in Level C, whereas they are not in Layer B. On the other hand, the Level C faunal material had much more anthropic damage than did Layer B—in burning (8% vs. 2%) and in non-burning human damage (1.0% vs. 0.5%) (Laroulandie and d'Errico, Chapter 7; Patou-Mathis, Chapter 8). Laroulandie and d'Errico have interpreted the Level C material to represent a single, brief occupation, with carnivores partially responsible for accumulation. In fact, more carnivore evidence (tooth marks) probably would have been found if material was not so fragmented. It should be noted that *none* of the edges of the Level C lithic material or bone tools shows evidence of having been worn, trampled, or abraded, and there are intact tool resharpening scatter zones, despite this apparent use of Level C as a hyæna den. The lithic assemblage also indicates a single, brief occupation.

No constructed features such as hearths or pits were noted during the excavation of Level C. Lenses of burned sediments, however, were present in the northeastern part of the shelter, a small portion of the faunal remains had traces of burning, and microscopic charcoal was present in samples taken for palynological analyses. Root etching and chemical alteration of the Level C macro-faunal assemblage points to at least a thin vegetational cover and water percolation, and palynological data (Gerasimenko, Chapter 2) suggests the living surface was open for a long time, with a stable, slow deposition rate of pollen. The small mammal fauna recovered from the level (Markova, Chapter 3) indicates that at the time of deposition of the cultural layer, arid, open steppe prevailed in the area around the site and that there was a nearby river. While there are some cold tolerant species such as *Microtus gregalis*, the assemblage is periglacial in composition. Mosses and grape ferns in the pollen spectrum point to the aridity of the climate with boreal steppes surrounding the site. Given the dates and the features of the overlying Layer B, this level has been correlated with the last stadial of the Middle Pleniglacial.

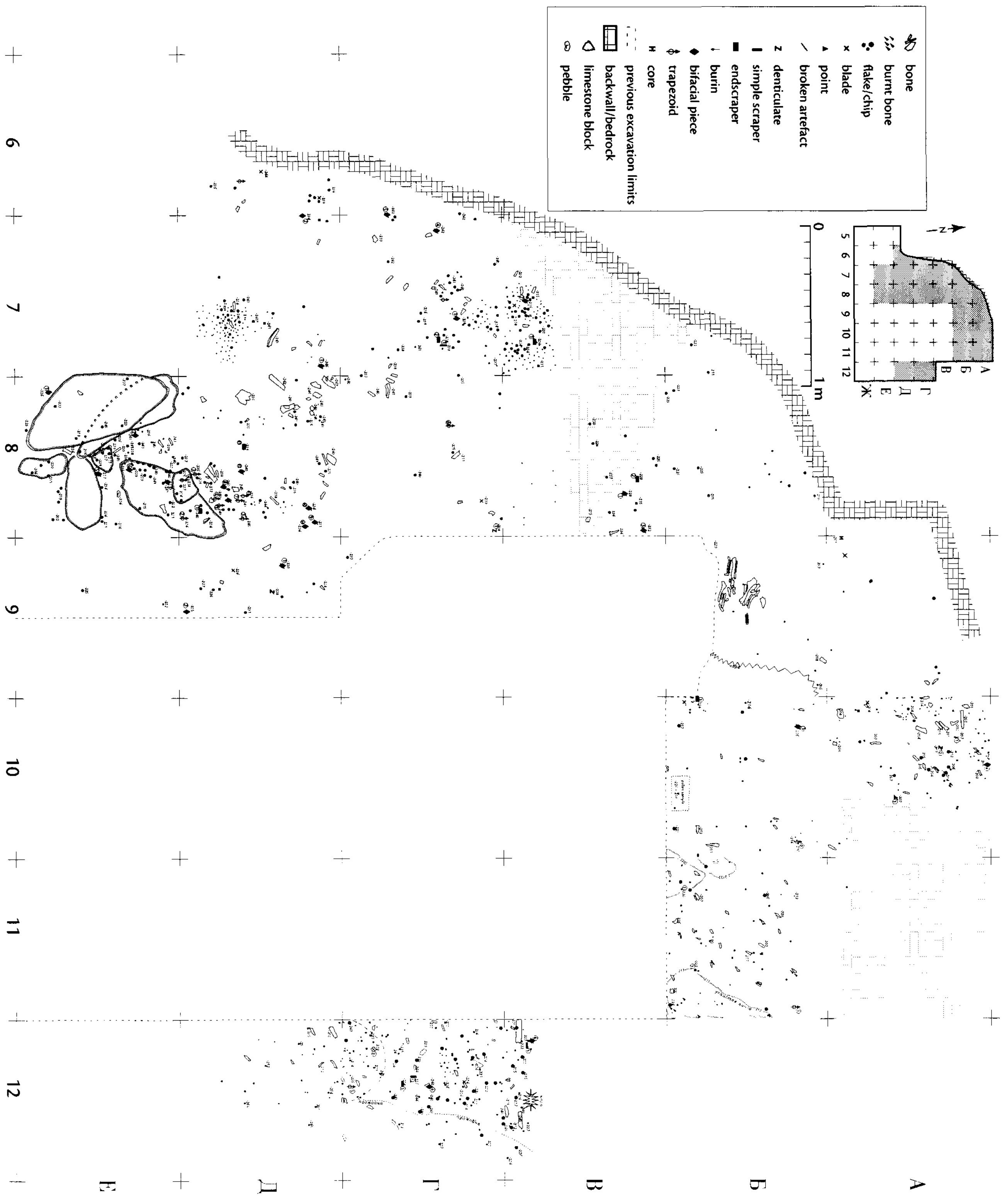


Figure 1-6—Plan of excavations at Buran-Kaya III Level C.

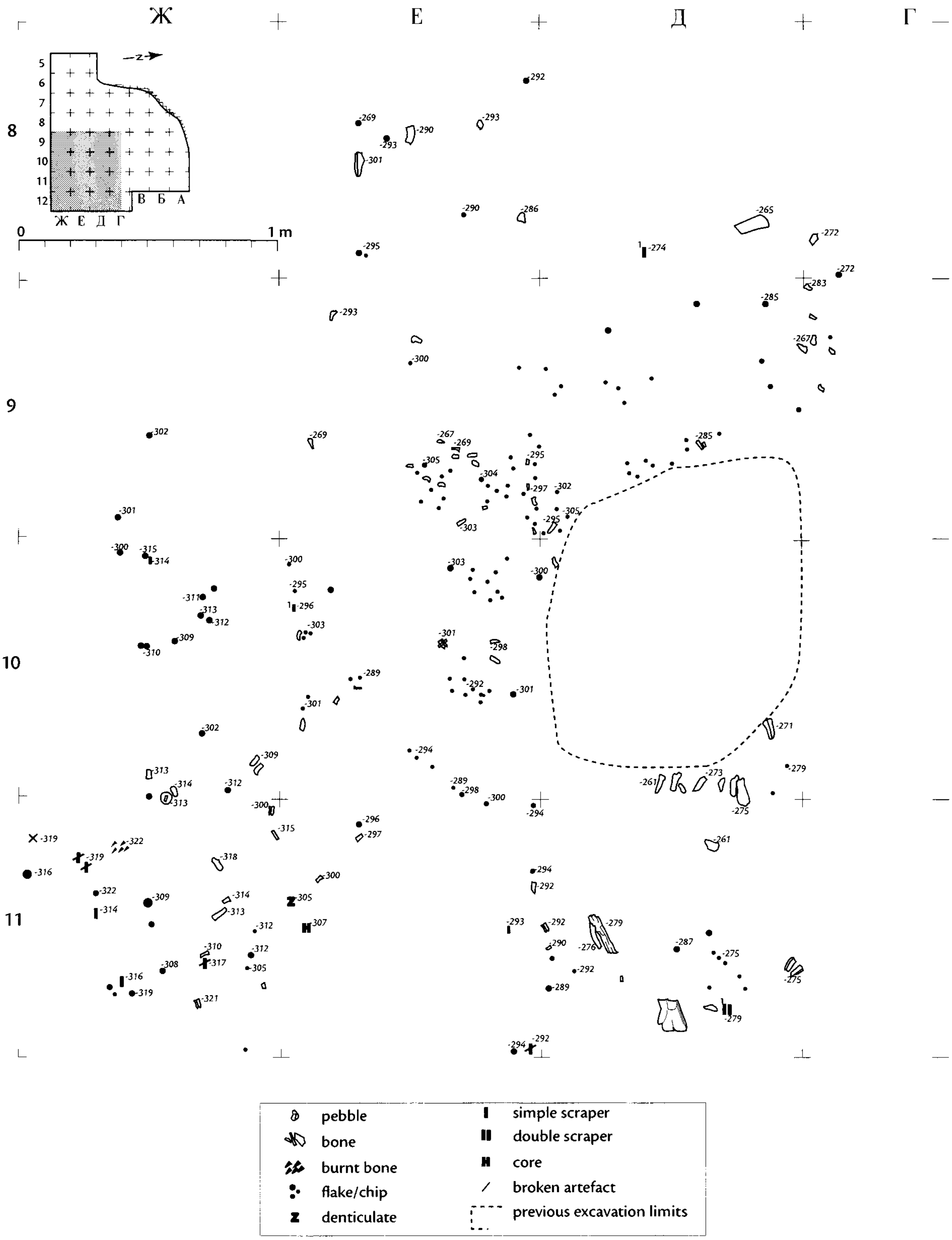


Figure 1-7—Plan of excavations at Buran-Kaya III Level D.

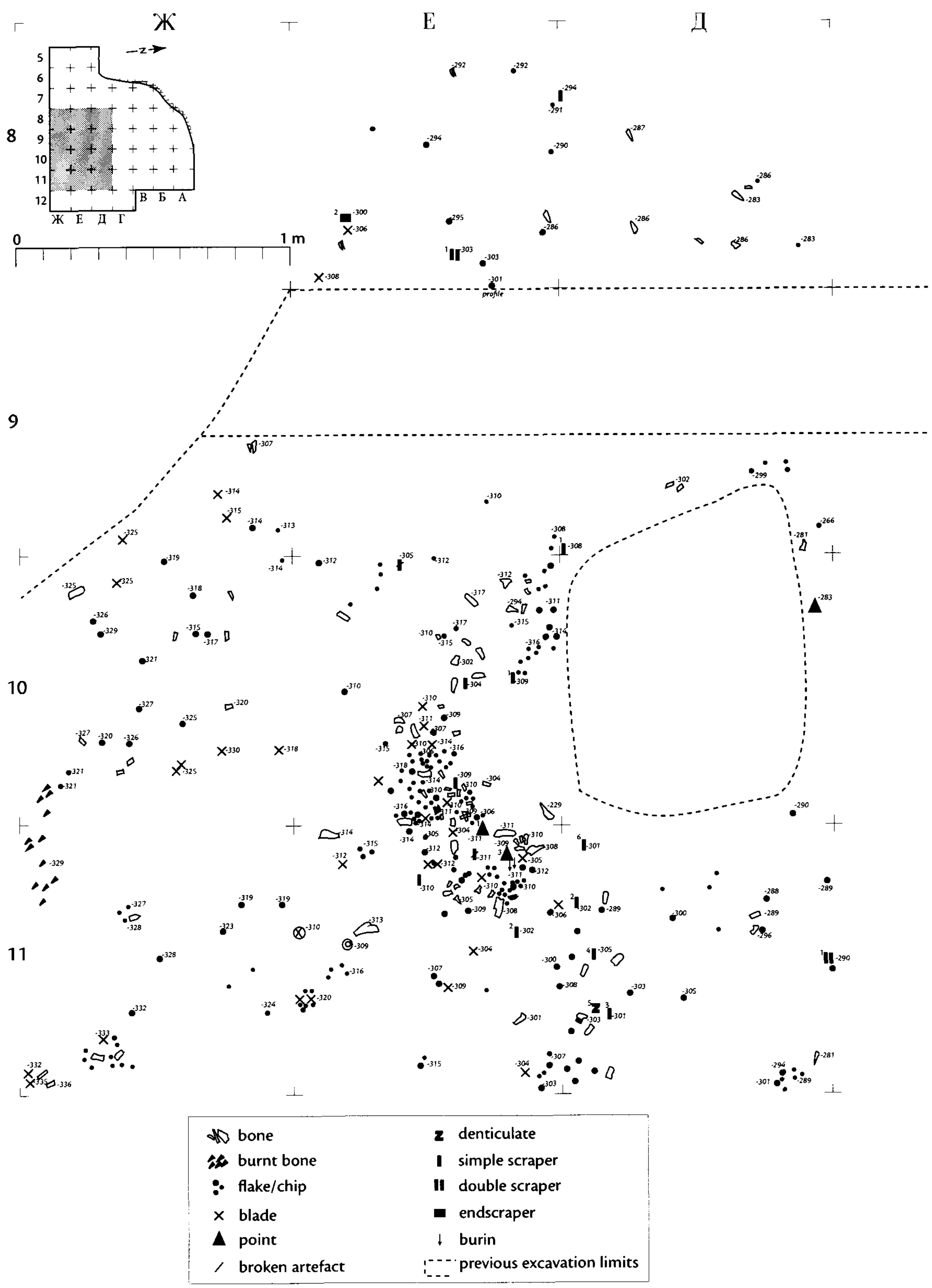


Figure 1-8—Plan of excavations at Buran-Kaya III Level E.

Level D was only encountered during the 1996 excavations, although the 1m^2 sondage of the 1990 season clearly penetrated the level. The level consists of a very thin scatter of lithics and bone in the southern part of the site (Figure 1-7). Level D was not present along Ж5–8 owing to the erosion and talus cone at the shelter mouth and it was not present in the northern half of the excavation area, presumably due to the configuration of the bedrock. No Level D sediments or lithic material were encountered during the 2001 field-season: it was hoped that they would be present along line 12 based on the apparent distribution of the material, but this portion of the site was destroyed.

There were less than a dozen recognizable faunal elements in Level D; most of the bone assemblage was small and in poor condition and was not submitted for analysis. No small mammal faunal or malacofauna were found during the excavation or screening of sediments. As Level D was not present in the main profile sampled for pollen in 1996 (Figure 1-3A), nor in the 2001 excavation area, no palynological analyses were conducted for this level. Finally, the poor condition of the bone precluded it from being submitted for AMS dating. In sum, little is known about the timing or paleoclimatic conditions during this occupation, other than it was deposited before the major overhang collapse in the southern part of the site.

Level E was also only encountered during the 1996 excavations, although previous excavations cut into it in two separate areas (Figure 1-8). Level E comprises a thin scatter of lithic and faunal remains in the southern sector of the rockshelter, with a marked slope from north to south (Figure 1-3B). Only a few pieces in the faunal assemblage exceeded 5 cm in greatest dimension; overall the assemblage is small and highly fragmented. Although burnt bone was present near the south wall, no hearths were found during excavation. As with the overlying level, the faunal assemblage has not been analyzed, no microfaunal or malacological remains were discovered, no suitable bones were available for AMS dating, and no sediments were submitted for palynological analyses. This level contains blades (Monigal, Chapter 4) and, on this basis alone, has been called "Upper Paleolithic" (Chabai 2000a; Chabai et al. 2000), but it must be stressed that very little is known about the timing or nature of this occupation, other than it is definitely in situ and predates ca. 40,000 BP.

Buran-Kaya III Analyses

Buran-Kaya III is a surprisingly complicated site given its rather limited areal extent of 50 m^2. The exceptionally rich and deep cultural sequence spans the latter part of the Late Pleistocene through the early Holocene, and its comprehensive analysis requires the expertise of a great many specialists. At the commencement of the American involvement in the excavations, we envisaged a volume devoted to the Buran-Kaya III sequence in its entirety. Such a publication, however, not only was exceptionally difficult to organize given the number of specialists involved, whose studies all tend to be at different stages of completion, but seemed illogical, since we presume few of our audience would be as equally as interested in the Kiik-Koba as the Swiderian. More logical was to keep the lower part of the site's sequence in its geographical and cultural context of the late Middle to Early Upper Paleolithic of the eastern Crimean Peninsula. While this is true of most of the papers devoted to Buran-Kaya III in this volume, certain paleoclimatic studies for the site—pollen, microfauna, and malacology—obviously must be published in their totality.

Buran-Kaya III has provided the most extensive Pleistocene pollen sequence in Crimea, derived from the entirety of the three meters of the cultural deposits. The evolution of landscapes in the Belogorsk region described by Natalia Gerasimenko in Chapter 2 provides an extremely important addition to our knowledge base for the peninsula, and links the previous palynological investigations conducted at Zaskalnaya V and Kabazi II, which only had Middle Paleolithic deposits (Gubonina 1985; Gerasimenko 1999), and at Skalisty, which only had Final Paleolithic deposits (Cohen et al. 1996). The majority of samples analyzed in Gerasimenko's study of Buran-Kaya III were taken from the north profile of the 1996 excavations along lineБ/В. In this area of the site, however, Level C was represented by an extremely thin deposit adjacent to bedrock, and Levels D and E were not present at all. Additional samples were therefore taken in 2001 from Level C as well as from the sterile alluvial deposits at the base of the sequence.

The extensive research by Anastasia Markova on Quaternary microfauna is a fundamental component of the paleoclimate reconstructions done during the past decade for Eastern Europe and Markova has continued her work initiated in the western Crimean Paleolithic sites (Markova 1999) in the eastern half of the peninsula (Chapters 3, 17, 23). Her analyses of the Buran-Kaya III small mammals in Chapter 3 includes a portion of the lower part of the sequence—the Eastern Szeletian of Level C and the Kiik-Koba of Layer B. (The underlying Levels D and E did not yield adequate faunal material.) Markova's analysis also includes the Upper Paleolithic layers immediately overlying these: Levels 6-5, 6-4, and 6-3, said to be Aurignacian; Levels 6-2 and 6-1, representing a Gravettian occupation; and Layer 5, a Shan Koba/ Epi-Gravettian deposit. As the absolute dating record of the Middle and Upper Paleolithic of Crimea is far from complete, a microfaunal analysis such as this is absolutely essential in placing these cultural layers into their environmental and chronological context. The sample used by Markova was from multiple years of excavation and represents the better part of all the occupations within the shelter.

The lithic assemblages from Levels D and E of Buran-Kaya III have frequently been described as preliminary and awaiting further augmentation (e.g., Marks 1998: 357). Yet, at the end of the 2001 field season, it became clear that the samples were as complete as they were ever going to be. The material of these two levels from the 1996 field season is described in Chapter 4.

Chapter 5, by Katherine Monigal, focuses on the lithic assemblage from Level C. This material has been described as "transitional" between the Middle and Upper Paleolithic (Marks 1998), as "Upper Paleolithic" (Chabai et al. 2000), as "Eastern Szeletian" (Monigal 2001) and as Streletskaya-related (Chabai et al., Chapter 25). In short, it is a fairly unique lithic assemblage with a contested status. No modern human remains, art objects, dwellings, or other features typically associated with the Upper Paleolithic were found in Level C. The level underlies the Middle Paleolithic Kiik-Koba Layer B. The assumption about its "advanced" status lays in its technology, which is unlike the recognized Crimean Middle Paleolithic facies, and to a lesser extent, a few of its typological features.

The skeleton of the golden eagle analyzed by Gleb Gavris and Svetlana Taykova (Chapter 6) was found during the 1996 excavations of Level C in square Б9 (Figure 1-6). The bones were in articular position and included nearly all of the skeletal elements. It is unknowable whether the bird simply died in the rockshelter while using it as a nesting place and was overlain by sediments without being disturbed by scavengers or, as Gavris and Taykova suggest, it was ritually slaughtered and buried. As noted above, the remainder of the Level C faunal assemblage did have extensive carnivore damage, and it is evident that the cultural material of this level lay in the open for a fair amount of time before it was buried. Yet, no burial pit in this area was noted during excavation.

Golden eagles inhabit a wide variety of landscapes, from barren plains to coniferous forests, and tend to nest on high cliff ledges (or, if these are unavailable, tall trees), overlooking grasslands where prey can be sighted easily. Golden eagles are monogamous and a pair will often hunt together, covering a territory of 90 km^2. *Aquila chrysaetos* preferentially eats rabbits, squirrels, and other lagomorphs and rodents, but will supplement its diet with lizards and birds, including large birds such as geese. In all of these aspects, the area around Buran-Kaya would have provided plentiful food supplies and a sheltered location from which to survey a portion of the surrounding territory. On the other hand, golden eagles re-use their nests from year to year, and often from generation to generation (DeGraaf et al. 1991; MacLaren et al. 1988). There is little in the faunal material from Level C that points to long-term habitation of the rockshelter by a pair of golden eagles, suggesting that, at most, it was used as a temporary perching place. These are large birds: they can carry up 4 kg in flight and have a wingspan reaching over 2 m. Given their size and predilection towards roosting in isolated and inaccessible areas, they are presumably difficult for humans to hunt. The manner of death, age, and sex of the golden eagle found in Level C is undetermined. The femora and fibulae that Gavris and Taykova note as missing in the material submitted for analysis, were in fact present during excavations, when they were drawn and photographed in situ. Before they were removed from position, however, pothunters or scavengers stole these bones. On the other hand, the feet, claws, and beak were not found during excavation, since these elements cannot survive in such a depositional environment.

Véronique Laroulandie and Francesco d'Errico cover a number of issues about the large mammal fauna from Level C in Chapter 7. Aside from providing a basic enumeration and identification of the assemblage, they describe its taphonomic patterning. They also elaborate on their previous studies of the Level C bone tools (d'Errico and Laroulandie 2000) with an extensive, heavily illustrated analysis of bone tool taphonomy, the techniques used for tool production, and supporting evidence from experimental manufacture. Finally, they discuss the implications of this unique bone tool assemblage, which, as they note, may be Middle Paleolithic, transitional, or Upper Paleolithic, and may have been made by Neandertals, modern humans, an acculturated, or a hybrid population. Their review of Late Middle Paleolithic/transitional non-Aurignacian sites with worked bone makes a very strong case that such an elaborate, time-intensive, and highly specialized tool production as seen at Buran-Kaya III was not the purview of only Upper Paleolithic anatomically modern humans.

As Laroulandie and D'Errico note (Chapter 7), the first bone handle found at Buran-Kaya III, during the 1994 excavations, was from layer 7-6, the base of Yanevich's Kiik-Koba level. Other material from that particular excavation collection bore many similarities to Level C, leading to the assumption that a mixture of two cultural levels had occurred during excavations in that year. There are a number of reasons to conclude that the haft belongs to Level C and not to the Kiik-

Koba layer: its AMS date is identical to another bone tube from Level C, it is obviously of the same techno-typology as the bone tool assemblage from C, and no worked bone remotely of this nature has been found in the Kiik-Koba faunal material excavated since 1996. The sample studied by Laroulandie and d'Errico represents the entire Level C faunal assemblage excavated during the 1996, 1997, and 2001 field seasons.

The analysis of large mammal remains of Layer B (1996 collection) is the subject of Chapter 8, by Marylène Patou-Mathis. This sizeable and very well preserved faunal assemblage furnishes evidence for the climatic conditions at the time of the Layer B occupation, on hunting patterns, site patterning, butchery practices, and the diet of the rockshelter's occupants. Based on her wide-ranging examination, Patou-Mathis suggests that the Layer B Neandertals came to Buran-Kaya III seasonally in order to hunt Saiga antelope, which comprises the better part of the assemblage, and that this animal was the primary reason for the site's occupation.

The lithic collection from Layer B of Buran-Kaya III is the largest of all known assemblages of the Kiik-Koba facies of the Crimean Micoquian and Yuri Demidenko's analysis of the material, presented in Chapter 9, is by far the most in-depth study yet available of this facies. This study focuses on the lithic assemblage recovered from the 1996 field season; although these excavations were small in area—less than 7 m^2—over 17,000 pieces were recovered. While the description alone of such a huge assemblage would be daunting to most, Demidenko also reconstructs the lithic *chaîne opératoire* employed over the course of occupations and puts the material into its landscape-use and Micoquian contexts.

The excellent preservation of the Level B lithic assemblage makes it an ideal candidate for use-wear analyses. Chapter 10, by Evgeny Giria, touches on a number of issues in addition to his traceological description, including the question of whether tools were imported into or manufactured on the site, how they were used, how they were modified during their use-life and eventually discarded, and what sort of post-depositional damage they incurred. Long assumed manufacture and use aspects of Micoquian lithics find verification in Giria's study, such as the order in which ventral and dorsal surfaces of bifacial tools were shaped and rejuvenated, that the type of use the tools withstood dulled edges in a predictable manner, and that the subsequent resharpening of these resulted in the small, heavily retouched tool kits that are the hallmark of the Kiik-Koba.

The age-old question archeologists have grappled with—the meaning of lithic technological and typological variability—can be examined from a number of different angles. Some of the those which have lately received the most attention are the nature of a site's occupation and how it fits into a regional mobility framework, the *chaîne opératoire* of the lithic assemblage and which, if any, phases took place off-site, how the end-products of this *chaîne opératoire* were used, and how much that use affected their form. Many studies that try to solve such issues start on the broad, regional scale and are hamstrung by patchy knowledge about landscape and resource use. The authors of Chapters 11–14, Thorsten Uthmeier, Jürgen Richter, and Martin Kurbjuhn, are part of research team approaching these problems for the Crimean Middle Paleolithic with a novel methodology, beginning with the smallest unit of study—the raw material nodule—and working upwards and outwards from there.

The specifics of this methodology, or transformation analysis, and its theoretical underpinnings are detailed in Chapter 11 by Thorsten Uthmeier. While a few issues particular to the late Crimean Middle Paleolithic are touched upon here, the chapter truly does describe a *modus operandi* that may be applied with ease to any lithic assemblage.

Chapter 12, also authored by Thorsten Uthmeier, applies this methodological approach to the lithic assemblage from Level B1. Beginning with raw material source exploitation, Uthmeier reconstructs the original shape of nodules or artifacts imported into the site, how they were prepared and transformed into cores or surface-shaped tools, the blanks and tools produced, and what was discarded or exported from the site. Then he discusses how these activities were part of the day to day activities of the Neandertals that inhabited the site and how task groups and larger movements were organized.

Jürgen Richter (Chapter 13) focuses on a single aspect of the transformation analysis: the *chaîne opératoire* for pointed tools. The *fossils directeurs* for the Kiik-Koba facies, are, of course, the small, off-axis point and the convergent scraper; two forms that grade into each other and are distinguished only by their pointedness (points) and slight lateral asymmetry (scrapers). Any presentation of a Micoquian lithic assemblage will distinguish between, and discuss separately, the unifacial and bifacial tools (see e.g., Chapters 9 and 20), even in those cases where the unifacial and bifacial tool type counterparts differ solely in their surface shaping. Richter turns our conventional wisdom on its head by his elegant analysis of these tools from Level B1.

One of the first steps in the transformation analysis presented in these chapters is to sort a lithic assemblage into raw material types and then into their basic units, either nodules or single pieces. Chapter 14, by Martin Kurbjuhn, presents the itemization of each of the units recognized in the Level B1 assemblage, in a manner similar to that used for refitted cores. It includes such details as the morphology and visual characteristics of the raw material units, their source, the spatial distribution in the site, and the life history of each unit.

The study of the malacological remains found at Buran-Kaya III is presented in Chapter 19 as part of a larger snail analysis of eastern Crimea. Constantine Mikhailesku's study is temporally limited to Late Middle Paleolithic/Early Upper Paleolithic, so the prevalent snail remains of layer 6 and upwards in the Buran-Kaya III sequence were not included. As noted above, no malacological remains were found in Levels A, D, or E, and those from Level C were extremely limited. Layer B, on the other hand, did yield an adequate enough sample to make some characterization of the paleoecological conditions current during its deposition.

With the last field season, in 2001, aside from a witness section in squares A–B12, most of the Paleolithic cultural remains have been excavated at Buran-Kaya III. The small cave at the rear of the site (north of squares A9–A10) may be a meter or more deep, but given the steep rise in the bedrock in this section of the site, the very thin remains of Levels B and C north of line B, and the predilection of Epi-Gravettian people to dig pits, it is highly doubtful that the cave will contain any material older than Epi-Gravettian. Excavations in row 12 revealed that the site in squares Д–Ж12 and part of Г12is completely destroyed from the uppermost layers through the sterile sediments that cap bedrock. To the south of line Ж, the cultural layers slope towards the river and appear mixed in the profile. To the west, what is not limited by the cliff wall appears to be derived material (Level A) or sterile; Levels B–E were mainly concentrated in the central portion of the site.

2

Vegetational History of Buran-Kaya III

Natalia Gerasimenko

Pollen studies of the sediments in the multilayered site of Buran-Kaya III (eastern Crimea) reveal vegetational dynamics in the site and its vicinity over a long period of the site's existence—from the Middle Paleolithic to the Neolithic. The site's deposits (up to 3 m thick) accumulated within the rockshelter, which was formed in the limestone of the internal ridge of the Crimean Mountains (maximum altitude 350 m above sea level). The rockshelter is located in the steep right slope of the Burulcha River Valley, where it cuts the ridge at 250 m above sea level, 8 m above the water level. The rockshelter is exposed to the south-west and is presently wide-open to the light. A buried karst channel was discovered in the inner part of the shelter (personal communication, A. Yanevich), indicating that the Buran-Kaya III cavity was part of an underground drainage system. At the present time, water still seeps on the walls and moistens the lowermost deposits of the shelter.

Buran-Kaya III is located within the low mountain forest-steppe region (forests of *Quercus pubescens* Willd. and meadow steppes) of the Euxinian forest province, Crimean Mountain subprovince (Barbarych 1977). Arboreal vegetation is mainly found in river valleys and ravines, and consists of oak (*Quercus pubescens* Willd., *Quercus petraea* Liebl., and *Quercus robur* L., the first strongly predominates) with an admixture of maple (*Acer campestre* L.), ash (*Fraxinus excelsior* L.), and elm (*Ulmus suberosa* Moench.). The undergrowth is formed by spindle tree (*Euonymus europea* L.), hazelnut (*Corylus avellana* L.), shrub hornbeam (*Carpinus orientalis* Mill.), cornelian cherry dogwood (*Cornus mas* L.), bloody dogwood (*Cornus sanguinea* L.), buckthorn (*Rhamnus cathartica* L.), Christ's thorn (*Paliurus spina-Christi* Mill.), and smoke-tree (*Cotinus coggygria* Scop.). Hawthorn (*Crataegus pentagyna* Jacg.), blackthorn (*Prunus spinosa* L.), rose (*Rosa corymbifera* L.), and wild pear (*Pyrus elaeagnaceae* Pall.) grow in drier spots. Steppic plants dominate the plateau-like tops of the ridge, and consist of grasses (Gramineae) and Herbetum mixtum. The grasses are primarily sheep's fescue (*Festuca sulcata* Hock.) and feather-grass (*Stipa* L.), whereas the Herbetum mixtum includes many plants of the Lamiaceae (*Thymus*, *Satureja*, *Teucrium*, *Scutellaria*, *Salvia*), Rosaceae (*Filipendula*, *Potentilla*), Ranunculaceae (*Adonis*, *Thalictrum*, *Actaea*), Fabaceae (*Genista*, *Medicago*), Apiaceae (*Pimpinella*), and Asteraceae (*Centaurea*, *Xeranthemum*) families. Most of the above-mentioned species of Lamiaceae and Asteraceae, as well as *Genista* and *Pimpinella*, are well adjusted to the xeric conditions of limestone substrata.

The soils that formed on limestone under the steppe vegetation are turf-carbonate soils (rendzinas), whereas the soils formed under the low mountain forests are dark-brown mountain soils (brown rendzinas). The soils of the valley bottoms are meadow-chernozems; these are the most rich in humus and the thickest in depth.

Palynological investigations of Crimean Upper Pleistocene deposits were carried out at the Mousterian site of Zaskalnaya V, located in eastern Crimea (Gubonina 1985), at the Middle Paleolithic site of Kabazi II located in western Crimea (Gerasimenko 1999), and at the Final Paleolithic site of Skalisty in western Crimea (Cohen et al. 1996). The pollen spectra of the deposits in western Crimea display a much higher proportion and a greater diversity of arboreal pollen than the deposits in eastern Crimea, indicating a wetter climate in western Crimea. Presently, the eastern Crimean forest-steppe also has a more continental climate (greater temperature variation, longer frost period, shorter vegetational period) than western Crimea. From west to east, the precipitation drops from 600 mm to between 500–470 mm, resulting in more extensively distributed and taller stands of forest, as well as a more mesophytic composition of steppe coenoses in western Crimea as compared to the eastern Crimea forest-steppe.

Materials and Methods

A series of 24 pollen samples from the Buran-Kaya III sedimentary sequence was analyzed. The sample processing involved treatment with 10% HCl, 10% KOH, 15% $Na_4P_2O_7 \times 10\ H_2O$ and flotation in a Thoulet solution. The pollen frequency was generally low (8–33 grains per slide), yet enough to count between 100 and 200 grains per sample and to plot the pollen diagram (Figure 2-1). Two samples from Level 6 did not yield enough pollen to be included in the diagram. The highest pollen frequencies were observed in the sediments of Levels 3A, C, B, 6-3, basal portions of Levels 6-1 and 6-5, and at the top of Level 4, respectively. Layer 5 was the poorest in pollen.

Differential preservation of microfossils was found within each sample. Spores and arboreal pollen were consistently well preserved, whereas pollen grains of herbs had both good and bad preservation rates. The pollen grains of dicotyledonous herbs in particular were creased, while microfossils of Cyperaceae and Gramineae were frequently broken. This suggests that the arboreal pollen found in the site was mainly airborne, while herbaceous plant pollen was deposited in Buran-Kaya III both by eolian and slopewash transportation. The presence of a karst channel indicates that there was surface runoff into the rockshelter. Spores have a very high resistance to destruction and are therefore usually well preserved.

Generalized studies of surface samples in modern vegetational zones and in mountain vegetational belts (Grichuk and Zaklinskaya 1948; Klopotovskaya 1976) serve as the basis of the pollen diagram interpretations. Since the Buran-Kaya III pollen spectra are dominated by herbaceous pollen, studies of surface samples in the steppe zone are especially important (Dinesman 1977; Arap 1972; Bezusko et al. 1992, 1997). The characteristic feature of the Buran-Kaya III pollen diagram is a high percentage of spores—these account for an average of 37% (and up to 65%) of the total number of microfossils. High percentages of spores are typical for forest and tundra belts. Yet, the Buran-Kaya III pollen spectra point to neither forest zone (due to low percentages of arboreal pollen), nor tundra (due to the consistent presence of Polypodiaceae). Thus, the abundance of spores is a local feature of the pollen spectra formation dictated by paleovegetation in the immediate vicinity. Spores do not spread far from the plants that produce them, and both mosses and ferns usually grow in rock cracks and cavities. Within the modern steppe belt of Ukraine, certain rock outcrops are refugia for several fern taxa, enabling their preservation (Genov 1987).

The very low percentages of *Pinus* pollen (less than 11%) indicate that pine did not grow near the site, and also that pollen spectra formation in the rockshelter was not strongly affected by long-distance wind-blown transport. The pollen sequence from Buran-Kaya III reflects the vegetational dynamics only of the immediate site surroundings.

Specialized pollen studies of both mountain (Klopotovskaya 1976) and plain regions (Spiridonova 1991) have shown that the airborne pollen that accumulates on valley slopes and on terraces is derived mainly from pollen producers in the valley bottoms, and that upward air movements prevail in valleys. In Buran-Kaya III, the pollen spectra formation was affected by pollen input from runoff and slopewash processes, so the spectra reflect the vegetation of both higher and lower topographical altitudes, although lower altitude vegetation tends to dominate. It should be noted that Ranunculaceae pollen, a frequent member of meadow coenoses, as well as Fabaceae and Apiaceae pollen, are always well preserved. The highest numbers of disfigured pollen grains were seen in Lamiaceae, Rosaceae, Brassicaceae, Asteraceae, some Cichoriaceae, and Chenopodiaceae. This suggests that the representatives of these families grew in the higher topographic areas. Still, many pollen grains of Chenopodiaceae, *Artemisia*, and almost all of *Ephedra*, as well as part of Lamiaceae, Rosaceae, and Cichoriaceae, have very good preservation. This means that they contributed to the pollen spectra as wind-blown components from either the floodplain or the plateau.

In order to differentiate the regional environmental changes and the specific local features controlled by rock crevices, some adjustments are made in the pollen diagram (Figure 2-1). Arboreal pollen (AP) and non-arboreal pollen (NAP) percentages, as well as the percentages within each taxa of these groups, were calculated from the sum of arboreal and herbaceous pollen. Percentages of spores were calculated separately, from the total number of microfossils. Two special pollen sums were calculated within NAP: one comprised of xerophyte pollen (Chenopodiaceae, *Artemisia*, Plumbaginaceae, and *Ephedra*) and the other comprised of Herbetum mixtum pollen. This latter term is traditionally used in Russian geobotanical literature to designate dicotyledonous herbs that form a mesophytic component of steppe associations in the Eastern European Plain and that are especially abundant in meadow steppe environments (Herbetum mixtum steppes of the present day forest-steppe belt). The abundance of Herbetum mixtum in the steppe composition progressively decreases southwards in direct relation to lessening precipitation and increasing Gramineae and xerophytes in the steppe coenoses. Thus, the proportional representation of these two groups in the pollen percentages enables hypotheses about climatic conditions. Pollen of the Asteraceae family, which has both xerophytic and mesophytic representatives, is not included in Herbetum mixtum and is counted separately. The other more specific problems of pollen interpretation will be discussed below, after the description of the diagram's pollen zonation.

Pollen Zonation

Fourteen pollen zones were recognized in the Buran-Kaya III deposits (Figure 2-1). The basal portion of sedimentary sequence was studied in the exposure from the 2001 excavations (shown in the lower part of the diagram).

Pollen Zone I (3.00–3.05 m, Level E)

Zone I is one of few zones in the diagram with a forest-steppe type pollen spectrum (20% AP, 80% NAP). The arboreal pollen is dominated by boreal taxa: *Pinus*, *Alnus*, and *Betula*, though the presence of a single pollen grain of the broad-leaved *Tilia cordata* Mill. is notable. The good preservation of the *Tilia* grain excludes the possibility that it was redeposited. The non-arboreal pollen is dominated by Herbetum mixtum (especially Lamiaceae) and Cyperaceae. Asteraceae pollen is also rather abundant, whereas xerophytes (Chenopodiaceae) and Gramineae are underrepresented. Spores make up a significant proportion of the total number of microfossils (40%), and are dominated by Bryales (24%). Polypodiaceae are second in prevalence (9%), and primarily represented by Pterideae spores. The other spores are from Lycopodiaceae and *Botrychium* sp.

Pollen Zone II (2.55–2.90 m, Level D)

Pollen Zone II corresponds to Level D and is homogenous in its pollen content, with steppe pollen spectra (16% AP and 84% NAP). The arboreal pollen consists of boreal taxa: *Alnus* (dominating) and *Betula* consistently, and *Pinus* in the upper part of the level. Herbetum mixtum is a major component of the non-arboreal pollen, Cyperaceae are second in prevalence in the lower spectrum, while Gramineae and Asteraceae counts increase in the upper spectrum. Xerophytes are not significant, although *Artemisia* and *Ephedra* appear together with Chenopodiaceae. The composition of the Herbetum mixtum is not diverse: Lamiaceae, Rosaceae, and Brassicaceae dominate, and Rubiaceae and Cichoriaceae are noticeable, but Ranunculaceae pollen, present in Level E, has disappeared.

Two subzones, associated with Levels D3 and D1, can be distinguished based on their spore content (33% and 50% respectively). Counts of Lycopodiaceae and *Botrychium* are the same in both subzones (and match the values of zone I), whereas Polypodiaceae, and especially Bryales, first decrease in the lower level, then increase again in the upper level.

Level D1 is rich in Pterideae spores, although a distinctive feature of the level is the abundance of the other Polypodiaceae (Asplenieae, Aspidieae, Polypodiaceae s. str., et al.).

Pollen Zone III (2.30–2.40 m, Level C)

Zone III has the same general pollen content as Level D (16% AP, 84% NAP). The zone III non-arboreal pollen differs from zone II both by an increase of xerophyte pollen counts and by the diversification of Herbetum mixtum. The maximum number of Chenopodiaceae for the Buran-Kaya III 2001 section is seen in this zone, and Plumbaginaceae, *Artemisia*, and *Ephedra* contribute to the xerophyte pollen complex. Herbetum mixtum includes 10 families, with Lamiaceae and Cichoriaceae strongly prevailing in number. Arboreal pollen includes *Pinus*, Cupressaceae, *Alnus* (dominating), and *Betula*. The spore content (33%) is average for the section—Bryales prevail (11%), while counts of other spores are equally distributed among Lycopodiaceae, *Botrychium*, Pterideae, and the other Polypodiaceae. The pollen sample from Level C is enriched in microscopic charcoal.

The main part of the sedimentary sequence was studied from sample taken during the 1998 excavations at Buran-Kaya III (Figure 2-1 *supra*).

Pollen Zone IV (2.30–2.50 m)

Zone IV is characterized by steppe pollen spectra (5–12% AP, 88–95% NAP). The arboreal pollen consists only of *Pinus* and *Alnus*, with a distinct *Pinus* predominance in the lower part of the pollen zone. Xerophytes and Herbetum mixtum prevail in the non-arboreal pollen, followed by Gramineae pollen. Xerophytes (Chenopodiaceae, *Artemisia*, and *Ephedra*) are particularly prominent in the upper part of the zone, forming one of the xerophytic maxima in the pollen diagram. The lower part of the pollen zone has a higher Cyperaceae pollen content and a more diverse composition of Herbetum mixtum. Spores (35–45%) are predominantly Bryales (10–15%) and Pterideae (10–13%). The sediments of pollen zone IV are poorer in microfossils than Levels E, D, and C.

In the sedimentary sequence from the 1998 excavations at Buran-Kaya III, the deposits containing pollen zone IV underlie Level C, the pollen of which was analyzed from the 2001 excavations. What could be the position of pollen zone IV relative to the lower pollen sequence (Figure 2-1 *infra*) from Buran-Kaya III 2001? It has features both in common with and distinct from pollen zones II and III (Levels D and C respectively), though it definitely differs from zone I.

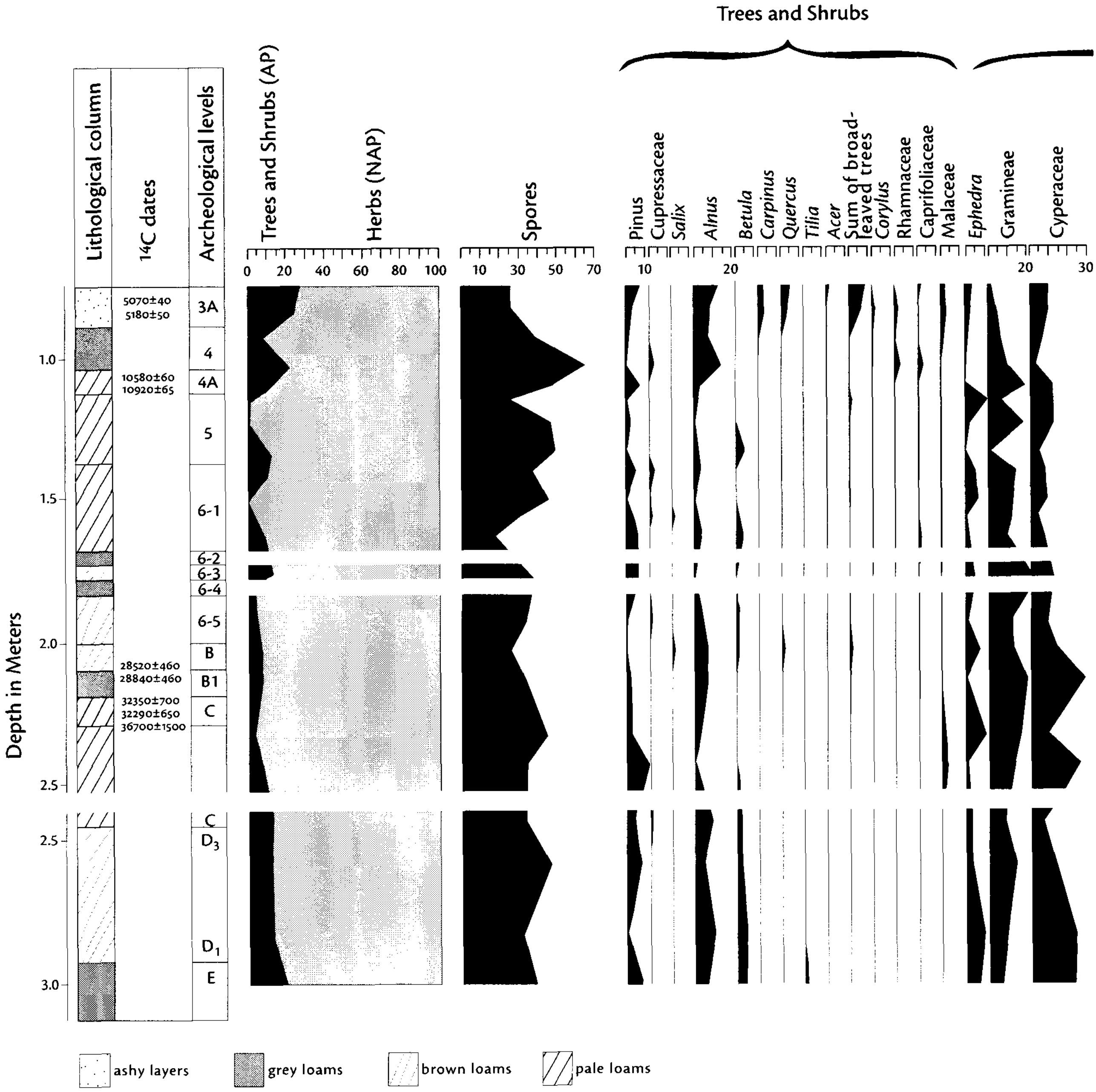


Figure 2-1—Pollen diagram of Buran-Kaya III.

From bottom to top, zone IV shows the same trend of increasing xerophytes and decreasing Cyperaceae as seen in the zone II and III sequence. Based on the non-arboreal pollen composition, it is possible to position zone IV between zones II and III as a kind of transition. Yet, discrepancies appear then with the arboreal pollen content and composition. Zone IV generally is poorer in arboreal pollen than zones II or III, and particularly poorer in *Alnus* pollen. It is also important that *Betula* pollen, rather typical for zones I–III, is absent in zone IV, which has arboreal pollen dominated by *Pinus*. The other difference is that in pollen zones D and C, Herbetum mixtum dominates over xerophytes, whereas the opposite ratio is found in pollen zone IV. From the standpoint of the pollen, it seems that there is no equivalent to pollen zone IV in the Buran-Kaya III 2001 sequence, or that the sediments of pollen zone IV were formed under conditions having very limited eolian pollen input (the inner part of a cavity, a narrow entrance).

Pollen Zone V (2.00–2.20 m)

Zone V represents Levels B and B1 and was identified by having common characteristics of steppe pollen spectra: (1) the same general composition of pollen

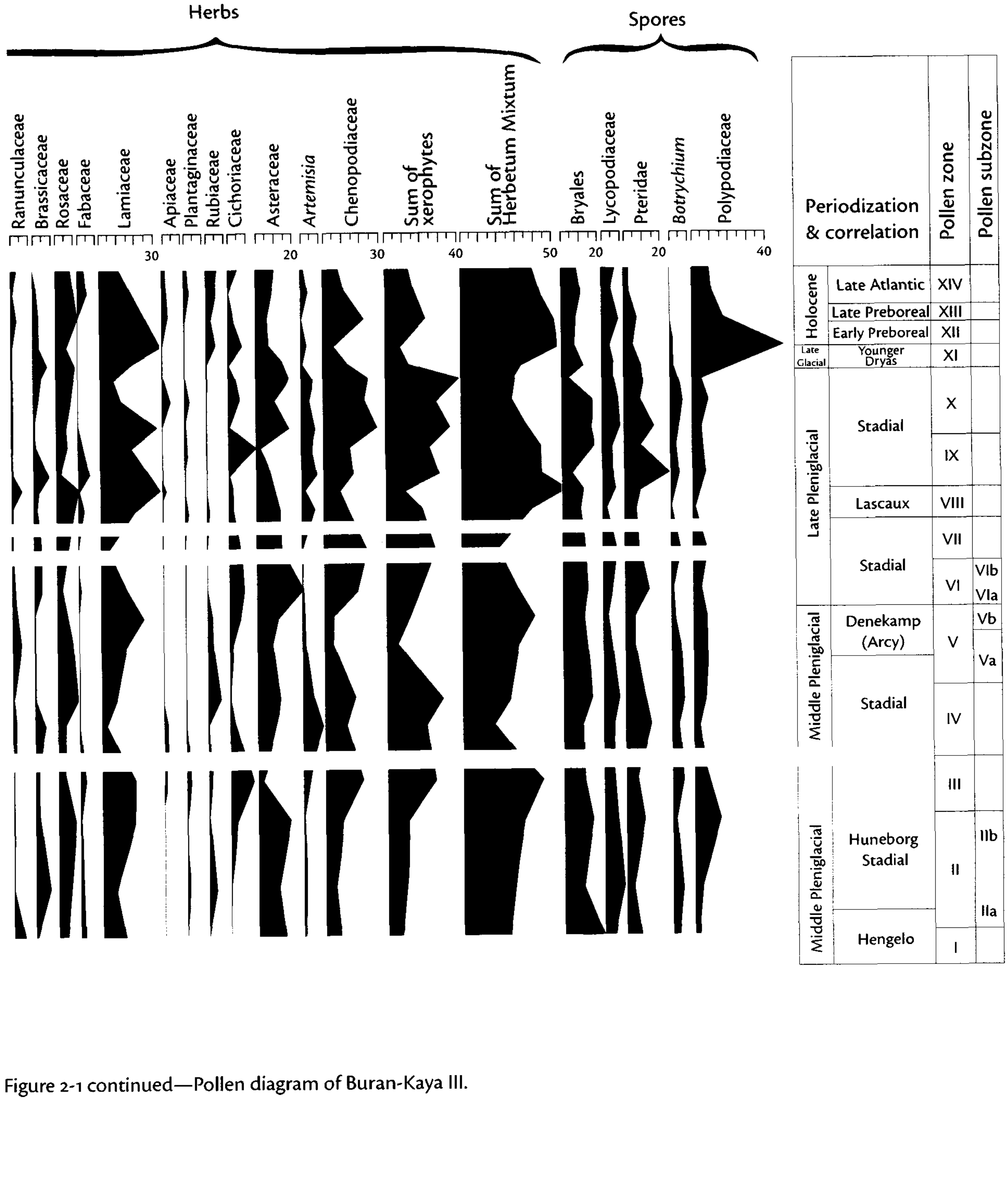


Figure 2-1 continued—Pollen diagram of Buran-Kaya III.

(8% AP, 92% NAP), (2) a lower percentage of spores than the average seen in the rest of the section, (3) a low number of xerophytes in the non-arboreal pollen, (4) the same taxa composition of non-arboreal pollen, (5) the predominance of *Alnus* in arboreal pollen, and (6) low values of Lycopodiaceae and *Botrychium* sp. The low proportion of xerophytes is a distinctive feature of pollen zone V in the diagram. Also distinctive is the significant number of grains from the Ranunculaceae family, which includes many mesophytic species. The boreal tree *Betula* is underrepresented in pollen zone V as compared to its counts in the lower archeological units (only a single *Betula* pollen grain was found).

Zone V can be subdivided into two subzones representing Levels B and B1, based on differences in the two pollen spectra. The lower subzone (Va, Level B1) is richer in Cyperaceae pollen and in spores, while the upper (Vb, Level B) has a higher count of Herbetum mixtum (at the expense of Lamiaceae) and of xerophytes (at the expense of *Ephedra*). The arboreal pollen of Layer B has a more diverse composition of boreal taxa (*Salix*, *Alnus*, and *Betula*), and single pollen grains of *Quercus* were noted. The well preserved *Quercus* pollen (*Quercus pubescens* Willd.) was not redeposited. Given the absence of *Pinus* microfossils (only one pollen grain of pine was found in Level B1), long-distance pollen transport into the site did not occur, and oak must have grown in the site vicinity. The sample from the upper Level B is enriched in microscopic charcoal.

Pollen Zone VI (1.80–1.9 m, Level 6-5)

Zone VI is rather similar to pollen zone V in most of the indices, including in the overall pollen and spore content (6–7% AP, 93–94% NAP, and 34–38% spores of the total sum) and diversity of taxa. The distinctive features are a higher number of xerophytes (mainly Chenopodiaceae) and Asteraceae, and lower values of Herbetum mixtum and Cyperaceae than in zone V. The lower part of zone VI is somewhat different from the upper part. The lower spectrum displays the Asteraceae maximum for the diagram, whereas the upper spectrum displays the Gramineae maximum for the diagram. Xerophytes are more abundant and Herbetum mixtum is less abundant in the upper part of the zone. The arboreal pollen in the lower spectrum is similar to that of zone V: *Alnus* (dominating), *Betula*, and Cupressaceae (*Juniperus* sp.). The arboreal pollen of the upper spectrum is comprised of only a few *Pinus* grains. Thus, the lower part of zone is a kind of transition between zone V and top of the zone VI. The upper sample is also poorer overall in pollen than the lower one and pollen zone V. This is the only sample contaminated by modern-day pollen of *Juglans regia* (3 grains), which presently grows near the section (A. Yanevich, personal communication). The spore group is dominated by Bryales, though Pteridae are abundant in the lower part of the zone. The remainder of the spore complex has the same values as pollen zone V, with slightly more Lycopodiaceae.

Pollen Zone VII (1.8–1.62 m)

Zone VII corresponds to the pollen-rich Level 6-3, and probably to Levels 6-4 and 6-2, as well, which are very poor in pollen. Levels 6-4 and 6-2 have been combined with the same pollen zone as Level 6-3 due to similarities in their overall pollen composition (14–16% AP, 84–85% NAP), the same arboreal taxa, and the prevalence of Herbetum mixtum over xerophytes in the non-arboreal pollen. The proportions of spores are higher in Levels 6-4 and 6-2 than in Level 6-3 (18%). This might be related to the better resistance of spores to those destructive factors that definitely affected the spectra formation of the two pollen-poor levels.

The arboreal pollen of pollen zone VII includes only boreal taxa: *Pinus*, *Alnus*, and *Betula* (in equal proportions). The non-arboreal pollen can be statistically characterized in Level 6-3, and is dominated by Herbetum mixtum and xerophytes. A drop in Gramineae, as compared to pollen zone VI, was observed. Herbetum mixtum is diverse in composition and as abundant as pollen zone V (Levels B and B1). Yet, the Cyperaceae counts are lower and the xerophyte values higher than in pollen zone V. The increase of *Artemisia* is noteworthy: beginning with this zone, it is an important component of the xerophyte complex in the diagram (up to the Holocene). The low spore percentage in subzone 6-3 is due to the very low counts of Lycopodiaceae and Polypodicaeae (with the exception of Pteridae), and to the absence of *Botrychium* spores. Pteridae and Bryales are more abundant in Level 6-2 and particularly in 6-4.

Pollen Zone VIII (1.55–1.62 m)

Zone VIII was distinguished in the lower part of Level 6-1 based on its having the maximum value of Herbetum mixtum in the Pleistocene part of the sequence, as well as having the lowest percentage of xerophytes. Nevertheless, the pollen spectrum for zone VIII is a steppe type (9% AP, 91% NAP), and the arboreal pollen includes only boreal taxa, though with a rather diverse composition (*Pinus*, Cupressaceae, *Salix*, *Alnus*, and *Betula*). Herbetum mixtum pollen is also diverse, but still dominated by Lamiaceae and Rosaceae. Pollen from the Ranunculaceae family, which includes many mesophytic species, is noticeable, while the total number of Cyperaceae is very low. Spores are dominated by Bryales and Pteridae, and only few *Botrychium* spores were found. The pollen sample is rich in pollen and in microscopic charcoal.

Pollen Zone IX (1.40–1.55 m)

Pollen zone IX corresponds to the middle and upper part of Level 6-1, and is identified by its high numbers of xerophytic and non-arboreal pollen (90–100%). Arboreal pollen is totally absent in the lower sample, whereas in the upper one, several pollen grains of *Juniperus* sp., along with *Pinus* and *Alnus*, were found. *Juniperus* pollen is typically poorly preserved in the sediments, so its presence in the sample indicates that this plant definitely grew near the site. The characteristic feature of the non-arboreal pollen is a rather high proportion of both *Artemisia* and *Ephedra*, in addition to the significant Chenopodiaceae component of xerophytic pollen. The taxa composition of Herbetum mixtum is poor, especially in the lower sample (only 4 families), and has a strong prevalence of Lamiaceae. The upper sample is rich in Cichoriaceae pollen, however. Beginning in pollen zone IX, Ranunculaceae disappears until the Holocene. Spores are fairly abundant, dominated by Bryales and Pteridae, although *Botrychium* also increases in number.

Pollen Zone X (1.15–1.40 m, Layer 5)

Zone X is rather homogenous in its spectra components, and has several distinctive features for the Buran-Kaya III pollen diagram. First, it displays the maximum values of xerophyte pollen and the lowest values of arboreal pollen (2%, 2%, and 7% of the samples). In the lower part of the zone, *Betula* pollen is noticeable (and this is the last zone in the sequence with *Betula*), whereas in the upper samples, only single grains of *Alnus* and *Pinus* were found. Xerophytes are represented by Chenopodiaceae, *Artemisia,* and *Ephedra*, while the Herbetum mixtum composition is very poor: two to four families in the lower samples. This low frequency may be connected to the low pollen frequencies in these samples overall; pollen has the same relative abundance as the spores, which are far more resistant to destruction. Asteraceae pollen is well represented, and Lamiaceae is predominant among the Herbetum mixtum. Spores are dominated by Bryales, although the Lycopodiaceae and *Botrychium* counts are significant. The percentage of Pteridae is high in the basal portion of the zone.

Pollen Zone XI (1.10–1.15 m, Level 4A)

Zone XI displays a steppe type composition (10% AP, 90% NAP), but the composition of the non-arboreal pollen spectrum is different from that of zone X. The group is dominated by Herbetum mixtum and Gramineae, and Asteraceae are noticeable, but xerophytes, represented only by Chenopodiaceae, drop sharply in number. The Herbetum mixtum composition continues to be very poor (three families), and Lamiaceae prevails. Arboreal pollen includes *Alnus* and *Pinus*. Spores are very abundant (48%) and dominated by different Polypodiaceae, though not so much by Pteridae. Bryales and Lycopodiaceae have relatively high counts, but *Botrychium* is represented by only a few grains.

Pollen Zone XII (1.00–1.10 m)

This zone corresponds to Level 4 (the lower part) and has a forest-steppe type of spectra. Spore counts reach their maximum in the diagram in this zone (65%), and, for the first time, the arboreal pollen count (21%) is at the same level as it was at the bottom of the sequence (pollen zone I). The arboreal pollen consists of boreal taxa—mainly *Alnus*—but still has rather diverse shrub pollen: *Juniperus*, *Rhamnus*, and Caprifoliaceae (*Viburnum*?). Xerophytes have the same low proportions seen in pollen zone I, whereas Herbetum mixtum has the absolute maximum in the diagram, and is more diverse than in pollen zone XI. Lamiaceae prevail, while Asteraceae are not important. Starting from this level, Herbetum mixtum pollen counts never return to the low values of the Pleistocene part of the diagram. Spores are absolutely dominated by Polypodiaceae (Asplenieae, Aspidieae, Polypodiaceae s. str.). Pteridae and other components of the spore complex (Bryales, Lycopodiaceae, and *Botrychium*) do not appear in significant numbers.

Pollen Zone XIII (0.90–1.00 m)

Zone XIII is found in the upper part of Level 4, and has steppe type pollen spectra that is similar to pollen zone XII (9% AP, 91% NAP, 39% spores). Zone XIII differs from zone XII by having a higher proportion of *Alnus* in the arboreal pollen, and by having lower values of Gramineae and higher values of Herbetum mixtum in the non-arboreal pollen. The diversity of this group is significant (Lamiaceae and Rosaceae prevail). Spores are still dominated by Polypodiaceae, but are only a third of the pollen zone XII values. Lycopodiaceae and Bryales are present, but *Botrychium* disappeared from the pollen diagram in this zone.

Pollen Zone XIV (0.76–0.90 m, Layer 3A)

Zone XIV demonstrates an important change in the diagram: the appearance of broad-leaved taxa, including *Quercus*, *Carpinus*, *Acer*, their satellite *Corylus*, and *Rhamnus*. *Alnus* is still a little higher in pollen counts than the broad-leaved taxa, but *Pinus* is lower. The pollen spectra are of forest-steppe type (20–29% AP, 71–80% NAP, 26% of spores from the total sum). Herbetum mixtum with a rich composition (nine families) strongly dominates the non-arboreal pollen, whereas xerophytes are second in abundance

(Chenopodiaceae dominates, but *Artemisia* and *Ephedra* are also present). The low proportion of Gramineae pollen is the other distinctive feature of the complex. Spores are dominated by Bryales and Polypodiaceae, though the number of Pteridae spores are the lowest in the section. Lycopodiaceae is average for the section, while *Botrychium* sp. is absent.

Main Characteristics of the Pollen Diagram and its Components

The main feature of the Buran-Kaya III pollen diagram is a distinct predominance of steppe pollen spectra, combined with a high proportion of diverse spores. These are explained by the impact of both regional and local factors on pollen spectra formation. Forest-steppe type pollen spectra were discovered at the base of the sequence (pollen zone I, Level E) and at the top of the sequence (pollen zone XII, the lower part of Level 4, and pollen zone XIV, Layer 3A). In two cases (Levels E and 3A), the forest-steppe spectra include pollen of broad-leaved taxa, which is rather abundant in Layer 3A. Pollen zone XII has only boreal pollen taxa. The only other appearance of a few pollen grains of broad-leaved species (namely *Quercus*) occurs in pollen zone V (the upper subzone, Level B). The arboreal pollen in the remainder of the diagram are boreal taxa.

The low percentages of *Pinus* pollen testify to its long-distance wind-blown origin. *Alnus* (alder) pollen is consistently the main component of the arboreal pollen. The alder pollen grains are normally developed, which means that the trees were well adapted to the environment (the Burulcha River floodplain). *Betula* (birch) pollen is found in small quantities in pollen zones I through X (the lower part), and disappears in the upper part of the section. The *Betula* pollen are arboreal forms (*Betula* sect. Albae), and are usually underdeveloped (small pollen grains with weak exines and weakly developed pore apertures). The environment was therefore not favorable to *Betula*'s pollination and growth. At the present time, the boreal tree *Betula* rarely grows in the temperate climate of the Crimean Mountains, it was obviously also at the limit of its natural habitat in the area under investigation during the Upper Pleniglacial, although for a quite different reason. In the colder northern part of Ukraine, well developed *Betula* pollen is present, including pollen of arcto-boreal shrub forms (*Betula* sect. Costatae et Fruticosae). Furthermore, normally developed *Betula* pollen grains have been found in Upper Pleniglacial deposits in western Crimea (Gerasimenko 1999). This may indicate that not the cold, but the aridity of the climate, was the factor limiting the distribution of *Betula* in eastern Crimea.

The other tree whose pollen punctuates the diagram in pollen zones III to XII (Levels C to 4) is *Juniperus*. This heliophytic plant can grow in the undergrowth of light pine forests, or may form separate associations in open landscapes. The latter definitely was the case for the Buran-Kaya Pleistocene environments. Pollen of other shrubs—*Corylus*, Rhamnaceae, and Caprifoliaceae—appear in the uppermost part of the diagram (pollen zones XII–XIV), whereas single pollen grains of *Salix* (willow) were found in the middle part of the diagram, and obviously originated in the floodplain. Willow pollen occurred in zones having a low proportion of xerophytes among the non-arboreal pollen (zones V and VIII, corresponding to Layer B and the lower part of Level 6-1).

Minimal arboreal pollen (0–2%) is characteristic of pollen zones IX and X (the upper part of Level 6-1 and Layer 5). Concomitantly, these zones are distinguished by the highest values of xerophytes and the lowest values of Herbetum mixtum in the diagram. The samples derived from the 2001 excavations of the site have a richer arboreal pollen content (16–20%) than the samples taken during the 1998 excavations (2–14%). This may be related to the different availability of the two sections to wind-blown pollen.

The lowest counts of xerophyte pollen are found in zones I, II, V, VIII, XII, and XIII (corresponding to Levels E, D, B1, B, the lower parts of Levels 6-1 and 4, and Level 4A). The minima in the lower three zones are correlated to maxima of both Herbetum mixtum and Cyperaceae, whereas the minima in the upper three zones are related only to Herbetum mixtum peaks. The environmental adaptations of these two wet-loving herbaceous groups are different. Herbetum mixtum mainly includes mesophytic plants reliant on precipitation, while Cyperaceae in the boreal and temperate belts grows azonally and relies on ground moisture. Cyperaceae are zonal components of ground cover in tundra and the sub-alpine belt of the Carpathians where there are low evaporation rates. They are also typical for Crimean *Yaila* meadow-steppe landscapes where precipitation is not less than 600 mm per year. It is assumed that precipitation during the Late Pleniglacial of eastern Crimea was not so high, since it is presently below 500 mm. On the other hand, the low temperatures of the Pleniglacial resulted in substantially lower evaporation rates, and much lower amounts of precipitation were thereby needed to produce an environment humid enough for Cyperaceae distribution (wet meadows), at least in valleys. As with all the Pleniglacial valleys before the Holocene terrace erosion, the Burulcha River Valley was less deep than today, and the Buran-Kaya III site was closer to the floodplain. This, as well as possibly higher precipitation during the formation of the pollen spectra of zone I and the lower parts of zones II, IV, and V were the cause of the Cyperaceae peaks (Level E, the lower parts of Levels D, B1, and the base of the 1998 excavation). During the formation of the upper pollen zones rich in Herbetum mixtum pollen (VIII, XII, and XIII), either the precipitation was lower or the temperature was higher, in order to produce wet meadows beyond the alder groves in the floodplain.

The impact of the adjacent river valley can be seen in the predominance of Herbetum mixtum in the nonarboreal pollen of most of the pollen spectra. With the exception of the zones richest in xerophytes—IX and X (the upper part of Level 6-1 and Layer 5)—the other zones with a predominance of xerophytes over Herbetum mixtum are zone IV and the upper part of zone VI (substrata of Layer B and the upper part of Subzone 6-5). The indicator for a typical steppe landscape is Gramineae pollen. It is usually underrepresented in pollen spectra because of its poor preservation rate, so even values of 15% Gramineae can indicate extensive distribution of a grass steppe in the vicinity (Dinesman 1977). In the Buran-Kaya III diagram, this is seen in pollen zones IV–VI, XI, and partly in IX and X (Layer B with substrata, Levels 6-5, 4A, and partly 5 and 6-1).

Among xerophytes, *Artemisia* is the most specialized indicator of dry steppes, while Chenopodiaceae are present in most of the steppe zone pollen spectra. The continuous *Artemisia* curve, though it does not have high values, extends from zone VII to X (Levels 6-3 to 5). Another characteristic feature of the diagram is the almost constant presence of the steppe plant *Ephedra*, which is regarded as a typical representative of Late Pleniglacial and Late Glacial steppes (Khotinsky 1983; Bezusko 1999). Among Herbetum mixtum, Lamiaceae, Rosaceae, Brassicaceae, and Cichoriaceae are the most important. Representatives of these families grow in different environments: in meadows, steppes, and dry limestone slopes. Lamiaceae, the most richly represented pollen in the section, is similar to *Scutellaria* pollen, which presently inhabits steppes, rocky slopes, and limestone outcrops in Crimea. Pollen of *Thymus* and *Salvia*, which are presently abundant in the area, were not found, at least not well preserved. *Leonurus* and *Stachys* pollen types seem to be represented in the pollen spectra. Asteraceae, which are regarded as the most xerophytic of Herbetum mixtum (and have been counted separately here) are second in abundance after Lamiaceae among the dicotyledonous herbs in the diagram. They may also indicate eroded substrata. The zones richest in Asteraceae are I, II, VI, X, and XI (Levels E, D, 6-5, 5, and 4A).

Oscillations in spore content in the diagram are not regular and often demonstrate local environmental changes dictated by the development of fissures and caverns in limestone rocks. All of the Buran-Kaya III samples have a higher spore count than the zonal forest-steppe and steppe spectra (<20%) of the present-day temperate belt of the Russian Plain. This is obviously a result of the rock lithology and topography around the site. Some of the peaks of spores are also related to their better preservation rate in the sediments, and are observed only in pollen-poor zones. Still, several extremes in the spore counts in the diagram reflect climatic changes. These climatically dependent changes can be recognized by their direct correlation to changes in the other components of the pollen spectra. For instance, the maximum spore values in the diagram (pollen zones XII and XI, or Levels 4 and 4A) are related to the increase of mesophytic herbs, and partially to arboreal pollen. The minimum spore values are correlated with either the lowest pollen counts of mesophytic herbs and arboreal vegetation (pollen zone X, Layer 5), or with the appearance of broad-leaved taxa, and therefore a warmer climate and higher evaporation rate (zone XIV, Layer 3A, zone IV, Layer B).

The members of different taxonomical groups of spores in the spectra are important for paleoenvironment reconstructions. Bryales (green mosses) are common representatives in spore vegetation in steppes and even semi-deserts. The maximum spore values in pollen zones IX and X (Level 6-1, the upper part and Layer 5) are attained at the expense of Bryales, and are not unusual for steppe zones. The absolute maximum of spores in zone XII (Level 4, the lower part) is driven by moisture-loving Polypodiaceae (ferns), which is well correlated with the maximums of arboreal and Herbetum mixtum pollen here. In most of the spectra in the diagram, the Polypodiaceae contents are within the present limit for plain-steppe (<10%) and forest-steppe (<15%) zones. A peculiar feature of the Buran-Kaya III sequence is a significant amount of spores from the Pteridae subfamily of Polypodiaceae (which have been counted separately). Some representatives of Pteridae grow on limestone stones, fissures, and rock-shelters, while others (*Pteridium*, for instance) grow in light forests and meadows. Their presence within the steppe zone is connected only with mountain refugia and waterlogged areas that would provide sufficient moisture.

The other peculiar feature of the spore group composition is the presence of Lycopodiaceae and *Botrychium*, which are not presently typical of forest-steppe and steppe zones of the temperate belt, and are characteristic of forest and tundra zones. Nevertheless, representatives of these groups are described as typical components in the composition of the Pleniglacial steppe vegetation of the southern Russian Plain, where they are proportionally more abundant than in the Buran-Kaya III sequence (Bolikhovskaya

1995; Bezusko and Bogutsky 1986). Low numbers of Lycopodiaceae were found in the Middle Pleniglacial interstadials and interphasial deposits of the Kabazi II section (Gerasimenko 1999). In Buran-Kaya III, Lycopodiaceae, as well as *Botrychium*, also have their highest values in the lower part of the sequence (zones I–III, Levels E–C), and they appear throughout the sequence, though in small numbers. This is related to the closer position of Buran-Kaya III to the floodplain as compared to Kabazi II. These two spore taxa grow in meadows of the boreal zone. *Botrychium* spores drop in value and disappear upwards starting from pollen zone XI (Level 4A), and only unique examples appear in zones V–VIII (Levels B1–6-1, the lower part). The diversity of spores and the poor composition of arboreal pollen demonstrate that during this period, the Burulcha River Valley provided a habitat for many moisture-loving plants, but not to warmth-loving plants.

Generally, the Buran-Kaya III diagram is rather homogenous, especially in the portion framed by the uppermost and lowermost forest-steppe pollen complexes. The ratio of herbaceous xerophytes and mesophytic Herbetum mixtum is most characteristic of steppe pollen spectra. Despite the cyclic oscillations in the non-arboreal pollen components, the general trend is towards increasing xerophytes from the bottom to the top of the 2001 section (from Level D to Level C), and from the bottom to the top of the late Pleistocene sequence in the 1998 section (from Level B1 to Layer 5). Based on the counts of xerophyte pollen, the diagram can be subdivided into 4 major parts: (1) pollen zones I–III and V (Levels E–D and Layer B) with relatively low xerophyte content, (2) pollen zones VI–VIII (Level 6-5 through the lower part of Level 6-1) with middling xerophyte content, (3) pollen zones IX–X (Level 6-1 to 5) with the maximum xerophyte content, and (4) pollen zones XI–XIV (Levels 4A–3A) with low xerophyte content.

Environments of Buran-Kaya III

Level E Environment

Pollen zone I (Level E) indicates the existence of forest-steppe vegetation in the Burulcha River Valley, though open landscapes dominated over forest associations. The forest, made up of alder and birch, occupied the floodplain, and a few lime trees grew in protected locations on the slopes of the southern foothills. The herbaceous vegetation was dominated by meadow types, including mesophytic plants of the Ranunculaceae family. In many places, the ground was significantly waterlogged, which favored the extensive distribution of sedges and mosses. Ferns, as well as some club mosses and grape ferns, grew both in forests and in rock cavities. The rather high pollen counts of Asteraceae possibly reflect the development of erosional processes in the river valley.

The presence of *Betula*, club mosses, and grape fern (*Botrychium*) in the vegetational composition indicates a boreal climate for this interval, although the occurrence of the broad-leaved species *Tilia cordata* Mill. indicates that it was close to south-boreal conditions. Possibly, it was a transitional climate of the end of an interstadial: relatively humid and allowing for the forest-meadow type of vegetation in the Burulcha River Valley.

Level D Environment

Pollen zone II (Level D) shows some reduction in forest areas in the river valley and the disappearance of broad-leaved trees. The open landscapes were still dominated by wet meadow coenoses at the beginning of the interval, but some xeric elements had already appeared (*Ephedra*, *Artemisia*). Later on, sedges were replaced by grasses and mesophytic Herbetum mixtum, and so the waterlogged areas in the valley were reduced. Erosional processes, recorded in the vegetation of disturbed substrata, developed around the site, especially at the end of the interval. It appears that at the end of the interval, the rockshelter itself had a lot of moisture—all spore plants (mosses, club mosses, and ferns) have their maxima in the diagram in this zone.

The vegetational composition of zone II indicates a boreal steppe climate that got colder and progressively drier than the climate of the preceding interval. The herb coenoses changed from wet meadows to Gramineae-Herbetum mixtum during the interval. Still, steppes were mesophytic, and birch-alder forest existed in the floodplain. At the end of the interval, an intense local input of moisture occurred in the rockshelter, causing an increase in the population of spore plants.

Level C Environment

Pollen zone III (Level C) indicates a further increase of aridity of the boreal climate. Chenopodiaceae, *Artemisia*, *Ephedra*, and Plumbaginaceae formed separate xeric associations and replaced the grass coenoses in dry areas. Mesophytic herbs of with a rather rich composition were also extensively distributed in the river valley. Two families (Lamiaceae and Cichoriaceae) dominated mesophytic associations. Lamiaceae included many plants growing on limestone substrata, and are very typical of the modern herb cover of the Crimean forest-steppe. Cichoriaceae are common in meadow and steppe, but frequently produce maxima in the cultural horizons of archeological sites (Kremenetsky 1991), reflecting ruderal vegetation. The presence of Plantaginaceae pollen in the spectrum, which is also indicative of human impact on vegetation, is interesting in this context. The sharp drop in Asteraceae pollen might indicate that the erosional processes around the site stopped. The activities of Paleolithic peoples affected the same stable surface of the site for a longer period, and the traces of these activities are better reflected in the pollen spectra and the sediments (abundance of microscopic charcoal).

Birch-alder groves grew in the floodplain, and some bushes of the heliophytic plant *Juniperus* grew on limestone rocks. Climatic aridity (and human impact?) might be responsible for the drop in spore plants in the rockshelter. The relative abundance of club mosses, and particularly of grape fern, in the spore composition point to a boreal climate during the period.

Pollen zone IV (substrata of Level C in the 1998 section) shows the disappearance of birch-alder forest in the Burulcha River Valley. This episode is not recorded in the 2001 section. A boreal steppe zone existed in the area, with more xerophytic steppe coenoses than during the formation of Levels E, D, and C. At the beginning of the interval, waterlogged areas covered by sedges were present not far from the site. Later on, sedges were replaced by Herbetum mixtum, which needs less moisture. Grasses and xeric herbs (Chenopodiaceae, *Artemisia*, and *Ephedra*) were consistently abundant, but especially so at the end of the interval. Spore plants permanently grew in the rock cavities. From the beginning to the end of the interval, ferns became less abundant, whereas mosses, club mosses, and grape fern became more extensive. This, together with reduction of sedges, indicates the decreasing wetness of the site and its surroundings to the end of the interval. The lithological evidence may show evidence of whether this dry and cold spell happened before the formation of the lithological sequence of the 2001 section, or whether it is part of the arid interval with the harshest climatic conditions recorded in pollen zone III (Level C).

Layer B Environment

Pollen zone V (Layer B) indicates steppe landscapes, though with more mesophytic herbs than in the intervals recorded in pollen zones II–IV (Levels D, C). At the beginning of this time span (Level B1), wet meadows with a high proportion of sedges occupied the floodplain. Mesophytic plants of the Ranunculaceae family also grew there. Grass associations were extensively distributed on the drier areas. Xeric coenoses were not widespread in the Burulcha River Valley. Alder trees framed the river channel.

In the second half of the interval (Level B), the meadows became drier and were dominated by Herbetum mixtum. Representatives of the Lamiaceae family were particularly abundant everywhere around the site. Pollen of *Scutellaria* and *Stachys* types was observed in the samples—the former is adapted to limestone substrata, the latter grows in meadows. Willow and birch occurred in the alder groves along the river, and a few oaks grew in the protected foothills of the southern slope. The spore population of rock cavities decreased, particularly in connection with a drop in boreal spore plants—club mosses and grape fern.

These vegetational changes demonstrate a climatic improvement as compared to the preceding intervals. The low number of boreal elements (both of birch and boreal spore plants) and the appearance of broad-leaved species (*Quercus pubescens* Willd.) may indicate warming. The very low number of xerophytes in the herb composition is evidence for increased precipitation than in the preceding stages of steppe distribution (especially at the beginning of the interval). Still, steppes dominated the landscape, and the participation of broad-leaved trees in the vegetation was low. This suggests that the interval was an interphasial.

Level 6-5 Environment

Pollen zone VI (Level 6-5) reflects steppe landscapes with a more xeric composition of herb coenoses than during all the preceding intervals. Grass steppes with a high proportion of Chenopodiaceae prevailed during the second half of the period, whereas the beginning of the interval was a kind of transition from the previous wetter interphasial to full stadial conditions. At the beginning of the interval, Herbetum mixtum (especially Lamiaceae) still prevailed in the herb cover, and birch and alder trees lined the river. In the second part of the stadial, the area was treeless. At the beginning of the interval, erosional processes possibly developed around the site (recorded in the Asteraceae peak), and additional input of moisture to the rockshelter occurred (the high values of Pteridae ferns). Generally, spore plants were dominated by mosses and included a few boreal elements (club mosses and grape ferns).

Levels 6-4–6-2 Environment

Pollen zone VII (Levels 6-4–6-2) enables the environmental reconstruction for only the middle part of the period (Level 6-3). It appears that the climatic conditions were also alike at the beginning and at the end of this interval because of the similarities in the main pollen spectra indices, but the pollen counts in the corresponding sediments are too low to provide detailed analysis. Obviously, throughout the interval, birch-pine groves grew in the Burulcha River floodplain and boreal steppes were present in the site's vicinity. During the sedimentation of Level 6-3, steppes were mainly dominated by Gramineae-Herbetum mixtum associations, though xerophytic coenoses also significantly contributed to the steppe vegetation composition. Dry steppe vegetation, such as *Artemisia*, started to spread in the area. Lamiaceae and Rosaceae dominated the Herbetum mixtum composition. The vegetation indicates a stadial climate, but one less harsh than at the end of the Level 6-5 interval. The distinctive feature is a decrease in spore plants around the site. Mosses did not change in number, but club mosses and ferns, especially grape ferns, practically disappeared.

Level 6-1 Environment

Pollen zone VIII (the lower part of Level 6-1) also indicates a boreal steppe, but with more mesophytic herb coenoses than in the previous stadials. The area was occupied by meadow steppes, recorded in the maximum of Herbetum mixtum values and in the very low number of xerophytes. The distribution of the Lamiaceae family (pollen of *Scutellaria* and *Stachys* types) reached its maximum at this time. Ranunculaceae, the representatives of which grow in meadows, appeared. Alder, birch, and willow edged the river channel, and juniper bushes grew on slopes. The spore population increased in number around the site, and was dominated by mosses and Pteridae ferns. In fact, the vegetation was very similar to that of the interstadial and interphasial described in the Buran-Kaya III sequence, but broad-leaved species did not occur. The mesophytication of steppes reflects a strong decrease in climatic continentalism during this interval, and, conventionally, it could be related to an interphasial.

Pollen zone IX (the upper part of Level 6-1) shows a significant environmental change, as compared to the previous wet interval. Dry steppe associations (*Artemisia* and *Ephedra* in a complex with Chenopodiaceae) spread in the area and replaced the Herbetum mixtum coenoses. The latter were possibly restricted to only the floodplain. The valley was treeless, or, at most, only few alders and junipers appeared near the river. Lamiaceae dominated the Herbetum mixtum composition, although Cichoriaceae also became abundant at the end of the interval. The lower part of the pollen zone is marked by the maximum of Pteridae spores, which can only be explained by some very local changes in the rockshelter environment. Mosses dominated the spore composition in the latter part, while the number of wet-loving ferns decreased during this interval. The vegetation of this interval indicates a stadial with a continental climate, which was similar to, or more continental, than the climate recorded in the upper part of pollen zone VI (top of Level 6-5).

Layer 5 Environment

Pollen zone X (Layer 5) demonstrates the further progressive increase of climatic continentalism, recorded in the maximum spread of xerophytes, including Chenopodiaceae, *Artemisia,* and *Ephedra*. Mesophytic coenoses of Herbetum mixtum still grew in the floodplain, but their distribution was significantly reduced, especially at the end of the interval. Concomitantly, the floristic composition of Herbetum mixtum became very poor.

At the beginning of the interval, a few birch and alder grew near the water, but later on, the valley was treeless. The increase in Asteraceae throughout the zone indicates a pioneer vegetation of disturbed substrata. The vegetation cover was probably sparse, and erosional processes developed elsewhere. The samples for zone X have the lowest pollen frequencies in the section. In this context, the high number of spores in the lower spectra of the zone appears to be related to the proportionally low number of pollen grains. In the upper sample, which is richer in pollen, the percentage of spores is low. Mosses dominated among the spore plants, whereas the more moisture-demanding ferns were generally reduced in number during the interval. It is notable that boreal spore plants (club mosses and grape ferns) got more abundant in this period than during the previous intervals that were recorded in the 1998 sequence. This may indicate that the climate was cold, as well as continental. Pollen zone X corresponds to the climatic pessimum for the entire diagram.

Level 4A Environment

Pollen zone XI (Level 4A) shows some improvement in climate. Boreal steppes still dominated the vegetation, and only a few alder trees appeared in the floodplain. However, the composition of steppe associations implies an increase in precipitation. The number of xerophytes dropped sharply, and instead, Herbetum mixtum-Gramineae coenoses were extensively distributed in the area. The floristic composition of Herbetum mixtum did not recover after the peak in aridity of the preceding interval and was very poor (Lamiaceae, Rosaceae, and Brassicaceae), while plants of the Asteraceae family were still abundant. Spore plant population of the site increased, particularly at the expense of moisture-loving ferns. In contrast, the proportion of boreal grape fern decreased during this interval, which may indicate an increase in moisture and temperature as compared to the preceding interval.

Level 4 Environment

Pollen zone XII (the lower part of Level 4) indicates forest-steppe vegetation. Alder groves spread extensively in the floodplain. Meadow steppes occupied the whole area, whereas xeric coenoses practically disappeared. The floristic composition of Herbetum mixtum became richer, but the most distinctive feature of the mesophytic vegetation was an extensive fern distribution. They obviously grew abundantly around the rockshelter, as well as in the floodplain forest. Elements of broad-leaved flora did not appear yet in the area, whereas bushes—Rhamnaceae and Caprifoliaceae—started to spread. The climate of the interval was wet, but was still boreal, and may correspond to an interstadial or to the beginning of an interglacial.

Pollen zone XIII (the upper part of Level 4) shows a return to a steppe landscape in the Burulcha River Valley, although the steppes were mesophytic with a rich floristic composition of Herbetum mixtum. Representatives of the Lamiaceae family were especially abundant. The area was dominated by boreal meadow-steppe, and alder groves framed the river valley. Ferns became much less widespread, but boreal club mosses somewhat increased in number. The climate was drier than during the preceding forest-steppe interval, but much wetter than during the previous stadials.

Layer 3A Environment

Pollen zone XIV (Layer 3A) indicates a forest-steppe vegetation with a temperate climate. At that time, broad-leaved trees and bushes—hornbeam, oak, maple, and hazel—grew on the slope foothills, and alder groves spread along the river. *Rhamnus* and *Viburnum* grew in the undergrowth. Forests were not, however, dominant in the landscape; meadow steppe was widespread and included a very rich herb composition. Xerophytes, including *Artemisia* and *Ephedra*, grew on dry slopes. The amount of spore plants in the ground cover was below average for the period of the site's existence: shade-loving Pteridae ferns sharply dropped in number and boreal grape fern disappeared. The vegetation of the interval indicates a full interglacial, though it was an interglacial phase with a relatively continental climate favorable to meadow steppe predominence in a forest-steppe landscape.

Temporal Correlations

The vegetational history of Buran-Kaya III provides evidence for the following series of environmental events: (1) interstadial with forest-steppe landscapes (Level E); (2) stadial, first with meadows (Level D), later with more xeric steppe coenoses (Level C); (3) interphasial with mesophytic steppe (Levels B, B1); (4) stadial with grass steppe (Level 6-5); (5) interphasial with meadow steppe (the base of Level 6-1); (6) stadial, first grass steppe (Level 6-1), later on, xeric steppe (Layer 5), and again, grass steppe (Level 4A); (7) interstadial, or beginning of interglacial (Level 4); (8) interglacial (Layer 3A).

The ^{14}C dates obtained for Buran-Kaya III provide the chronological framework for the correlation. In the lower part of the sequence, the AMS dates for Level C are 32,350 ± 700; 32,200 ± 650; and 36,700 ± 1,500; for Level B1 are 28,520 ± 460 and 28,840 ± 460; and for Level 6-5 are 28,700 ± 620 and 34,400 ± 1,200 kyr BP (Chabai et al. 2000). The interphasial seen in pollen zone V (Levels B and B1) can be correlated then with the Denekamp/Arcy interstadial at 28–30 kyr BP. The arid climate of eastern Crimea restricted the distribution of arboreal vegetation and was possibly why this warm spell was registered as an interphasial in the Buran-Kaya III sequence. In the eastern Crimean site of Zaskalnaya V Layer I (Gubonina 1985), broad-leaved vegetation was likewise absent during the interval that is correlated with Level B (Chabai 2000). As is the case in the Buran-Kaya III section, this interval at Zaskalnaya V Layer I is distinctive in its predominance of meadow steppe, the incidence of birch and alder, and the extensive distribution of spore plants.

The cold spell with boreal steppe vegetation recorded in Levels D and C corresponds to the last stadial of the Middle Pleniglacial, which occurred between 30–36 kyr BP. The interstadial of pollen zone I can be correlated then with the end of the Hengelo, or with a cooler Huneborg/Les Cottés interphasial occurring around 35 kyr BP (Hammen 1995). In Kabazi II, this interphasial was also characterized by a low proportion of broad-leaved trees in the vegetational composition, though pine forest was extensively distributed. The differences in the ratio of steppe and forest in landscapes during this interval in Western and eastern Crimea may have been controlled by differences in the climatic continentalism of the two areas, also observed in the present day.

Based on the archeological correlations (Chabai et al. 2000), the Les Cottés interphasial of Kabazi II corresponds to Zaskalnaya V Layer II and the latter might therefore be correlated with Buran-Kaya III Level E. Nevertheless, the pollen of Zaskalnaya V Layer II differs from Level E by a steppe type of spectra and higher counts of xerophytes, and is more similar to the pollen complexes of Levels D and C. According to the available pollen data, Levels D and C belong to different phases of the same stadial, and show a progressive increase in aridity from the beginning to the end of the period. Concerning the characteristics of herbaceous vegetation of the last Middle Pleniglacial stadial in Kabazi II and Buran-Kaya III, it appears that the latter site was richer in hydrophytes during the first half of the stadial (Level D). We can explain this only by the closer position of Buran-Kaya III to the floodplain, providing waterlogged substrata for hydrophytic Cyperaceae coenoses.

Level 6-5 does not differ from Level B in its ^{14}C dates, but its pollen spectra indicate a stadial climate. The lower part of the zone represents a transition from interstadial to stadial conditions, with meadows and alder trees in the valley, while the upper part corresponds to full stadial conditions with a predominance of grass steppe. A prevalence of boreal grass steppe was also established at this time, overlying Denekamp deposits in Kabazi II—the Bug pollen zone and the beginning of Upper Pleniglacial.

Buran-Kaya III was surrounded by boreal steppe during the formation of the upper part of the sequence, up to and including Level 4A. Radiometric dates for Level 4A place it in the Younger Dryas (10,580 ± 60 and 10,920 ± 65), corresponding to the upper chronological limit of the Late Glacial. The Upper Paleolithic was replaced by the Final Paleolithic (Swiderian) culture at this time (Yanevich 1999).

Layer 5, characterized by the harshest continental climate seen in the Buran-Kaya III sequence, is the last level of the Pleniglacial. The second half of the Pleniglacial (the upper part of Level 6-1 and 5) was distinctive for having more xeric steppe coenoses than the first half (Levels 6-1–6-3). This corresponds well to the view of two glacial vegetational phases—an earlier cold/wet phase and a later cold/dry one (Grichuk 1972). In Upper Pleniglacial (Late Valdai) sections of the northern and central part of the Russian Plain, the beginning of the maximum increase of *Artemisia* is dated to around 15 kyr BP (Bolikhovskaya 1995). A tentative correlation of the upper part of Level 6-1 and Layer 5 with the date 15–13 kyr is therefore suggested.

Pollen in the base of Level 6-1 indicates a cool and wet interphasial. The underlying Level 6-2 is ^{14}C dated to 30,740 ± 460, but contains a Gravettian cultural layer (Chabai et al. 2000). This archeological culture is usually regarded as younger than the Last Glacial Maximum, which occurred around 18 kyr BP (A. Yanevich, personal communication). The interphasial seen in this zone, bracketed within 18 and 15 kyr BP, can tentatively be correlated therefore with the Western European Lascaux interstadial, dated 17–16 kyr BP, or the Plyussky interstadial of the Central Russian Plain of 16.5–15 kyr BP (Bolikhovskaya 1995). It is interesting that the arcto-boreal species of Lycopodiaceae and *Botrychium boreale* Milde. disappeared during the Plyussky interstadial on the Central Russian Plain (Bolikhovskaya 1995), whereas a decrease in club mosses and grape ferns (and their eventual disappearance) was also observed in the lower part of Level 6-1 and in Level 6-3. Unfortunately, gaps in the pollen records of Buran-Kaya III occur in Levels 6-2 and 6-4, but, judging from the pollen content of Level 6-3, the climate during this part of the Pleniglacial was somewhat wetter than during the formation of the upper part of Levels 6-5 and 6-1 and Layer 5. The interval with the most xeric vegetation within the first half of the Late Pleniglacial (the upper part of Level 6-1) can tentatively be correlated with the arid interval at the beginning of the Late Pleniglacial of Western Europe, between 27 and 23 kyr BP (Hammen 1995).

Level 4 overlies the dated Younger Dryas deposits and should belong to the Holocene. It displays a continuing cool boreal climate, first very humid, then continental. Correlation of the wet interval with the beginning of Preboreal (10.3–9.6 kyr BP) is suggested, whereas the following arid spell may correspond to the cold second half of Preboreal (9.6–9.0 kyr BP). The Pereslav cooling of this time (established by Khotinsky 1982), indicates a retreat of Late Glacial flora and aridification of the climate.

Layer 3A is ^{14}C-dated to 5,070 ± 40 and 5,180 ± 50 and includes the Neolithic cultural horizons (A. Yanevich, personal communication). It represents the second half of the Atlantic period, with an interglacial type of vegetation. The forest-steppe vegetation of the period generally corresponds to the modern vegetation of the area. Judging from the complete afforestation of the lower part of the Burulcha River Valley nowadays, however, it seems that the climate was somewhat drier during the Late Atlantic. This is regarded as a more arid stage than the preceding Atlantic climatic optimum at 5.5 kyr BP and also drier than the beginning of the Subboreal, 4.5 kyr BP (Khotinsky 1982).

Conclusion

Pollen analysis of Buran-Kaya III demonstrates the absolute predominance of steppe landscape through the Late Pleniglacial and Late Glacial history of the site. South-boreal forest-steppe existed at the beginning of the Buran-Kaya III sedimentary sequence formation. This time span (Level E) is tentatively correlated with the end of the Hengelo interstadial. The Denekamp (Arcy) interstadial had drier environments,

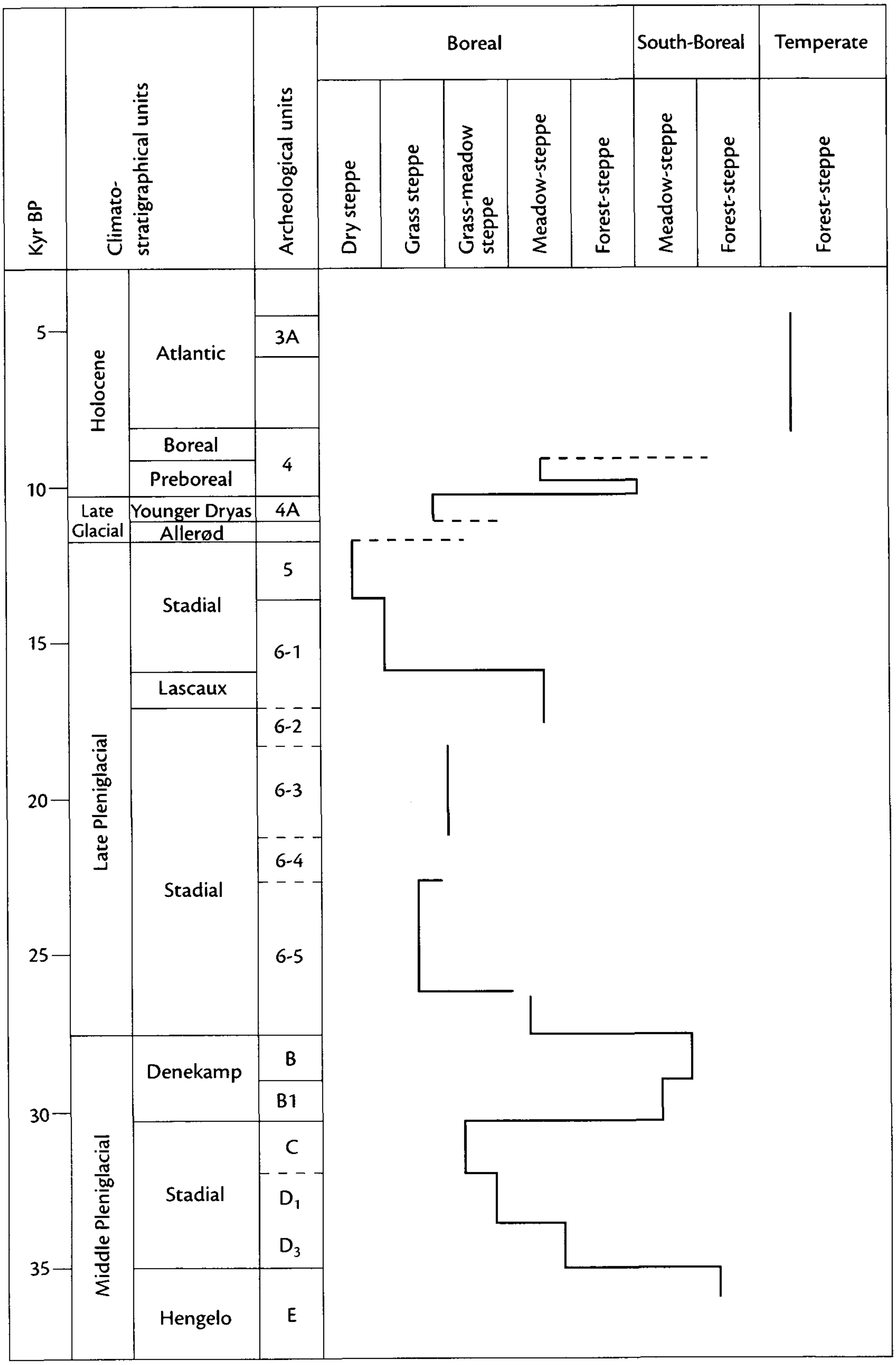


Figure 2-2—Vegetational dynamics of Buran-Kaya III.

represented by south-boreal meadow-steppe. This interstadial corresponds to the last Middle Paleolithic culture in the site (Layer B). The stadial that separates the two Middle Pleniglacial interstadials (Level D) was characterized by boreal steppe vegetation, which continued to have a considerable proportion of meso-hydrophytic coenoses.

The Late Pleniglacial interval obviously began in Level 6-5, although the transition from the Middle to Late Pleniglacial is recorded in the Buran-Kaya III sequence as a gradual one. The Late Pleniglacial steppes were generally more xeric than the Middle Pleniglacial ones. A trend towards xerophytization of the vegetation from the beginning to the end of Late Pleniglacial is observed. The landscapes of first half of the Late Pleniglacial (Levels 6-5–6-3) were dominated by Gramineae (grass) and Herbetum mixtum-Gramineae steppes. During the second half of Late Pleniglacial (Layer 5, the upper part of Level 6-1), dry steppes were extensively distributed in the area, especially during the Layer 5 interval. The area periodically became treeless. This dry climatic spell is correlated with the Late Valdai cryo-xerophytic phase (13–15 kyr BP).

A cool and wet interphasial occurred in the interval following the appearance of the Gravettian and prior to the cryo-xerophytic phase. In this context, the interphasial (the lower part of Level 6-1) is tentatively correlated with the Lascaux (Plyussky) Interstadial (16–17 kyr BP). Meadow steppes occupied the area during this period.

During the Younger Dryas (Level 4A), the xeric steppes of the end of the Late Pleniglacial were replaced by a typical grass steppe. This shows a decrease of climatic aridity during the Late Glacial, though the climate was still cold and continental. The last occurrence of Upper Paleolithic culture was associated with the last xeric phase of the Upper Pleniglacial, and the Final Paleolithic occurred in the area during the Younger Dryas and Preboreal.

At the beginning of Preboreal (the lower part of Level 4), a re-establishment of forest-steppe environments occurred for the first time since the Hengelo interstadial. The humid climate favored the extensive distribution of meadow steppe, alder forest, and an abundance of Polypodiaceae ferns. The later dry spell with the reappearance of boreal steppe (the upper part of Level 4) is correlated with the Late Preboreal (Pereslav) cooling (9.6–9.0 kyr BP). The climate was less continental than during the Late Pleniglacial and Late Glacial stadials, and meadow steppes spread in the area.

From the Denekamp Interstadial up to Late Preboreal, there was a boreal type of vegetation and climate in the area. The beginning of Preboreal could be similar to the south-boreal conditions (appearance of Rhamnaceae and Caprifoliaceae, Polypodiaceae maximum). Subboreal (temperate) forest-steppe existed in the area during the Late Atlantic. The Neolithic population of the site lived during a climate similar to the modern one, or slightly drier.

The vegetational dynamics recorded in the Buran-Kaya III pollen sequence are shown in Figure 2-2. The environmental changes in the site are generally well correlated with the main events of the period from the end of Middle Pleniglacial to the end of Late Pleniglacial. The Late Glacial interstadials are not represented in Buran-Kaya III, and some Late Pleniglacial phases were possibly overlooked because of low pollen frequencies in the samples. In the Middle Pleniglacial records, the amplitudes of stadial/interstadial changes are less pronounced than in the western Crimean site Kabazi II. This can be explained by the greater aridity of eastern Crimea (*in re* arboreal pollen), as well as by the stronger impact of floodplain vegetation in Buran-Kaya III (*in re* herbaceous pollen). The site's position in the lower part of the mountain river valley also controlled the Late Pleniglacial records of the site. Xerophyte pollen was never as abundant in Buran-Kaya III as it was in the Upper Pleniglacial pollen spectra in the Ukraine plain, including its northern part (Sirenko and Turlo 1986; Bolikhovskaya 1995; Gerasimenko 2001). From the Middle Pleniglacial to the Middle Holocene, grass steppes and meadow steppes were the dominant vegetational type in the site vicinity. Dry steppes extended over large areas only during the 13–15 kyr BP interval.

3

Small Mammal Fauna from Buran-Kaya III

Anastasia K. Markova

The Buran-Kaya III rockshelter is situated in Eastern Crimea, on the second mountain ridge, in the Burulcha River basin. The site is located at 250 m asl and is 8 m above the present Burulcha River water level. Buran-Kaya III includes many cultural layers, which, by archeological industries, are separated into two main groups (Monigal, Chapter 1). The lower (early) group includes archeological Levels E, D, C, and Layer B. Layer B is subdivided into Level B (uppermost) and Level B1 (lowermost) and is associated with lithological layer IV. Level C, containing an Eastern Szeletian/Streletskayan assemblage, is about 4 cm thick and has AMS ^{14}C dates of 32,350 ± 700 (OXA-6672), 32,200 ± 650 (OXA-6869), and 36,700 ± 1,500 (OXA-6868) BP. The Kiik-Koba facies of Layer B has AMS ^{14}C dates from Level B1 of 28,840 ± 460 (OXA-6673) and 28,520 ± 460 (OXA-6674) BP (Pettitt 1998a). The upper (late) group includes, from bottom to top, archeological Levels 6-5, 6-4, 6-3, 6-2, 6-1, and Layer 5, which are all considered to be Upper Paleolithic (Janevic 1998).

The small mammal remains described in this report are from Levels C, B1, B, 6-5, 6-4, 6-3, 6-2, 6-1 (and its sublevels), and Layer 5. These remains were recovered during the 1996 and 2001 excavations of Buran-Kaya III and were given to the author for study in 2001.

Materials

The small mammal bone material in the analyzed levels is relatively well preserved. The angles of the teeth are intact and several mandibles with teeth were found. Most of the bones have a light yellow color, with occasional remains colored black due to burning.

Small mammal bones were collected during excavation and during the screening and washing of sediments from the cultural layers. The number of bones in the deposits is rather high. The small mammal fauna at Buran-Kaya III mostly includes species of rodents (Rodentia), a few insectivores (Insectivora), and lagomorphs (Lagomorpha).

Taphonomy

Most small mammal remains were accumulated in the rockshelter as the pellets and excrement of predator birds and large mammals (Gromov 1961; Andrews 1990). Studies of Crimean predators have shown the main food preferences of the fox *Vulpes vulpes* to be hares and voles. Muridae are second in importance in its diet (Kotovshikova 1936). The remains of open biotope mammal species prevail in the excrement of fox, because of this animal's hunting strategy.

Gromov (1961) has demonstrated that most of the small mammal remains in the cultural layers of Crimean sites were deposited by owls. The European eagle owl *Bubo bubo* today in Crimea typically includes among its prey voles of the genus *Microtus*, the hamsters *Cricetus cricetus* and *Cricetulus migratorius*, the hare *Lepus europaeus*, the northern mole-vole *Ellobius talpinus*, mice of the genera *Apodemus* and *Mus*, and the hedgehog *Erinaceus europaeus*. The remains of the large jerboa *Allactaga major*, birch mouse *Sicista*, and white-tooth shrew *Crocidura* are only rarely found in owl's pellets (Gromov 1961). The remains of open landscape species dominate in recent *Bubo bubo* pellets. This bird hunts over a large area, up to 10 kilometers, and takes any animal weighing up to 17 kilograms, even the young roe deer *Capreolus capreolus* (Andrews 1990).

The tawny owl *Strix aluco*, which inhabits rockshelters situated in the forests of the Crimean Mountains, primarily hunts small forest mammals (voles, Muridae, shrews) (Gromov 1961). Its hunting range is about 200 to 700 meters around its nest and it will take any animal weighing up to one kilogram (Andrews 1990).

Thus, the accumulation of the bones of small mammals of differing ecology and size in the cultural layers of sites depends very strongly upon predator preferences. In most cases, however, these concentrations reflect the small mammal faunas from areas a few kilometers around the site. Reconstructed small mammal assemblages thereby provide a broad picture of the environment during the deposition of cultural layers, in contrast to snail fauna, which only reflect the immediate local conditions in the cave or rockshelter.

Species Composition of Small Mammals from Level C and Layer B

The small mammal fauna recovered from Buran-Kaya III Level C and Layer B includes 10 species of Rodentia, Lagomorpha, and Insectivora. Five hundred small mammal remains have been analyzed, of which about two hundred have been identified to species. Six species of rodents, one insectivore, and one lagomorph have been identified.

Small Mammals from Level C

Level C includes seven species of rodents and lagomorphs (Figure 3-1, Table 3-1). The bones of little suslik (ground squirrel) *Spermophilus pygmaeus*, great jerboa *Allactaga major* (Figure 3-1: *1*), water vole *Arvicola terrestris* (Figure 3-1: *5*), yellow steppe lemming *Eolagurus luteus* (Figure 3-1: *2*), narrow-skulled vole *Microtus (Stenocranius) gregalis* (Figure 3-1: *4*), and the "obscurus" vole *Microtus obscurus* (Figure 3-1: *3*) were identified. Also, the remains of the European hare *Lepus europaeus* were found.

The favorite habitats for the little suslik are various types of semi-deserts (sand, clay-sand, and loess semi-deserts) and dry, arid steppes with wormwood. It is also found in deserts. The little suslik inhabits the low mountain steppe belt as well, but it does not live above 400–500 m asl.

The great jerboa is a typical representative of arid steppes and semi-desert landscapes. It prefers biogeocoenoses with solid (dense) soils having thin vegetation. Sometimes the great jerboa penetrates into forest-steppes, using dry open slopes with thin grass cover (Ognev 1948). *Allactaga major* still inhabits Crimea. The remains of great jerboa have been found in interglacial and glacial Pleistocene faunas on the Russian Plain. For example, its remains have been found in the deposits of the Bryansk Interstadial soil (33–24,000 BP) in the Upper Dnieper basin (Desna River basin) in the site of Arapovichi, together with lemmings, narrow-skulled voles, and steppe lemmings

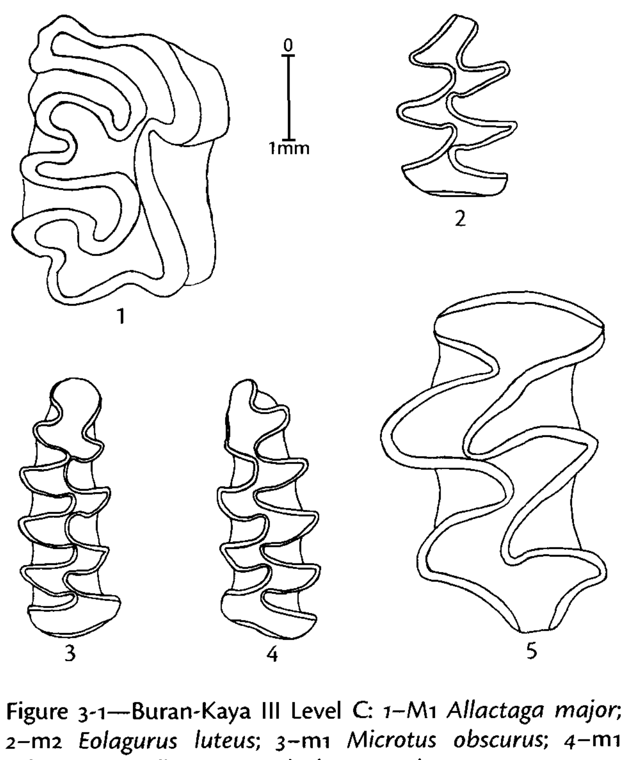


Figure 3-1—Buran-Kaya III Level C: *1*–M1 *Allactaga major*; *2*–m2 *Eolagurus luteus*; *3*–m1 *Microtus obscurus*; *4*–m1 *Microtus gregalis*; *5*–M1 *Arvicola terrestris*.

TABLE 3-1
Small mammal remains from Buran-Kaya III Level C and Layer B

	Level C	*Level B1*	*Level B*
Insectivora			
Sorex araneus Linnaeus (Eurasian common shrew)	—	2 mandibles with teeth	—
Lagomorpha			
Lepus europaeus Pallas (European hare)	9 molars, 12 incisors	2 molars, 2 incisors	—
Rodentia			
Spermophilus pygmaeus Pallas (little suslik)	13 molars	25 molars, 20 incisors	20 molars, 10 incisors
Allactaga major Kerr (great jerboa)	1 M1	2 m2	—
Cricetulus migratorius Pallas (grey hamster)	—	1 mandible with m2 and fragment of m1; 1 maxilla with M1	—
Ellobius talpinus Pallas (northern mole-vole)	—	—	1 m2
Lagurus lagurus Pallas (steppe lemming)	—	1 m1	3 m1
Eolagurus luteus Eversmann (yellow steppe lemming)	1 m2	—	1 mandible with m1, m2; m1
Arvicola terrestris Linnaeus (water vole)	1 M1, 3 incisors, mandible fragment	—	1 M1, 2 m1, 1 m2
Microtus (Stenocranius) gregalis Pallas (narrow-skulled vole)	1 m1, mandible with m2	—	—
Microtus (Microtus) obscurus Eversmann (M. arvalis group) ("obscurus vole")	1 m1, mandible fragment	mandibles with m2, 2 m1, 2 m2	1 M1, 1 M3, 4 m1, 1 m2
Microtus sp. (vole)	8 incisors	20 incisors	10 incisors
Total number of species	7	7	6

(Markova 1985; Markova, Simakova, Puzachenko, and Kitaev 2002). The small mammal composition of this locality belongs to a typical periglacial community. However, there are also many indications for the presence of *Allactaga major* bones among typical interglacial faunas (Markova 1982a). The most important factor for this animal was therefore the presence of open landscapes with thin vegetation, rather than temperature.

The yellow steppe lemming *Eolagurus luteus* now inhabits only Middle Asia, Mongolia, and China, where it lives in open landscapes (Figure 3-1: 2). Today it prefers semi-deserts, dry steppes, and even deserts (Ognev 1950; Gromov and Erbaeva 1995). During the Last Glacial, its area of distribution was very wide and included the central and southern Russian Plain, as well as Crimea. This species was typical for the so-called "mixed" periglacial faunas, not only of the Valdai Glacial, but also of earlier glacials (Markova 1998). Yellow lemmings of different evolutional levels (species) have been found among interglacial Early, Middle, and Late Pleistocene faunas in Eastern Europe (Agadjanian and Markova 1983; Markova 1982; Rekovets 1994). The *Eolagurus* range remained rather broad during the Holocene, and even into the nineteenth century, the yellow steppe lemming existed in the Lower Volga River drainage basin and in the deserts of Kazakhstan. Thus, the presence of the remains of this animal in Level C indicates, most of all, dry open landscapes near the site.

Three species of voles were found in Level C. The water vole *Arvicola terrestris* inhabits the banks of rivers and other water reservoirs. This species has an intrazonal range and inhabits sub-aquatic biotopes over wide areas of Eastern Europe, from steppe zones to forest-tundra. It is absent today only in the tundra and arctic zones (Ognev 1950). The presence of this animal indicates the proximity of some surface water near the site.

The narrow-skulled vole *Microtus (Stenocranius) gregalis* is an inhabitant of various types of open landscapes. *M. gregalis* now lives in tundra and steppe zones. This animal is practically indifferent to low temperatures. During the Valdai Glacial, its range was very wide and *M. gregalis* was one of the characteristic members of the mammoth faunal complex (Markova 1982b; Baryshnikov and Markova 1992). More recently, after the degradation of the Valdai ice sheet, its range separated into two parts: tundra and steppe. The morphology of first lower molar of *M. gregalis* found in Buran-Kaya III Level C (Figure 3-1: *4*) has the typical "*gregalis*" morphotype without the additional angle on the anterior loop of the anteroconid complex. Such morphology is more characteristic of the late Middle Pleistocene narrow-skulled voles and of the modern steppe populations. This morphotype is rare in Valdai Glacial *Microtus gregalis* populations of the central Russian Plain, for which a more complicated structure of the first lower molar of the narrow-skulled vole was typical (Motuzko 1992; Rekovets 1985; Markova 1982a, 1992).

Microtus obscurus prefers open meadow-steppe landscapes, and its range now includes Crimea and the Caucasus Mountains, the Volga River basin, and the Urals (Malygin 1983; Zagaradniuk 1991). This species was identified by fossil materials only during the most recent studies of small mammals from Crimean Paleolithic sites (Markova 1999, 2000).

Lepus europaeus today inhabits different open landscapes: forest-steppe, steppe, and semi-desert. It can also live in the forest zone, but only in open glades and on their edges (Ognev 1940; Gromov and Erbaeva 1995).

Thus, all of the small mammal species found in Buran-Kaya III Level C indicate dry open landscapes near the site. Arid steppes with patches of semi-desertic vegetation are suggested. The presence of water vole points to the existence of a stream near the site.

Small Mammals from Layer B

Buran-Kaya III Layer B (Levels B and B1) represents the only cultural layer with a Kiik-Koba type industry. The separation of these levels was first noted during the 1996 excavations based on the difference in the saturation of burned bones. In this report, the fauna from these levels is analyzed jointly, although the distribution of material from Levels B and B1 is enumerated separately in Table 3-1.

The fauna from Layer B includes eight species of Rodentia, one species of Lagomorpha, and one species of Insectivora (Table 3-1).

Two mandibles of the Eurasian common shrew (*Sorex araneus*) (Insectivora) were identified from this layer (Figures 3-2: *1*; 3-3: *3*). The range of *Sorex araneus* has recently been wide, including tundra-forest, forest, and forest-steppe zones. It prefers forests of different types and bushes, but also inhabits grasslands with high grasses. The common shrew is abundant in the floodplains of rivers, creeks, and other water reservoirs, which are its favorite biocoenoses (Gromov and Erbaeva 1995). Its presence in Layer B most likely indicates the proximity of some surface water near the site.

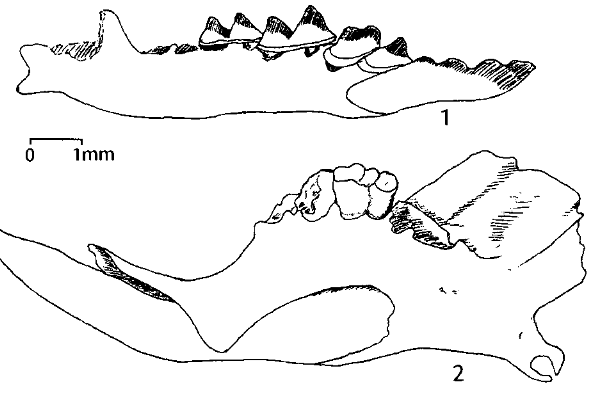


Figure 3-2—Buran-Kaya III Level B1: *1–Sorex araneus* mandible; *2–Cricetulus migratorius* mandible.

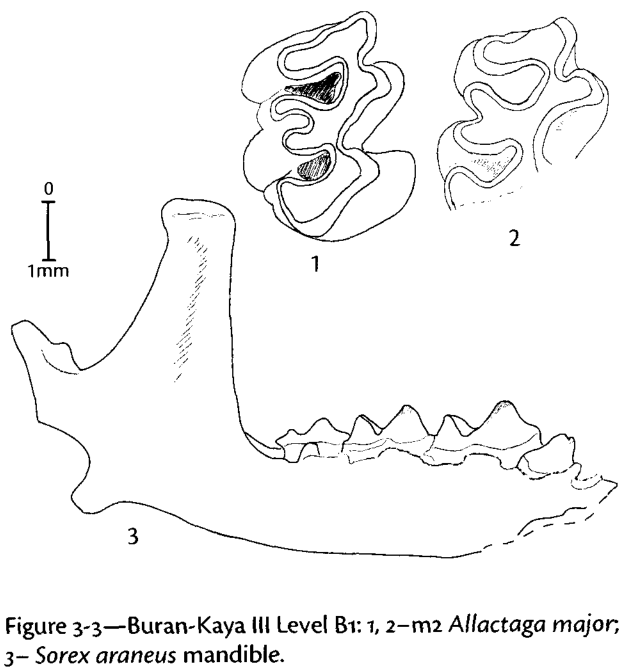


Figure 3-3—Buran-Kaya III Level B1: 1, 2–m2 *Allactaga major*; 3– *Sorex araneus* mandible.

Several remains of *Lepus europaeus* were found in this layer. Its ecology has been described above.

Many remains of little suslik (ground squirrel) *Spermophilus pygmaeus* were discovered in Layer B, indicating a wide distribution of open landscapes near the site. The great jerboa (*Allactaga major*) also inhabited the environs during the accumulation of Layer B (Figure 3-3: *1–2*). The description of its ecology was presented above.

Two mandibles of the grey hamster (*Cricetulus migratorius*) have been found in this layer (Figure 3-2: *2*). This species now inhabits open landscapes of different types. Its modern range includes the central and southern Russian Plain, Crimea, and Middle Asia. The grey hamster favors plain and mountain steppe habitats, but it is common in forest-steppes and semi-deserts as well. *Cricetulus migratorius* burrows rather simple holes, and it often uses rocky areas in the mountains, where it lives in hollows. The subspecies *Cricetulus migratorius phaeus* now lives in Crimea. The presence of grey hamster bones indicates that there were open steppe landscapes—and possibly rocky areas—near the site.

A lower second tooth of a northern mole-vole (*Ellobius talpinus*) was found in Layer B (Figure 3-4). *Ellobius talpinus* prefers open landscapes, mostly steppes and forest-steppes with rich soils. Today this animal inhabits the northern part of the Crimean Peninsula. Its range also includes steppes and semi-desert between the Ingul and Molochnaya Rivers (southern Ukraine) and the steppes of the Northern Caucasus. Its range extends eastward to the Aral

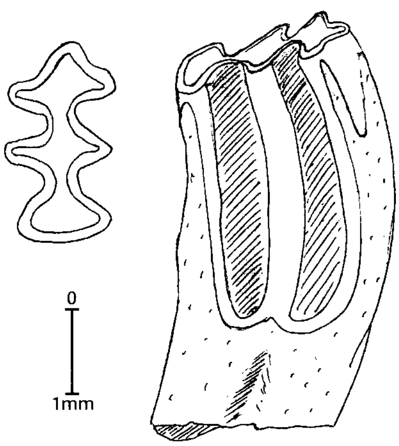


Figure 3-4—Buran-Kaya III Level B: m2 *Ellobius talpinus.*

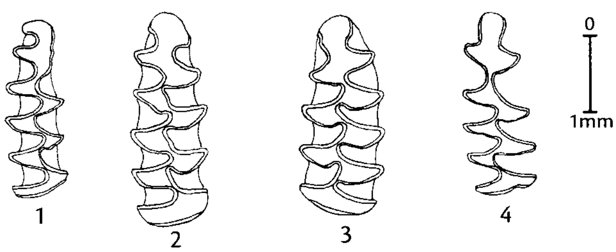


Figure 3-5—Buran-Kaya III Level B1: 1–m1 *Microtus gregalis*; 2, 3–m1 *Microtus obscurus*; 4–m1 *Lagurus lagurus.*

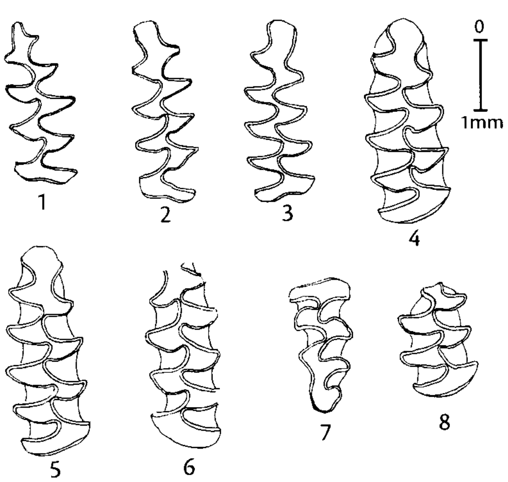


Figure 3-6—Buran-Kaya III Level B: 1-3–m1 *Lagurus lagurus*; 4-6–m1 *Microtus obscurus*; 7–M3 *Microtus obscurus*; 8–m2 *Microtus* sp.

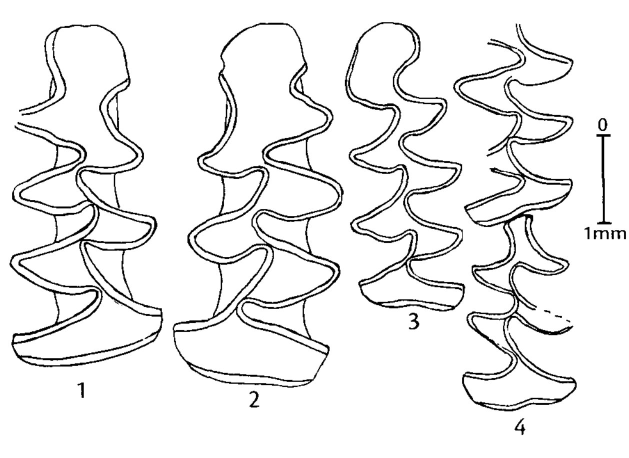


Figure 3-7—Buran-Kaya III Level B: 1, 2–m1 *Arvicola terrestris*; 3–m1 *Eolagurus luteus*; 4–m1 (fragment) and m2 of *Eolagurus luteus.*

Sea and the Amu-Darya River basin. The northern mole-vole is a zonal representative of steppes and semi-deserts. Its range also extends into forest-steppes, where it inhabits open areas. *Ellobius talpinus* burrows deeply and lives an underground life. Plant roots are the mainstay of its diet. It can make burrows in different types of deposits: in soft soils, in sands, and even in rocky deposits (Gromov and Erbaeva 1995; Ognev 1950).

The first lower tooth of a steppe lemming *Lagurus lagurus* was found in Layer B (Figures 3-5: *4*; 3-6: *1–3*). The morphology of the tooth is typical for *Lagurus lagurus*, with well-differentiated enamel and the trefoil form of the anterior loop. This species (and its ancestral forms) was very characteristic of open landscapes of different types, including periglacial steppes and forest-steppes of the glacial stages, as well as the steppe-like landscapes of the interglacial epochs (Markova 1982b, 1998; Rekovets 1994). During the Valdai Glacial, it was widely distributed in the northern hemisphere and penetrated far to the north and to the east from its modern distribution. Steppe lemmings were found during this time as far away as the British Islands. *Lagurus lagurus* was a consistent member in the mammoth faunal complex of the second half of the Late Pleistocene (Baryshnikov and Markova 1992, 2003).

A northern mole-vole *Ellobius talpinus* lower second tooth was found in Layer B (Figure 3-3). The lower molars of the yellow steppe lemming *Eolagurus luteus* are typical in their structure (Figure 3-7: *3–4*). The ecology of this animal was described above.

The first lower molars of the water vole (*Arvicola terrestris*) are rather large and have positive enamel (Figure 3-7: *1–2*). These features permit an attribution of these remains to the modern species *Arvicola terrestris*. The presence of this animal indicates surface water near the site.

Only one species of the genus *Microtus* was discovered in Layer B. It was attributed to the "obscurus" vole, *Microtus obscurus* (Figure 3-6: *4–8*). This mammal prefers steppe and meadow conditions.

The majority of the Layer B small mammal species were inhabitants of different types of open steppe and semi-desert landscapes. Only the water vole and the European common shrew prefer periaquatic biotopes. The absence of *Microtus gregalis* possibly indicates some warming, compared with the Level C assemblage. This warming could be correlated with the Bryansk Interstadial.

Species Composition of Small Mammals from Level 6-5 through Layer 5

The small mammal fauna recovered from the Upper Paleolithic part of the Buran-Kaya III sequence includes 10 species of Rodentia and Lagomorpha.

Small Mammals from Levels 6-5, 6-4, and 6-3

Six species of small mammals were found in Level 6-5 (Table 3-2). They belong to two orders: Lagomorpha and Rodentia.

European hare *Lepus europaeus* is the only lagomorph present. Rodentia remains include *Spermophilus pygmaeus*, *Ellobius talpinus*, *Eolagurus luteus*, and *Microtus obscurus*, all representatives of open steppe-like and semi-desert-like landscapes (Figures 3-8 and 3-9). The ecology of these species was described above. The remains of water vole *Arvicola terrestris* in Level 6-5 indicate that there was surface water near the site (Figure 3-8: *2*). The absence of bones of the narrow-skulled vole *Microtus gregalis* may suggest interstadial conditions.

The overlying Level 6-4 includes the remains of five species: *Lepus europaeus*, *Spermophilus pygmaeus*, *Ellobius talpinus*, *Eolagurus luteus*, and *Microtus obscurus* (Table 3-2; Figures 3-10 and 3-11). All of the species found in Level 6-4 inhabit various types of open landscapes. Remains of the narrow-skulled vole *Microtus*

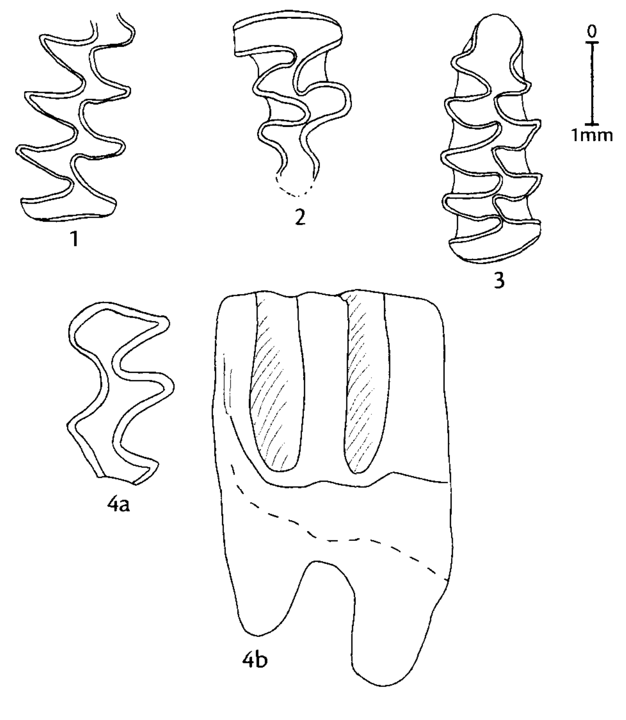


Figure 3-8—Buran-Kaya III Level 6-5: *1*–m1 *Eolagurus luteus*; *2*–M3 *Arvicola terrestris*; *3*–m1 *Microtus obscurus*; *4a* and *4b*–M2 *Ellobius talpinus*.

TABLE 3-2
Small mammal remains from Buran-Kaya III Levels 6-5, 6-4, and 6-3

	Level 6-5	*Level 6-4*	*Level 6-3*
Lagomorpha			
Lepus europaeus Pallas (European hare)	10 molars, 5 incisors	14 molars, 9 incisors	3 molars, 2 incisors
Rodentia			
Spermophilus pygmaeus Pallas (little suslik)	1 molar	5 molars, 8 incisors	—
Ellobius talpinus Pallas (northern mole-vole)	1 M2, 1 m2, 1 m3	1 M1, 1 M3, 3 incisors	—
Eolagurus luteus Eversmann (yellow steppe lemming)	1 m1, 1 m2, 1 M1	1 M1, 2 m1, 1 m2, mandible fragment, 8 incisors	1 M2
Arvicola terrestris Linnaeus (water vole)	1 M3	—	1 m2
Microtus (Stenocranius) gregalis Pallas (narrow-skulled vole)	—	—	1 m1
Microtus (Microtus) obscurus Eversmann ("obscurus vole")	2 m1, 1 M1	1 m1	2 m1
Microtus sp. (vole)	2 M1, 1 M2, 5 incisors	1 M2, 3 M1, 10M1, 1 m1 fragment, 2 mandible fragments, 27 incisors	m1 fragments, M1, 2 m2, 20 incisors, 2 mandible fragments
Total number of species	6	5	5

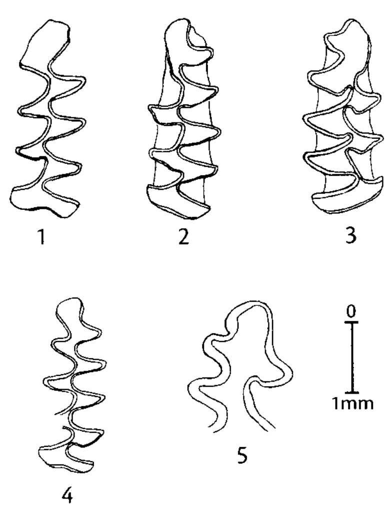


Figure 3-9—Buran-Kaya III Level 6-5,1: 1–m1 *Eolagurus luteus*; 2–m1 *Microtus gregalis*; 3–m1 *Microtus oeconomus*; 4–m1 *Lagurus lagurus*; 5–m1 (fragment) *Ellobius talpinus*.

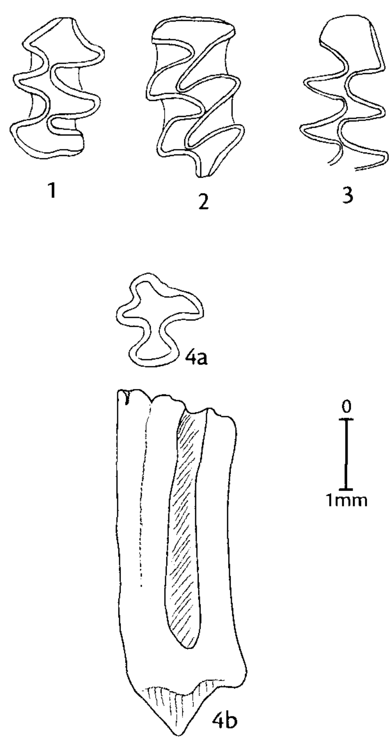


Figure 3-10—Buran-Kaya III Level 6-4, 1: 1–m3 *Arvicola terrestris*; 2–M1 *Microtus* sp.; 3–m1 *Eolagurus luteus*; 4a and 4b–M3 *Ellobius talpinus*.

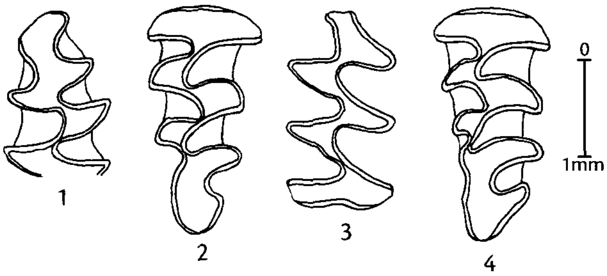


Figure 3-11—Buran-Kaya III Level 6-4, 1: *1*–m1 (fragment) *Microtus obscurus*; *2, 4*–M3 *Microtus* sp.; *3*–m2 *Eolagurus luteus*.

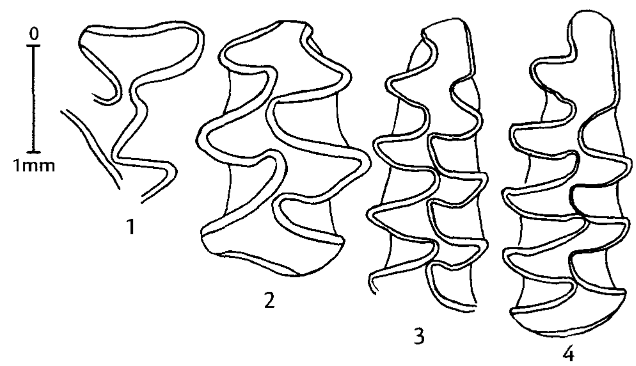


Figure 3-12—Buran-Kaya III Level 6-3, 1: *1*–M1 (fragment) *Eolagurus luteus*; *2*–m2 *Arvicola terrestris*; *3*–m1 *Microtus obscurus*; *4*–m1 *Microtus gregalis*.

gregalis also are absent in this level. It seems that this level could be also attributed to an interstadial.

Five species have been identified from cultural Level 6-3. European hare, yellow steppe lemming, water vole, narrow-skulled vole, and "obscurus" vole all inhabited the site environs during the deposition of Level 6-3 (Table 3-2; Figure 3-12). The presence of *Microtus gregalis* remains (Figure 3-12: *4*), may reflect cooler temperatures.

Thus, during the deposition of Levels 6-5, 6-4, and 6-3 some climatic changes took place near the end of this interval and indicate some cooling. Overall, however, open dry landscapes existed near the site during this entire interval.

Small Mammals from Levels 6-2 and 6-1

The small assemblage from Level 6-2 consists of three species of small mammals: *Lepus europaeus*, *Eolagurus luteus*, and *Microtus* (*Stenocranius*) *gregalis* (Table 3-3).

The first lower molar of *Microtus gregalis* has the simple "*gregalis*" morphotype of the anteroconid complex. This species indicates open landscapes near the site and some cooling, similar to the environment seen during the deposition of Levels 6-4 and 6-3.

Cultural Level 6-1 includes several sub-levels (Table 3-3), which have been analyzed as a single unit. Eleven species of small mammals were identified from Level 6-1. Ten species belong to Rodentia, and one to Lagomorpha (Table 3-3; Figures 3-13–3-21). The small mammal assemblage from Level 6-1 is one of the richest in Buran-Kaya III. As a comparison, today in the mountainous part of Crimea, fourteen species of rodents (including *Rattus* and *Ondatra*, which appear only in the Holocene) and six species of insectivores exist (Gromov and Erbaeva 1995; Panteleev et al. 1990; Flint et al. 1970).

Fauna of Level 6-1 includes the remains of little suslik (ground squirrel) *Spermophilus pygmaeus*, the thick-tailed jerboa *Stylodipus telum*, the great jerboa *Allactaga major* (Figure 3-19: *3*), the little earth hare (lesser five-toed jerboa) *Pygeretmus (Alactagulus) pumilio*, the northern mole-vole *Ellobius talpinus* (Figures 3-15: *10*; 3-18: *2*; 3-19: *1*; 3-21: *1–3*), the steppe lemming *Lagurus lagurus* (Figures 3-13: *1–2, 4–6*; 3-18: *1*; 3-20), the yellow steppe lemming *Eolagurus luteus* (Figure 3-13: *3, 7*), the water vole *Arvicola terrestris* (Figure 3-13: *8*), the root vole *Microtus* (*Pallasiinus*) *oeconomus* (Figure 3-14: *1–2*), the narrow-skulled vole *Microtus* (*Stenocranius*) *gregalis* (Figures 3-14: *4*, 3-16: *1*), and the "obscurus" vole *Microtus* (*Microtus*) *obscurus*. (Figures 3-14: *3*; 3-15: *2*; 3-16: *2–4*). The remains of European hare were also present in the level. Most of the spe-

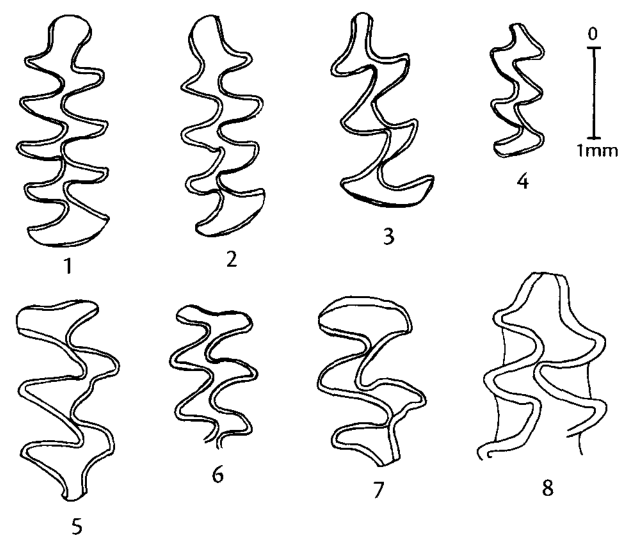


Figure 3-13—Buran-Kaya III Level 6-1, 4: *1, 2*–m1 *Lagurus lagurus*; *3*–m3 *Eolagurus luteus*; *4*–m3 *Lagurus lagurus*; *5*–M1 *Eolagurus luteus*; *6*–M3 *Lagurus lagurus*; *7*–M2 *Eolagurus luteus*; *8*–m2 *Arvicola terrestris*.

cies indicate that arid open landscapes were widely distributed near the site. *Stylodipus telum* (Figure 3-18: *3a, b*) and *Pygeretmus* (*Alactagulus*) *pumilio* (Figures 3-17; 3-19: *2a, b*) are also representative of very arid semi-desert and desert landscapes. *Stylodipus telum* today inhabits sand desert and desert-steppes of different types. It also lives on modern and old river dunes, and in clay deserts. The main food of this mammal is seeds. *Pygeretmus pumilio* now inhabits deserts. Its favorite biotopes are salt-marshes and *takyrs*. Bulbs are the main food of this animal in springtime, later it is the green part of grasses, and during the autumn, it feeds on seeds. The modern range of *Pygeretmus pumilio* includes the southern Russian Plain (parts of Don and Volga drainage basins). This mammal also inhabits Kazakhstan and Middle Asia (Gromov and Erbaeva 1995).

The small mammal assemblage from Level 6-1 indicates very arid environmental conditions near the site, seemingly a semi-desert. Most of the identified mammals prefer to inhabit semi-deserts, deserts of different types, and arid steppes. Only the water vole *Arvicola terrestris* and the root vole *Microtus oeconomus* live on the banks of rivers and other water reservoirs. These species, however, have an intrazonal range. Their presence in Level 6-1 indicates that a stream was nearby.

TABLE 3-3
Small mammal remains from Buran-Kaya III Levels 6-2 and 6-1

	Level 6-2, 1	*Level 6-1, 2*	*Level 6-1, 4*	*Level 6-1, 5*	*Level 6-1, 6*
Lagomorpha					
Lepus europaeus Pallas (European hare)	6 molars, 8 incisors	6 molars, 7 incisors	—	—	—
Rodentia					
Spermophilus pygmaeus Pallas (little suslik)	—	3 molars	2 molars, 4 incisors	1 molar	3 molars, 2 incisors
Stylodipus telum Lichtenstein (thick-tailed jerboa)	—	—	1 m1	—	1 M1
Allactaga major Kerr (great jerboa)	—	—	1 m3	—	—
Pygeretmus (Alactagulus) pumilio Kerr (little earth hare)	—	—	1 m1, 1 m3	—	—
Ellobius talpinus Pallas (northern mole-vole)	—	1 m1, 2 m1, 1 m2	2 M2, 5 incisors	1 m2, 1 incisors	1 M1, 1 incisor
Lagurus lagurus Pallas (steppe lemming)	—	3 m1, 1 m2, 1 m3, 1 M1, 4 incisors	3 m1, 2 m1, 1 m3, 1 M1, 1 M3, 8 incisors	—	1 m1, 2 incisors
Eolagurus luteus Eversmann (yellow steppe lemming)	1 M1, 2 incisors	—	1 m2	—	—
Arvicola terrestris Linnaeus (water vole)	—	—	1 M1, 1 m2, 2 incisors	—	—
Microtus (Pallasiinus) oeconomus Pallas (root vole)	—	—	2 m1	—	—
Microtus (Stenocranius) gregalis Pallas (narrow-skulled vole)	1 m1	—	1 m1	1 m1	—
Microtus (Microtus) obscurus Eversmann ("obscurus vole")	—	—	—	3 m1	—
Microtus sp. (vole)	5 incisors	7 M1, 2 M2, 6M3, 5m2, 1 m3, 25 incisors	—	1 M1, 1 M2, 1 m2, 1 m3, 10 incisors	1 m2, 3 mandible fragments, 5 incisors
Total number of species	3	4	10	4	4

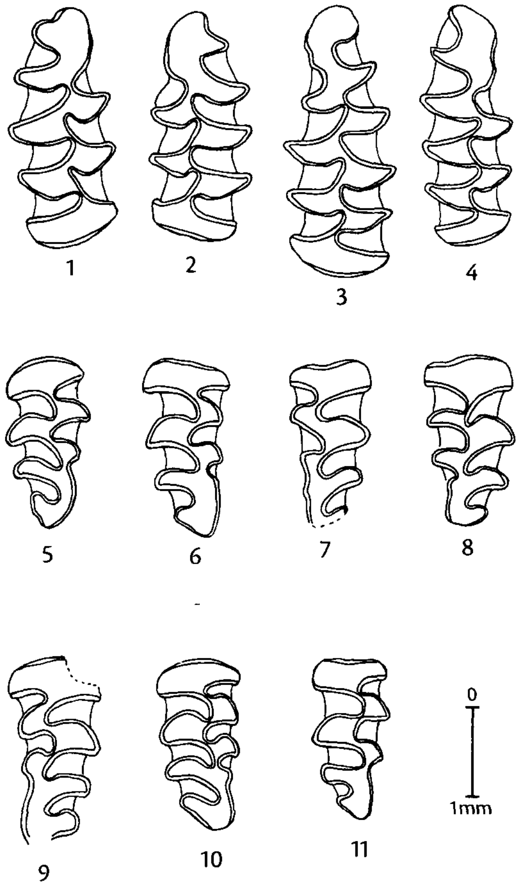


Figure 3-14—Buran-Kaya III Level 6-1, 4: 1, 2–m1 *Microtus oeconomus*; 3–m1 *Microtus obscurus*; 4–m1 *Microtus gregalis*; 5-11–M3 *Microtus* sp.

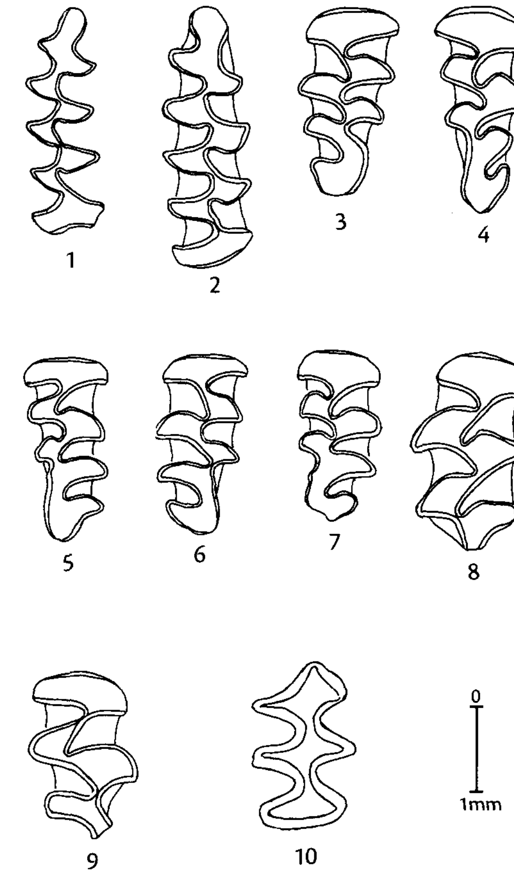


Figure 3-15—Buran-Kaya III Level 6-1, 2: 1–m1 *Lagurus lagurus*; 2–m1 *Microtus obscurus*; 3–7–M3 *Microtus* sp., 8–M1 *Microtus* sp., 9–M2 *Microtus* sp., 10–m2 *Ellobius talpinus*.

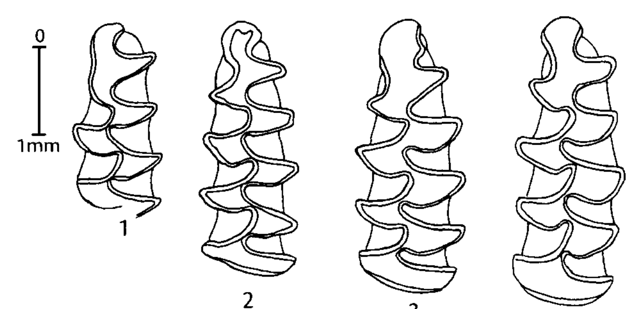


Figure 3-16—Buran-Kaya III Level 6-1, 5: 1–m1 *Microtus gregalis*; 2–4–m1 *Microtus obscurus* (3 is a juvenile).

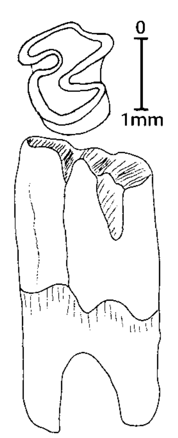


Figure 3-17—Buran-Kaya III Level 6-1, 4: *Pygeretmus pumilio* m3.

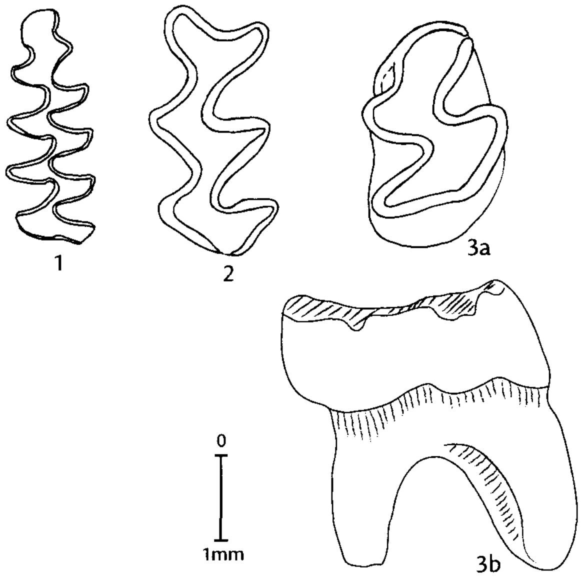


Figure 3-18—Buran-Kaya III Level 6-1: *1*–m1 *Lagurus lagurus*; 2–M1 *Ellobius talpinus*; *3a* and *3b*–M1 *Stylodipus telum*.

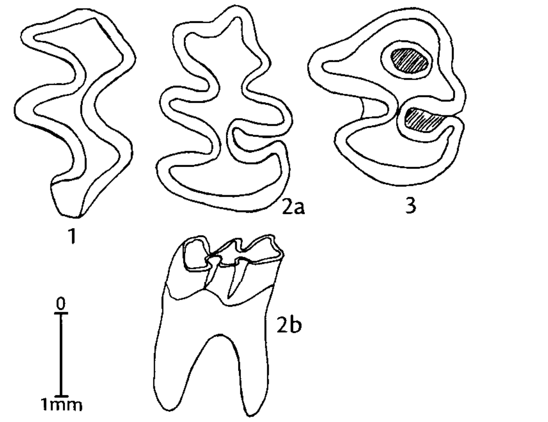


Figure 3-19—Buran-Kaya III Level 6-1, 4: *1*–M2 *Ellobius talpinus*; *2a* and *2b*–m1 *Pygeretmus pumilio*; 3–m3 *Allactaga major*.

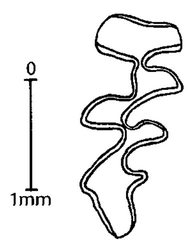


Figure 3-20—Buran-Kaya III Level 6-1, 4: M3 *Lagurus lagurus*.

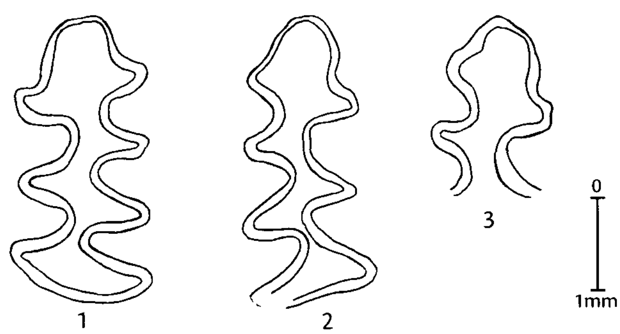


Figure 3-21—Buran-Kaya III Level 6-1, 2: m1 *Ellobius talpinus*.

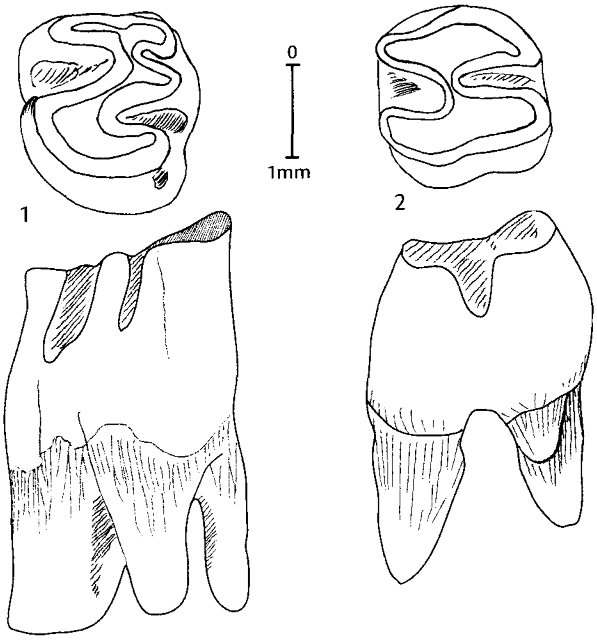


Figure 3-22—Buran-Kaya III Layer 5: *1*–m2 *Stylodipus telum*; 2–M2 *Stylodipus telum*.

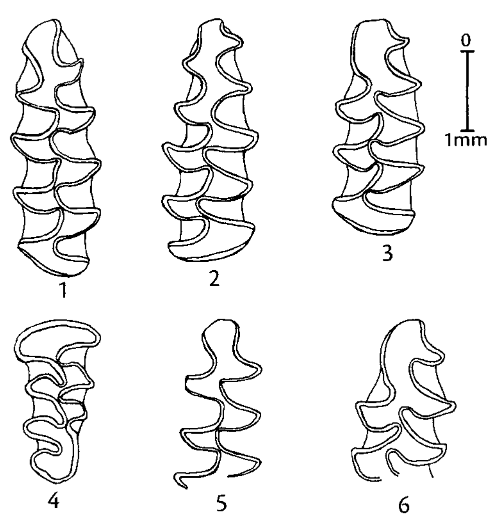


Figure 3-23—Buran-Kaya III Layer 5: *1*, 2–m1 *Microtus obscurus*; 3–m1 *Microtus oeconomus*; 4–M3 *Microtus* sp., 5–m1 *Lagurus lagurus*; 6–m1 *Microtus oeconomus*.

Small Mammals from Layer 5

The youngest small mammal assemblage analyzed from Buran-Kaya III was from Layer 5 (Table 3-4). This layer has a rather rich fauna, with ten species of rodents and lagomorphs identified: little suslik (ground squirrel) *Spermophilus pygmaeus*, thick-tailed jerboa *Stylodipus telum* (Figure 3-22: *1a, b; 2a, b*), northern mole-vole *Ellobius talpinus* (Figure 3-25: *1–3*), steppe lemming *Lagurus lagurus* (Figure 3-23: *5*), yellow steppe lemming *Eolagurus luteus* (Figure 3-24: *4*), water vole *Arvicola terrestris* (Figure 3-24: *1–3*), narrow-skulled vole *Microtus* (*Stenocranius*) *gregalis* (Figure 3-23: *1*), root vole *Microtus* (*Pallasiinus*) *oeconomus* (Figure 3-23: *3, 6*), "obscurus" vole *Microtus obscurus* (Figures 3-23: *2*; 3-25: *4*), and European hare *Lepus europaeus*. This faunal assemblage looks similar ecologically to that from Level 6-1, but the number of the identified remains is lower.

Table 3-4
Small mammal remains from Buran-Kaya III Layer 5

Lagomorpha	
Lepus europaeus Pallas (European hare)	1
Rodentia	
Spermophilus pygmaeus Pallas (little suslik)	9 molars
Stylodipus telum Lichtenstein (thick-tailed jerboa)	1 M2, 1 m2
Ellobius talpinus Pallas (northern mole-vole)	2 M1, 1 M2, 2 m1, 2 m2
Lagurus lagurus Pallas (steppe lemming)	1 M1, 3 m1, 6 m2, 4 m3
Eolagurus luteus Eversmann (yellow steppe lemming)	1 M1, 1 M2, 1 m1
Arvicola terrestris Linnaeus (water vole)	1 m1, 2 m2
Microtus (Stenocranius) gregalis Pallas (narrow-skulled vole)	2 m1
Microtus (Pallasiinus) oeconomus Pallas (root vole)	3 m1
Microtus (Microtus) obscurus Eversmann (*M. arvalis* group) (obscurus vole)	2 m1
Microtus sp. (vole)	15 M1, 6 M2, 6 M3, 7 m2, 4 m3, 15 incisors
Total number of species	10

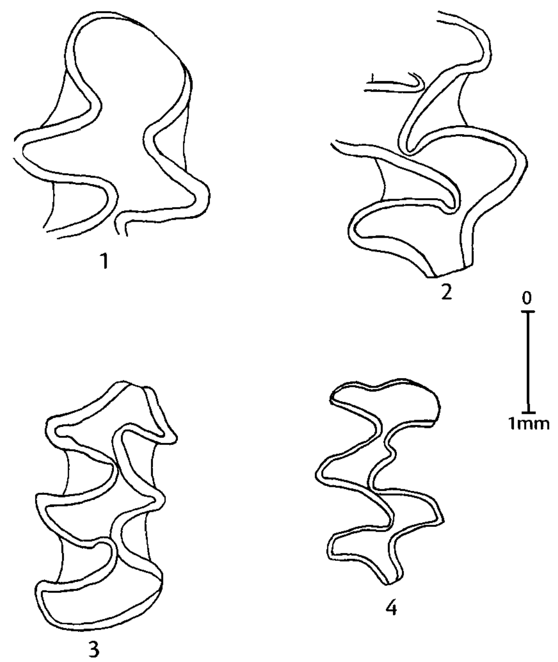


Figure 3-24—Buran-Kaya III Layer 5: *1*–m1 *Arvicola terrestris* (fragment); *2*–M2 *Arvicola terrestris*; *3*–m3 *Arvicola terrestris*; *4*–M2 *Eolagurus luteus*.

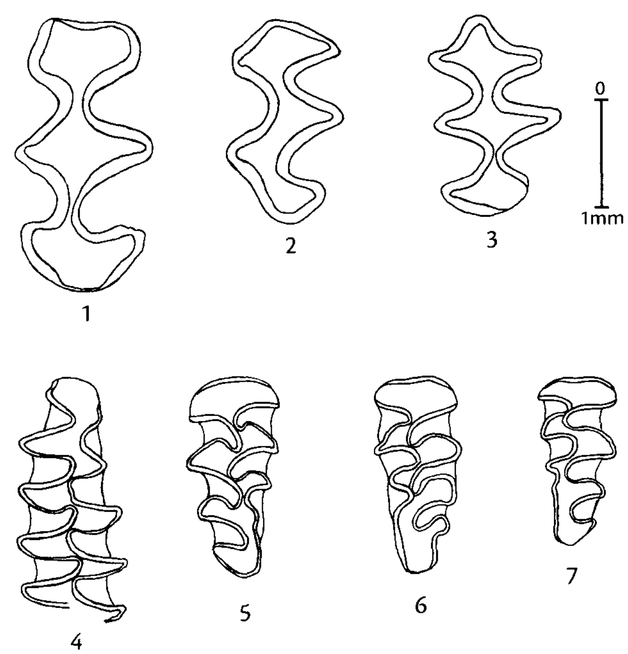


Figure 3-25—Buran-Kaya III Layer 5: *1*–M1 *Ellobius talpinus*; *2*–M2 *Ellobius talpinus*; *3*–m2 *Ellobius talpinus*; *4*–m1 *Microtus obscurus*; *5–7*–M3 *Microtus* sp.

Conclusions

The analysis of the Buran-Kaya III small mammal fauna permits the reconstruction of the principal environmental features during the human occupations at the site. The specific taphonomy of mammalian concentrations in the cultural layers deposited in the rockshelter could have left traces on the compositions of the small mammal species. This composition depends strongly on the hunting strategies of predator birds, which are the principal sources of small mammal bone accumulation in the site and concentrated in the form of pellets. However, the rather wide hunting area of these predator birds and the rich materials obtained from Buran-Kaya III permits a complete picture of the small mammal assemblages that existed during the human occupation.

Small mammal fauna from the analyzed levels includes fourteen species, which is comparable to the modern small mammal diversity. The majority of these species are Rodentia. Only one species of Insectivora and one species of Lagomorpha were found (Tables 3-1–3-4, Figures 3-26 and 3-27).

The species composition of the small mammals and their ecological proclivities reflect the principal ecological conditions surrounding the site and, at the same time, some environmental changes which took place during the human occupations of Buran-Kaya III (Figure 3-27). The majority of species belongs to the group of animals that inhabit open arid landscapes. Most of the small mammals found in Buran-Kaya III indicate the prevalence of arid steppe landscapes near the site. The typical cold-tolerant species are absent in the analyzed levels of the site. Forest and periaquatic animal remains are very rare as well.

During the earlier stage of human occupation (Level C and Layer B), the environmental conditions appear to have been a little more moderate than during the deposition of the overlying cultural layers. Some areas with bushes or trees existed near the site. Desert species were absent at this time. This interval with more moderate conditions may possibly be correlated with the Bryansk Interstadial.

Later, during the deposition of Levels 6-5 to 6-2, signs of forest-bush vegetation, and animals connected with such vegetation, practically disappeared. During this time, semi-desert and meadow-steppe small mammals inhabited the site surroundings. One periaquatic species, the water vole *Arvicola terrestris*, indicates the proximity of a stream near the site.

Finally, conditions became even drier during the deposition of Levels 6-1 and Layer 5. Besides a large group of semi-desert and dry steppe mammals, desert species also appeared near the site during this time.

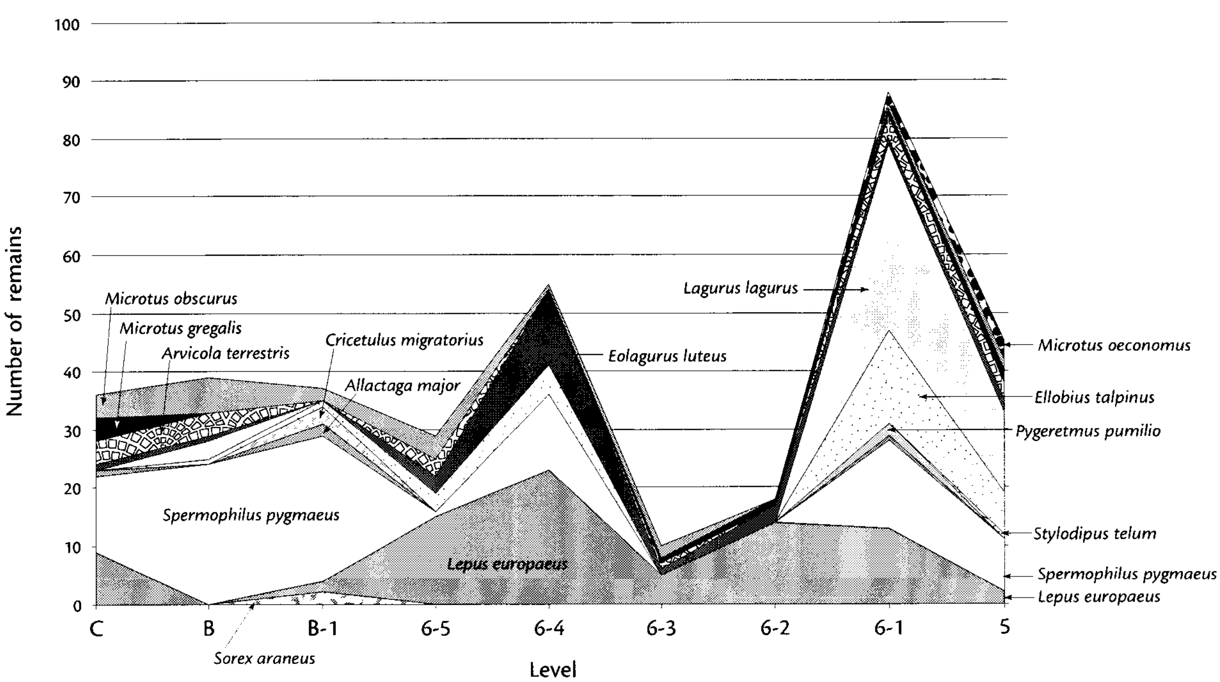


Figure 3-26—Species composition of small mammals in the analyzed levels of Buran-Kaya III.

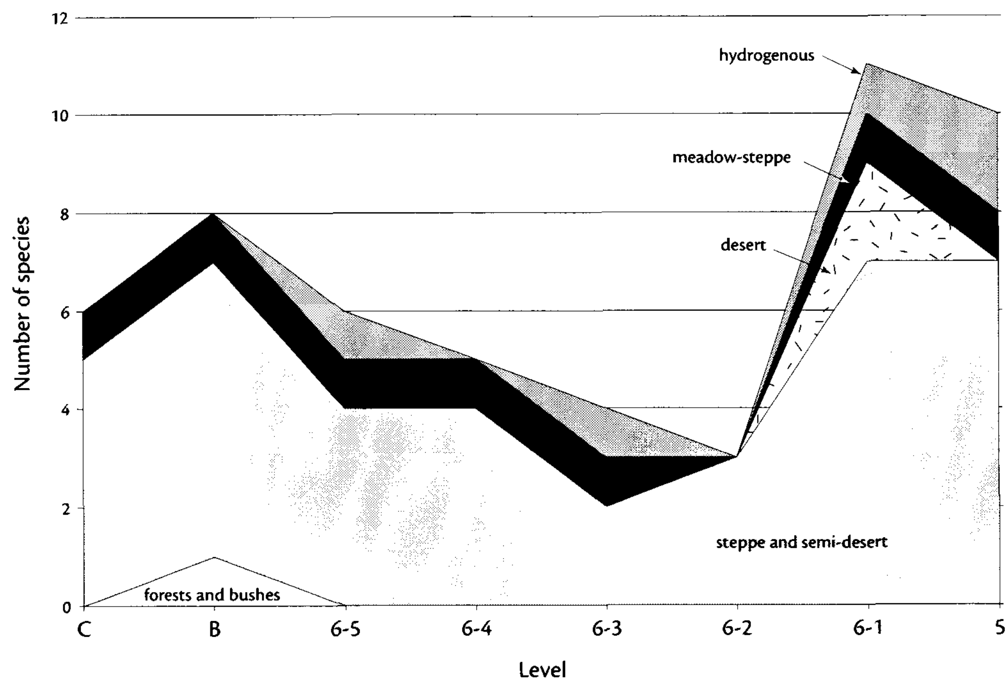


Figure 3-27—Ecological groups of small mammals in the analyzed levels of Buran-Kaya III.

This indicates a climatic aridification that may be correlated with the transition to the last Valdai glacial maximum.

Thus, the rich small mammal fauna discovered in Buran-Kaya III provides information about the surrounding environments during the human occupations. These results permit the reconstruction of the principal features of the ecosystems near the site over several thousands years. It is possible to say that these fauna do not indicate the severe cold conditions of a glacial period. This is the result of the southerly location of Crimean sites (including Buran-Kaya III) and also because Buran-Kaya III corresponds to the second part of OIS 3, which mostly had interstadial climatic conditions.

4

The Lithic Assemblages of Levels E and D of Buran-Kaya III

Katherine Monigal

This chapter describes the lithic assemblages from the two lowermost cultural layers in the Buran-Kaya III sequence, Level E and Level D. Both of these are small assemblages, and their analysis is further hampered by a fairly significant degree of breakage. While the assemblages from Levels E and D are both culturally unattributed, they are technologically and typologically distinct from one another, as well as from the other assemblages present in the site of Buran-Kaya III.

The Level E Lithic Assemblage

The Level E lithic assemblage consists of 1,558 items, most often made on black, speckled black, dark grey, and greyish-brown colored flint. Artifacts in this cultural layer were most heavily concentrated in the southeastern section of the intact deposits of the site (Monigal, Chapter 1). There was some minor edge damage and movement of artifacts, although this was slight overall; a few post-depositionally broken pieces were conjoinable.

The Level E assemblage has been subdivided into eight categories: chips (less than 30 mm in maximum dimension), flakes, blades (length = 2 × width), primary elements (having greater than 50% cortical coverage on the dorsal surface), core trimming elements (CTE), chunks (thick, fragmentary unidentifiable debitage), cores, and tools (any piece carrying purposeful retouch, including fragments). The bulk of the Level E assemblage is pieces less than 30 mm in maximum dimension (Table 4-1), comprising 91.5% of the total number of artifacts, so the non-debris (exclusive of chips and chunks) portion of the assemblage consists of only 129 items. There is, in addition, a fair amount of breakage in the assemblage—67% of all artifacts, or 34% of the non-debris assemblage (Figure 4-1).

The two cores in the assemblage, one of which was on a plaquette, are between 25 and 35 mm in maximum dimension. Although they are unbroken, they are too small and exhausted to classify properly. On

TABLE 4-1
Artifact totals for Level E of Buran-Kaya III

	N	%	%
Chips (< 3cm)	1426	91.5	
Flakes	38	2.4	29.5
Blades	32	2.1	24.8
Primary elements	7	0.4	5.4
Core trimming elements	13	0.8	10.1
Chunks	3	0.2	
Cores	2	0.1	1.6
Tools	37	2.4	28.7
Total	1558	100.0	100.0

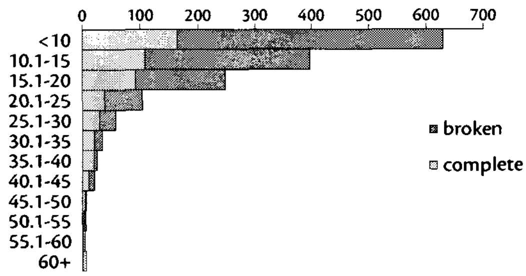


Figure 4-1—Histogram of the maximum dimensions (in mm) of broken and complete pieces from Level E.

the other hand, it can be noted that their last removals were flake-dimensioned, they were non-volumetric, and there was some preparation of multiple platforms. Based on the deep bulbar concavities on the core facets, it appears that a hard hammer technique was used for their reduction.

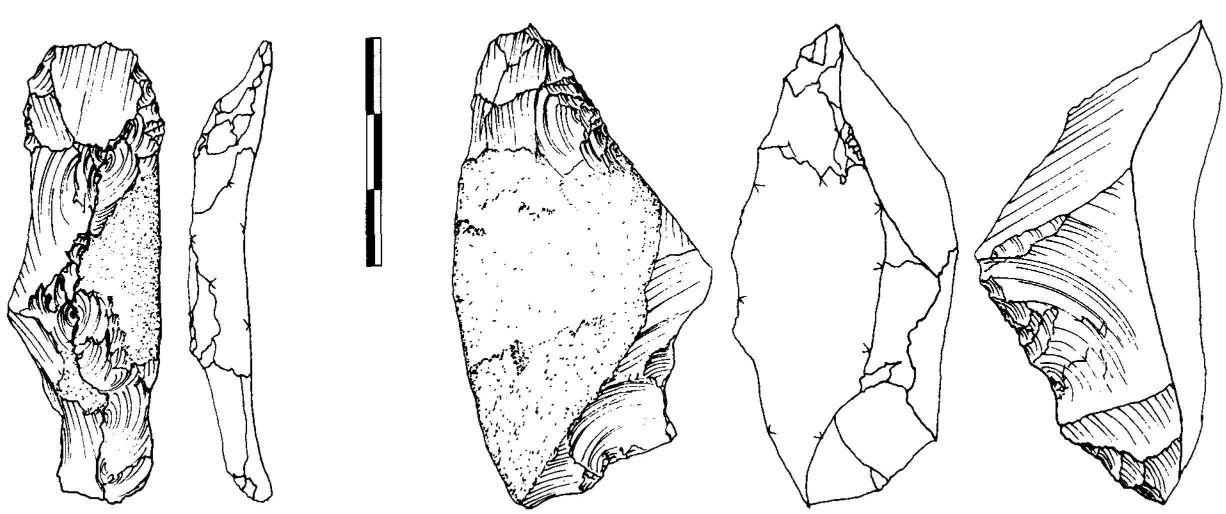
Core trimming elements, which make up 10% of the non-chip assemblage, include massive flakes that removed the top of the core's reduction surface and removals from the core edge where the platform and reduction surfaces intersect. These latter are often blade dimensioned, and resemble poorly-executed *lames à crête* (Figure 4-2: 1). Overall, the CTE confirm the characteristics noted for the cores—hard hammer, multiple prepared platforms, and flake-oriented debitage. They also suggest that the cores were rotated as one surface became too flat or had too many hinged removals, and an adjoining surface of the core use for reduction. The cores were not, however, volumetric—they were single surface in conception throughout the reduction sequence. The CTE further indicate that there was probably more multi-platform use, and therefore multi-directional reduction, than that suggested by the scar patterns on the debitage. There are no core tablets or other debris typically associated with prismatic blade core reduction.

Primary elements account for 5% of the non-chip assemblage and average 35 mm in greatest dimension, with a single piece that is 55 mm. A fair number of the pieces smaller than 30 mm are covered by more than 50% cortex on their dorsal surfaces, and debitage and tools frequently have small areas of cortex. These traits suggest that nodules did not undergo a separate step of decortication beyond setting up a striking platform before reduction began.

Flakes (Figure 4-3: *1, 2*) are small in the Level E assemblage: under 50 mm in maximum dimension, with an average of 35 mm. They are often as broad as they are wide, with blunt or plunging distal terminations, but rarely feathering terminations. Twisted ventral profiles dominate (48.3%), followed by flat (27.6%), incurvate (13.8%), and convex (10.3%).

Dorsal scar patterns on the flakes show an equal amount of unidirectional parallel and crossed/three-directions (43.3% each), with occasional bidirectional (10%) or irregular (3.3%) patterns; no unidirectional convergent dorsal scar patterns were noted on the flakes. The flakes have large bulbs of percussion, without lipping, éraillure scars, noticeable hackles, and indicate hard hammer percussion in all cases. Multiple faceted platforms are most common (57.1%), followed by unfaceted (28.6%), and dihedral (14.3%); no cortical platforms were noted on the flakes.

Blades—pieces the length of which is equal to or exceeds twice the breadth—are almost as common (25%) as flakes in the Level E assemblage (Table



1

2

Figure 4-2—Core trimming elements from Buran-Kaya III Level E: *1*–pseudo-*lame à crête*/core edge element; *2*–core fragment.

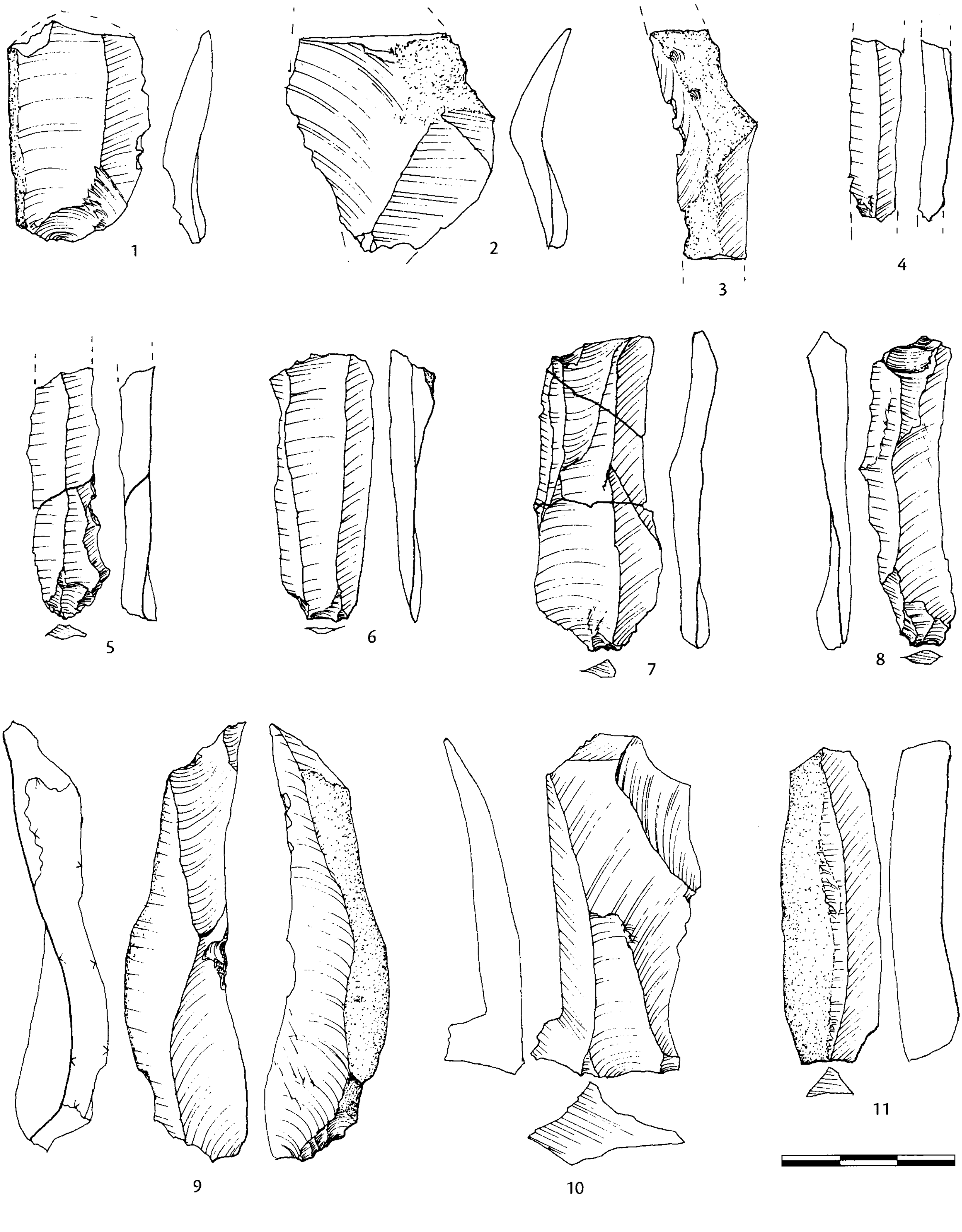


Figure 4-3—Flake and blade debitage from Buran-Kaya III Level E.

TABLE 4-2
Dimensional data for blades (including tools) from Level E

	Mean	*s.d.*	*N*
Length	47.68	14.21	33
Width	20.87	7.22	36
Elongation index (L/W)	2.49	0.55	32
Thickness	7.73	5.61	37
Platform width	12.66	5.95	17
Platform height	6.37	3.16	17
Platform flattening (w/h)	2.18	1.04	17
Relative plat. size (w/plat w)	1.95	0.06	17

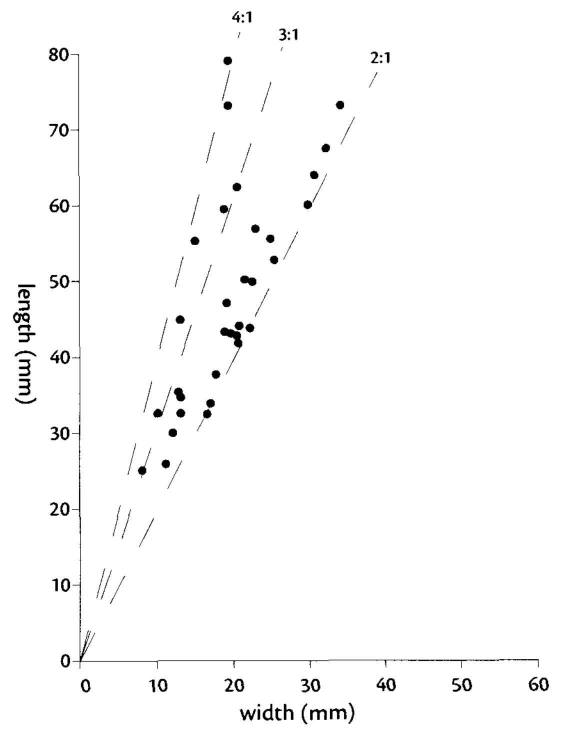


Figure 4-4—Length/width scatterplot of blades (including tools) from Buran-Kaya III Level E.

4-1). These are generally rectangular in shape, but irregularly so—they are often skewed in one direction and/or have wavy lateral edges (Figure 4-3). They are considerably larger than flakes, with a mean length of 48 mm (Table 4-2). The blades have a significant elongation index (that is, they tend to be long and narrow) with a mean of 2.5 and maximum of 4.1 (Figure 4-4). They are fairly thick (7.7 mm) and triangular to trapezoidal in cross-section. The relative platform widths (blank width divided by platform width) have high values (mean = 1.95 mm): platforms of blades are quite narrow; indeed, the blades often taper towards the proximal ends.

Ventral profiles of blades show the same proportional patterning as do the flakes, with a slightly higher incidence of twisted profiles: twisted (55.6%), flat (25.0%), incurvate (13.9%), and convex (10.8%). Most were struck off-axis. Dorsal scar patterns on blades are predominantly unidirectional parallel (54.5%), followed by the considerably rarer bidirectional (21.2%), irregular (15.2%), crossed (6.1%), and converging (3.0%) patterns.

Blade striking platforms are similar to the flakes, with salient bulbs and obvious hard hammer percussion. In contrast to the pattern seen on the flake platforms, the blades of Level E dominate in cortical platforms (45.2%). This is followed by multiple faceted platforms (32.3%), unfaceted (12.9%), and dihedral (9.7%). With a mean of 2.2, the index of platform flattening (the quotient of the platform width and platform height) indicates that platforms are rectangular in shape; about twice as wide as they are thick. There does not appear to be a significant relationship between the size of the blade or its platform and the degree of platform preparation.

Of the thirty-seven tools in the Level E assemblage, all are unifacial (Table 4-3). Denticulates make up a significant number of the tools (38%) (Figure 4-5). It should be noted that due to the presence of some edge damage (probably by trampling) in the assemblage, simple notched (Clactonian-like) items were excluded from the tool assemblage. Two-thirds of the denticulates are on elongated blanks, and denticulation is frequently bilateral. Retouched items make up the second most prevalent tool group (32.4%). One-third of these have marginal but continuous retouch, and one is inverse. Nearly one-half of the retouched items were made on blade blanks. There are five (13.5%) sidescrapers in the assemblage: three simple scrapers, whose classification is provisional since all are broken, a convex oblique sidescraper (Figure 4-5: *1*) and a convergent sidescraper (Figure 4-5: *6*). Sidescraper retouch is flat, semi-parallel, and well-executed, and is thereby contrasted with the retouched pieces with retouch

TABLE 4-3
Typology of Buran-Kaya III Level E

	N	%
Point	1	2.7%
Retouched point	2	5.4%
Simple sidescraper	3	8.1%
Convergent sidescraper	1	2.7%
Convex oblique sidescraper	1	2.7%
Endscraper	1	2.7%
Burin	1	2.7%
Atypical backed knife	1	2.7%
Denticulate	14	37.8%
Inverse retouch	1	2.7%
Retouched piece	11	29.7%
Total	37	100.0%

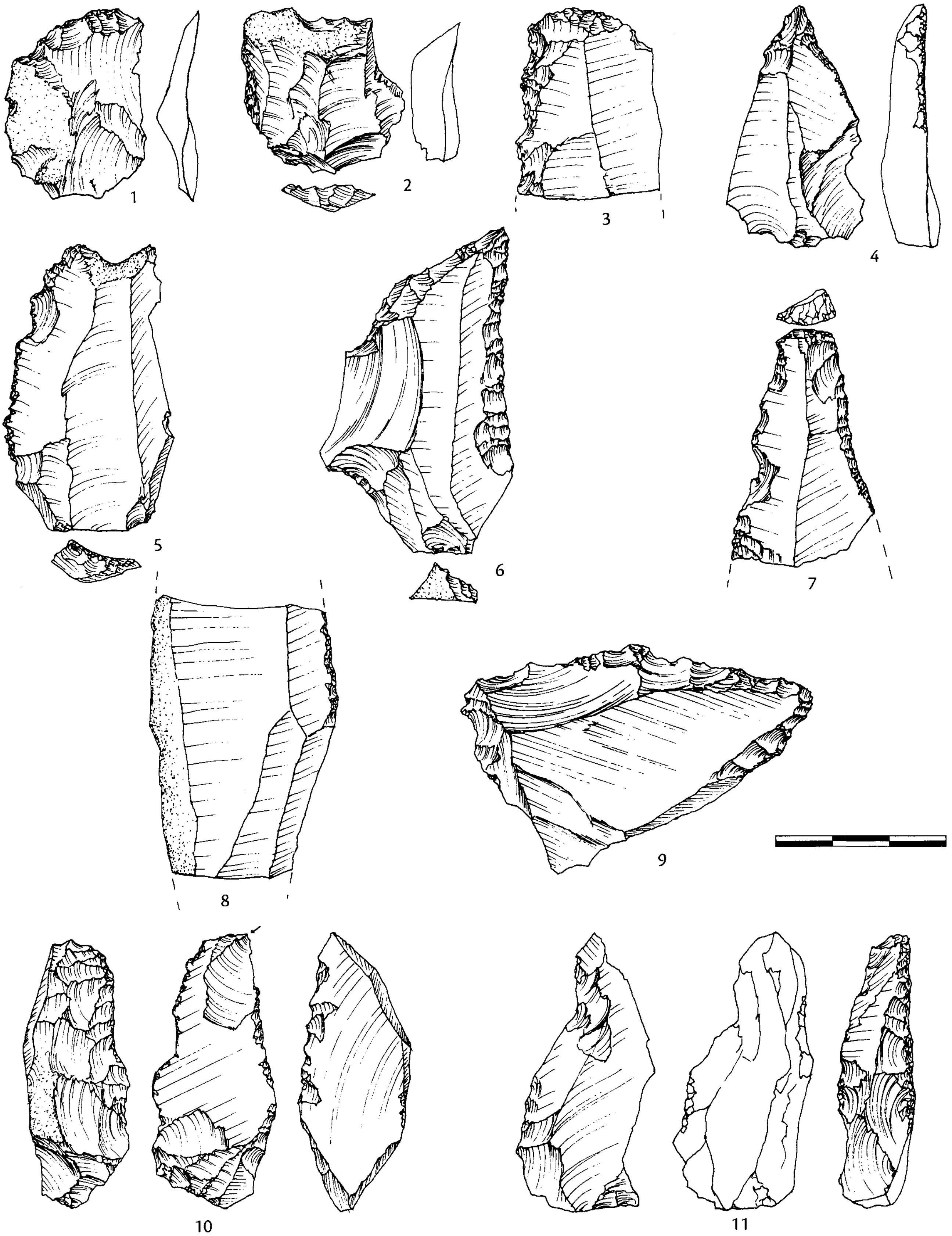


Figure 4-5—Tools from Buran-Kaya III Level E: 1–convex oblique sidescraper; 2–retouched flake; 3, 5, 9–denticulates; 4–retouched point; 6–convexo-concave convergent sidescraper; 7–endscraper on retouched and notched blade; 8–marginally retouched blade; 10–burin plan on heavily retouched piece; 11–backed piece.

varying from marginal to invasive, flat to steep, and which may be irregularly executed on the same piece.

The single endscraper in the assemblage is on an elongated piece with even, short retouch on one lateral edge, and denticulation on the other; the endscraper portion of the tool is steep and fairly well made (Figure 4-5: *7*). There are three points in the assemblage; these are flake-proportioned, slightly asymmetric, and probably do not derive from a Levallois reduction strategy given the characteristics of the rest of the assemblage. Two of these are retouched (Figure 4-5: *4*). There is one atypical backed knife (Figure 4-5: *11*) and a burin plan on a heavily retouched piece (Figure 4-5: *10*).

In sum, there is little in the Level E tool assemblage that is exceptional, or which could securely attribute it to a known Crimean industry. The reduction strategy, hard hammer percussion, typology, and overall morphological characteristics suggest that it is Middle Paleolithic in nature. On the other hand, the lack of any bifacial reduction or tool production means that it is not part of the Crimean Micoquian. While the Western Crimean Mousterian is also a unifacial industry with blade production, it is technologically and typologically dissimilar to the Level E material. For example, the blade production in the early stage of the Western Crimean Mousterian (WCM) is Levallois in nature, while in the late stage it is derived from bidirectional parallel cores. Blades in the WCM are rectangular to convergent—and regular—in shape, on-axis, broader and thinner than the Level E blades, and have large, wide, usually well faceted, semi-lipped platforms (Chabai 1998c). Retouch in the WCM is often scalar and semi-steep and extends the length of the tool edge, and the predominant tool types are simple and convergent sidescrapers (Chabai 1998c).

This assemblage from Buran-Kaya III Level E has been referred to as a "blade industry" in preliminary publications (e.g., Marks 1998; Marks and Monigal 2000) and, perhaps on this basis, has recently been ascribed to the Upper Paleolithic (Chabai et al. 2000). While the elongated pieces are certainly a noticeable component, their lack of morphological and technological standardization, along with the absence of other corroborating evidence for true blade core reduction, suggests that these elongated pieces most frequently served as core cleaning elements and by-products of a reduction strategy that was mainly geared to flake production.

The mere presence of blades does not automatically confer Upper Paleolithic status to an assemblage. Blade production in pre-Upper Paleolithic contexts has been noted repeatedly throughout Europe, Asia, and Africa (e.g., Cook 1986; Boëda 1988; Conard 1990; Otte et al. 1990; Schäfer and Ranov 1998; Bar-Yosef and Kuhn 1999; Delagnes 2000; Meignen 2000; Révillion 1994; Révillion and Tuffreau 1994; Monigal 2002), and, of course, there are myriad cases of Upper Paleolithic assemblages without any blade production whatsoever (Bar-Yosef and Kuhn 1999; Marks 2003). The single examples of an endscraper and a burin are hardly unusual in a Middle Paleolithic assemblage; after all, both are on the Bordian Middle Paleolithic type list (Bordes 1961) and even when present in significant numbers do not necessarily denote modern Upper Paleolithic behavior (e.g., Marks et al. 2001). The remainder of the tool assemblage is fully Middle Paleolithic in character and the cultural level lacks components of the typical behaviorally modern package such as art, ornaments, bone working, burial, or structures.

The Level D Lithic Assemblage

Level D, which was only present as a thin scatter in a small area of the rockshelter (Monigal, Chapter 1) contained a very small lithic assemblage: 394 pieces, of which only 31 were larger than 30 mm (Figure 4-6). The lithic assemblage was undoubtedly washed; there is light patination and edge damage on a substantial

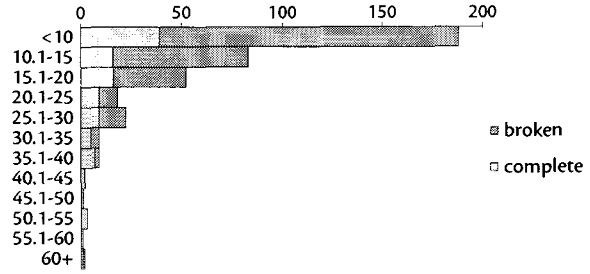


Figure 4-6—Histogram of the maximum dimensions (in mm) of broken and complete pieces from Level D.

Table 4-4
Artifact totals for Level D of Buran-Kaya III

	N	%	%
Chips (<3cm)	363	92.1	
Flakes	7	1.8	26.9
Blades	2	0.5	7.7
Primary elements	4	1.0	15.4
Core trimming elements	3	0.8	11.5
Chunks	5	1.3	
Cores	0	0.0	0.0
Tools	10	2.5	38.5
Total	394	100.0	100.0

number of pieces. There is, in addition, a high percentage of breakage: 72% of all pieces or 44% of pieces larger than 30 mm (Figure 4-6).

Table 4-4 presents the lithic artifact counts in Level D. No cores were found during excavation, but there were three core trimming elements (CTE): one core top and two core edges. Primary flakes (having more than 50% cortical coverage) are relatively frequent at 20% (including tools made on cortical flakes) of the non-chip assemblage.

Flakes in Level D are broad—nearly as wide as they are long—and fairly thick, with flat (41.7%) and twisted (37.5%) ventral profiles, or more rarely, incurvate (20.8%).

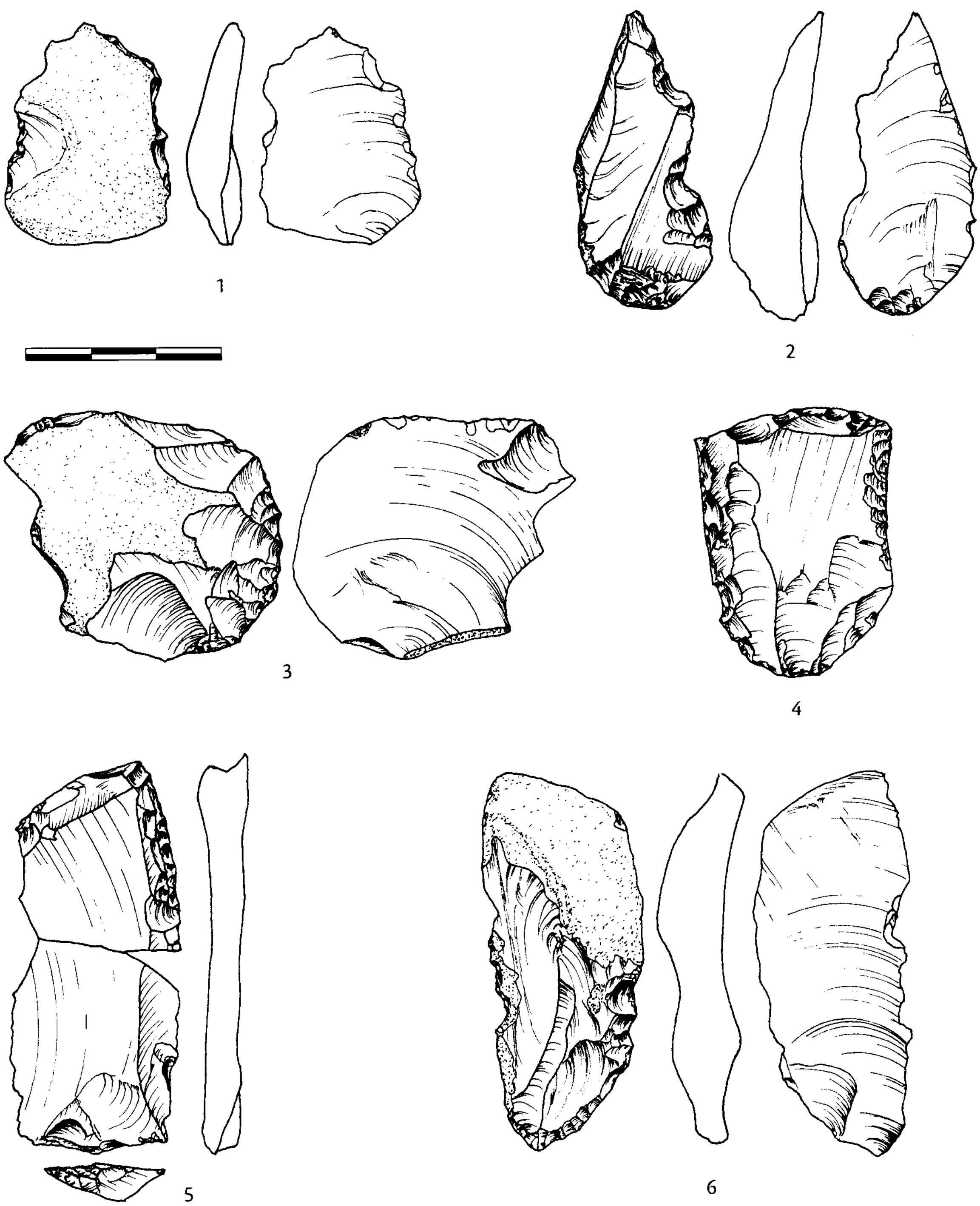


Figure 4-7—Tools from Buran-Kaya III Level D: *1, 2, 6*–denticulates; *3, 4*–sidescrapers; *5*–discontinuously retouched elongated flake.

Dorsal scar patterns on the debitage predominate in unidirectional (41.2%), followed by multidirectional (29.4%), irregular (17.6%), and bidirectional (11.8%). Of the recognizable, intact platforms, they vary in preparation: cortical = 30%, unfaceted = 25%, dihedral = 20%, and multiple faceted = 25%. They are usually fairly broad and thick, and obviously derived from a hard-hammer technique.

There are two blade-dimensioned pieces in the assemblage, but, like the tools on elongated flakes in Figure 4-7, they are wide and off-axis, and not derived from a blade core reduction technology. While there are some pieces in the assemblage that may be interpreted as bifacial thinning flakes, they are smaller than 30 mm in maximum dimension, and often broken. Based on the debitage characteristics, and the core trimming elements, the assemblage was probably completely derived from a true flake core technique; most likely a discoidal one given the scar patterns and frequent square to trapezoidal shapes.

Items classified as tools account for a high proportion (39%) of the lithic assemblage (Table 4-5), but many of these should be viewed cautiously. As noted above, there was frequent damage to the edges of the lithics, and even the unquestionable, purposeful retouch is often irregular or discontinuous. Denticulates account for 30% of the tools; two of these are made on primary blanks (Figure 4-7: *1, 2, 6*). There is one notch made on a broad, thick flake. The two sidescrapers are fairly well made in comparison to the other tools. One of these is convex, on a primary

TABLE 4-5
Typology of Buran-Kaya III Level D

	N	%
Convex sidescraper	1	10.0%
Concave sidescraper	1	10.0%
Notch	1	10.0%
Denticulate	3	30.0%
Retouched	1	10.0%
Bifacially retouched	1	10.0%
Fragment	2	20.0%
Total	10	100

flake, and has damage to the distal ventral edge (Figure 4-7: *3*). The other is concave, with what is probably trampling damage to its left and distal edges (Figure 4-7: *4*). There are two retouched pieces, one is bifacially retouched, the other is discontinuously retouched on an elongated blank (Figure 4-7: 1). Finally, there are two unidentifiable tool fragments.

The lithic assemblage from Level D is not only too small to securely classify, but has few distinct characteristics to be able to compare it to other Crimean assemblages. Based on the apparent discoidal, hard hammer technology, the sidescrapers, and to a lesser extent, the notches and denticulates, along with its stratigraphic position beneath the Micoquian assemblage of Layer B, it is probably Middle Paleolithic, but no further attribution is possible.

Conclusion

The lithic assemblages found in Levels E and D of Buran-Kaya III are both core-based, non-bifacial reduction/tool production strategies. In this, they stand in stark contrast to those lithic assemblages immediately overlying them in Levels C and B, both derived from a *façonnage*-type reduction. The assemblages of E and D are dissimilar from each other as well, notably in the presence of blades in Level E and their lack in Level D, but also in the morphological characteristics of the debitage and in the typological structures of the two assemblages. Given the small size of both assemblages, the absence of distinguishing tool types or reduction features, along with the absence of any paleoenvironmental data for these occupations (Chapter 1), it is virtually impossible to put these two assemblages into their broader Crimean context. It can, however, be stated that they are most likely Middle Paleolithic, but not Crimean Micoquian.

5

The Lithic Assemblage from Buran-Kaya III Level C

Katherine Monigal

This chapter describes the lithic assemblage recovered from Level C of Buran Kaya III during the 1996, 1997, and 2001 field seasons. Dated to between 36,000 and 32,000 years ago and underlying a Kiik-Koba type Micoquian (Monigal, Chapter 1), the cultural remains from this level are technologically and typologically distinct from any other known Crimean assemblage. The highly standardized and specialized bone and lithic tool production have been attributed to the Early Upper Paleolithic.

Assemblage Structure and Reduction Patterns

The lithic assemblage from Buran-Kaya III Level C consists of 3,780 pieces, all flint, recovered from an excavation area of 18 m^2 (Monigal, Chapter 1). A substantial portion of these are chips less than 30 mm in maximum dimension, pieces smaller than 10 mm are especially well represented (Table 5-1, Figure 5-1). Excluding debris related to flaking processes (chips, chunks, cores, pieces from tool resharpening), the remaining sample comprises 249 pieces: primary elements (9.2%), flakes (38.2%), blades (9.2%), and tools, including bifacial preforms (43.4%). Much of the breakage seen in the flint assemblage (Figure 5-1)

Table 5-1
Artifact totals for Level C

	N	%	%
Chips ≤ 15 mm	2583	68.3	
Chips 15.1–30 mm	922	24.4	
Chunks	5	0.1	
Cores	1	0.03	0.4
Primary flakes	23	0.6	8.5
Flakes	95	2.5	35.2
Blades	23	0.6	8.5
Tools	108	2.9	40.0
Tool resharpening pieces	20	0.5	7.4
Total	3780	100.0	100.0

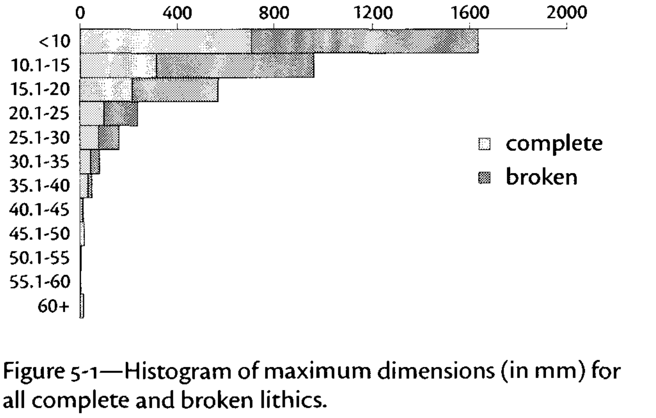


Figure 5-1—Histogram of maximum dimensions (in mm) for all complete and broken lithics.

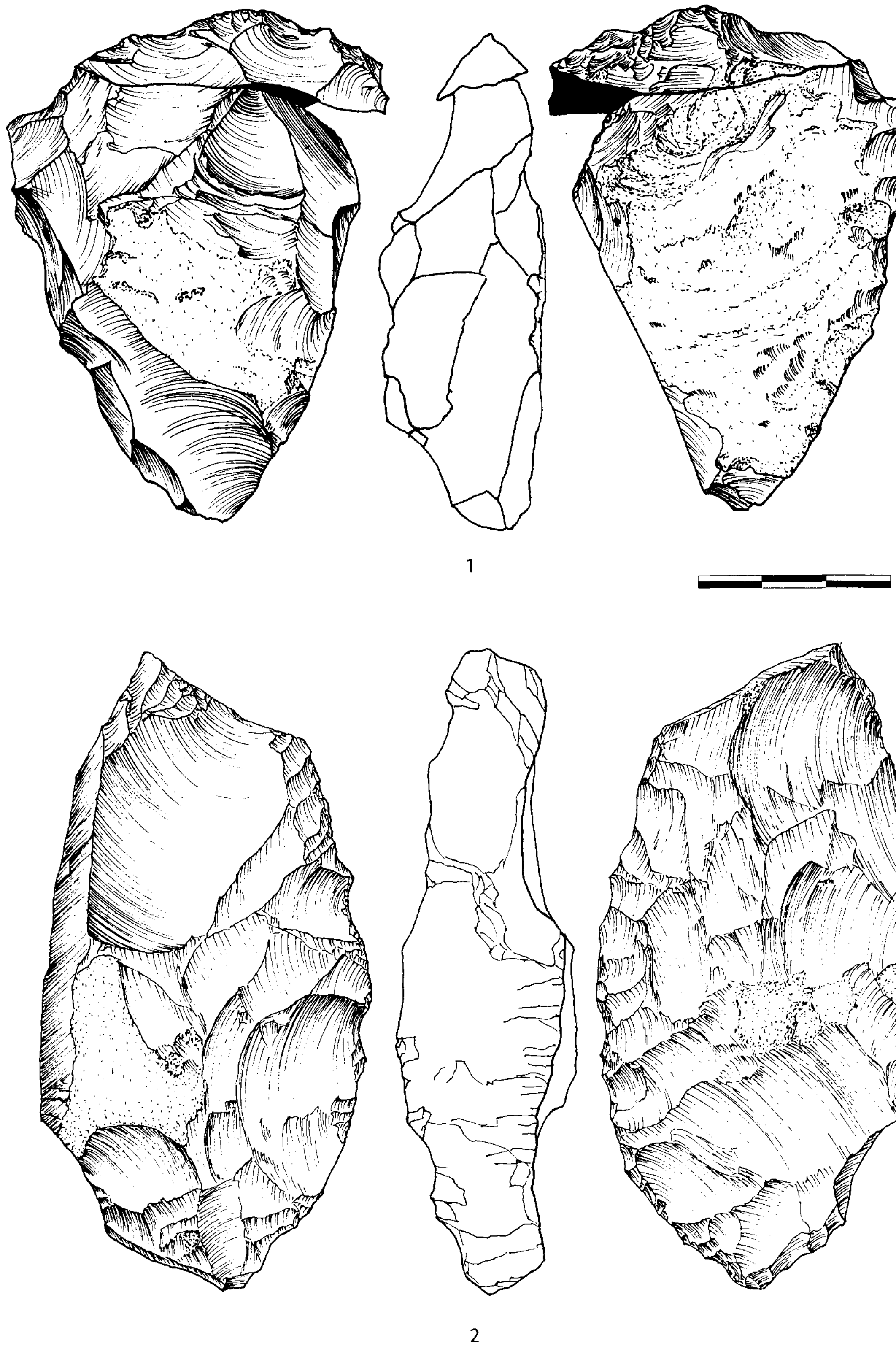


Figure 5-2—Inital stage bifacial preforms.

is due to the delicate nature of the flaking debris; all artifacts in this level were in primary context and show no evidence of having been moved, washed, or trampled. Lithic densities were highest in squares В–Г7, where there was a large cluster of flakes, chips, and a bifacial knife of the same raw material representing a single reduction episode, with an additional four bifacial knives (two fragmentary), two preforms, three scrapers, two trapezoids, six retouched pieces, and numerous tool rejuvenation pieces. Square Д8 also displayed a significant lithic density with a cluster of nine trapezoids, two endscrapers made from reworked bifacial cores, four broken bifacial knives, and three preforms (see Chapter 1, Figure 1-6). Given the incredible difficulty of refitting finely thinned bifacial pieces, an extensive refitting program was not attempted on the assemblage; yet, a very high number of fortuitously refit pieces did occur, underlining both the primary context in which the assemblage was found, as well as the numerous discrete reduction episodes,

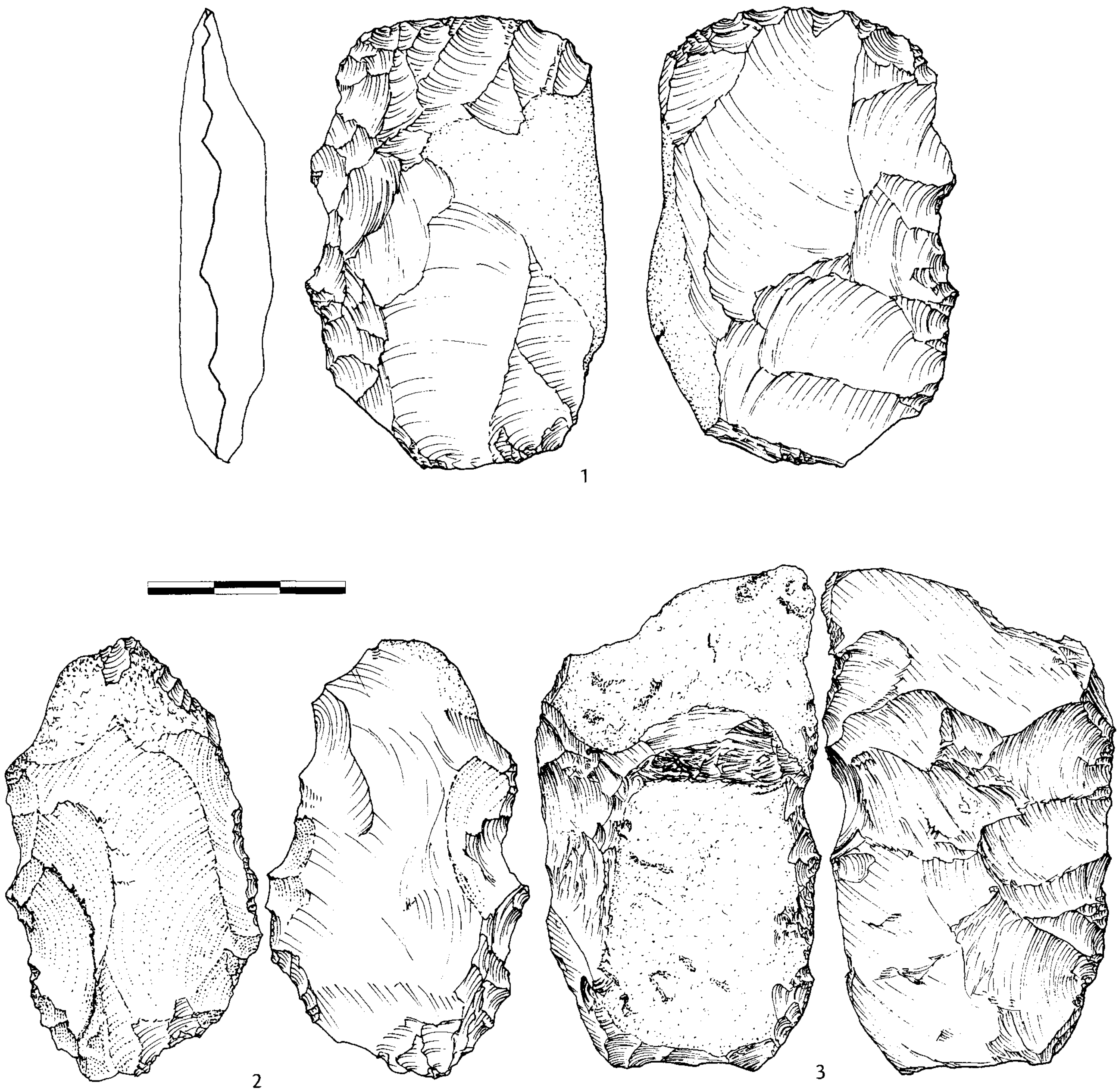


Figure 5-3—Inital stage bifacial preforms.

probably by single flintknappers, that make up this lithic assemblage.

The flint artifacts in the Level C assemblage range in color from translucent yellowish brown to shades of grey to opaque black. Based on the overall characteristics of the reduction strategy seen in the assemblage, as well as the high degree of cortical elements, it appears that the preferred raw material form was a plaquette. The original size of such plaquettes may be inferred from the numerous pieces with cortex on both their ventral and dorsal surfaces (e.g., Figures 5-2, 5-8): these range from 8 to 25 mm in thickness. When cortex is present, it appears as a thin, non-chalky rind, white to beige in color, but without pockmarking or battering suggestive of stream bed origin. At least one primary source for this type of plaquettes has been identified about ten kilometers north of the site in the Burulcha River valley (Uthmeier, Chapter 11).

These raw material plaquettes were worked in a singularly consistent manner: without preliminary decortication, at least two edges (one long edge and one short edge) of the plaquette were thinned bifacially to set up striking platforms. From these, a series of thin flakes and blades were struck by either a soft hard hammer or bone percussor from both surfaces. These initial shaping pieces were long and/or broad, but were often not particularly invasive in depth. As a result, the original raw material plaquette—which was already thin in its unworked state—was not substantially changed in thickness, but its surfaces were regularized and prepared for additional shaping and thinning *façonnage*. At this phase of the reduction sequence, the worked plaquette (Figure 5-2, 5-3) functioned as both an incipient tool and a core: the initial shaping flakes removed from it were later used as blanks for a number of tool forms while the plaquette itself would eventually be shaped into a bifacial knife.

The single true core in the Level C assemblage (Figure 5-4)—a piece not destined to later become a bifacially worked tool—is small and extremely thin: 58 × 67 × 13 mm. It was made on a broad primary flake, which underwent fairly limited preparation of two, opposing platforms and produced about five, very thin flakes, all under 37 mm in maximum dimension. This core is clearly related to the two endscrapers on recycled pieces previously identified as scaled pieces (Marks and Monigal 2000a; Hardy et al. 2001) discussed below and depicted Figure 5-17: *9, 11*. The core is larger, and unifacial, but the pieces removed from it unequivocally conform to the debitage from Level C—that is, despite being a "true core" it was reduced in the same manner and technique as items that are products of *façonnage*: a regularization of the platform, a soft hammer percussor, and the removal of a broad, thin, delicate flake totally in keeping with the attributes identified on the Level C flake-blanks.

The following description of the Level C lithic material is ordered according to unretouched debitage and discrete tool forms. Such a description, by its very nature, sets up the unfortunate dichotomies of core versus biface and debitage versus tool blank, when, in reality, all were interrelated parts of this one, very simple reduction strategy. In fact, all of the Level C lithic assemblage may be viewed as segments along a continuum, one that was, at times, circular in nature as items were recycled into new forms.

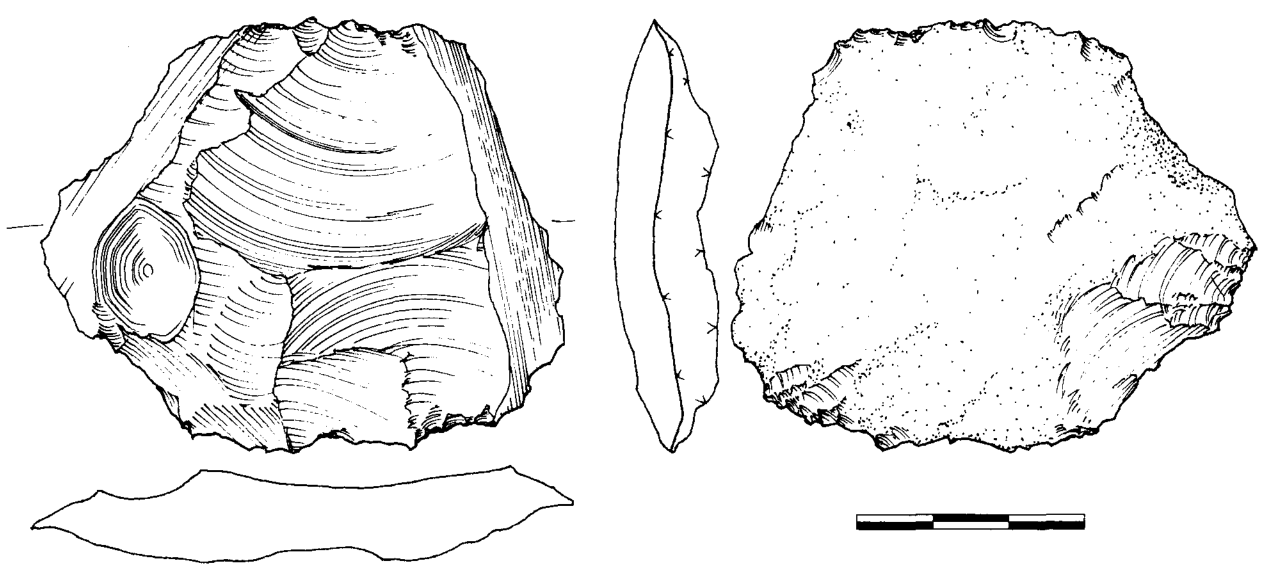


Figure 5-4—Core from Buran-Kaya III Level C.

Debitage

The debitage component of the Level C lithic assemblage consists of 95 flakes, 23 blade-proportioned pieces, and 23 primary flakes. Among the flakes, 31.6% are broken; these are usually distal or longitudinal breaks. Blades show a surprisingly low percentage of breakage—only 13.4%. Primary flakes on the other hand, have a high proportion of broken pieces at 56.5%, perhaps due to their relatively larger size and gracility.

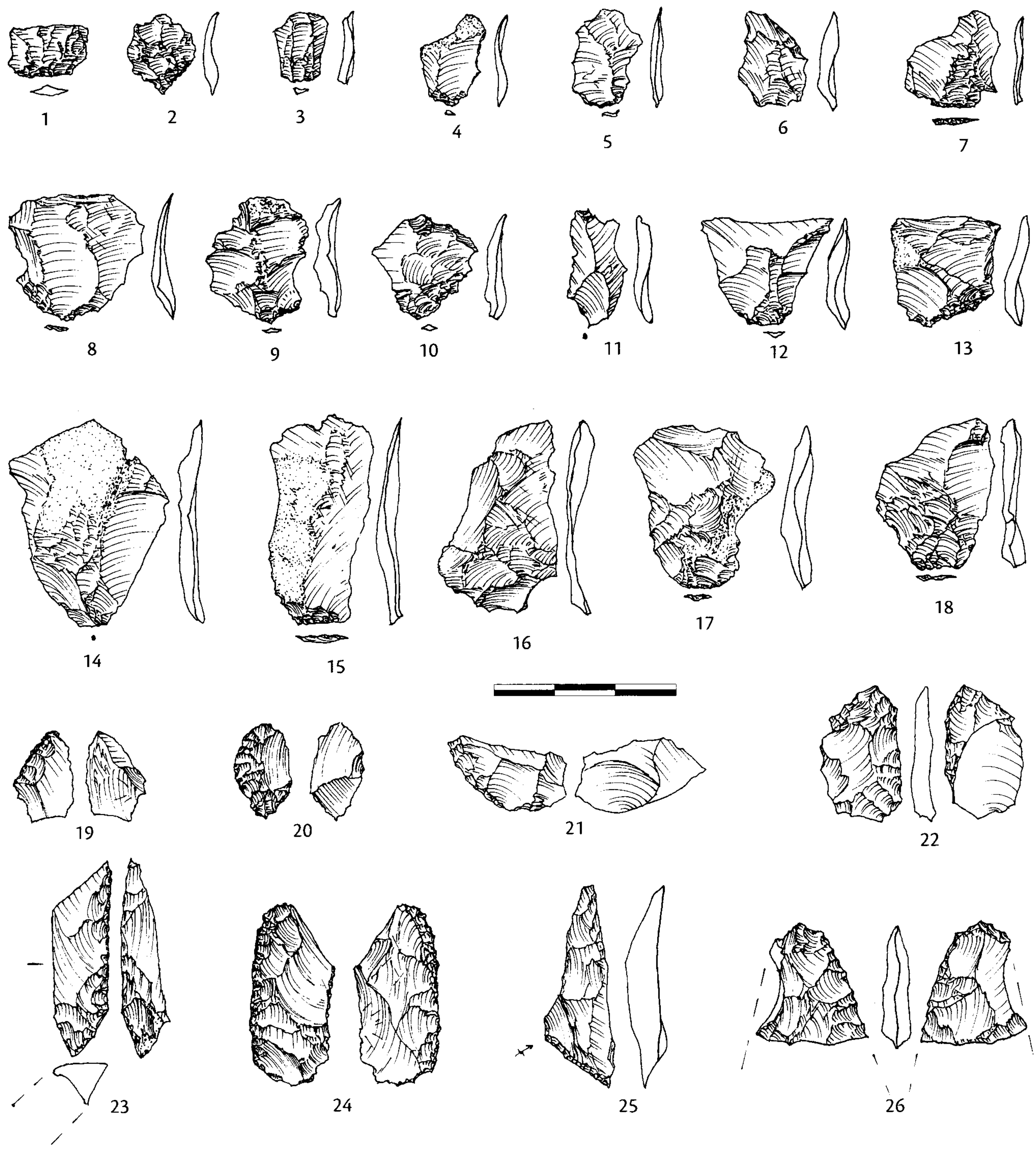


Figure 5-5—Typical bifacial thinning and shaping debris (1–18) and resharpening pieces (19–26) from Level C.

Unretouched flakes in the Level C assemblage share an unvarying suite of morphological characteristics: they are small (mean flake size of complete flakes = 35.5 mm), very delicate, thin in cross-section, usually incurvate in profile, and waisted at the proximal end. They have narrow, very short, faceted, semi-lipped striking platforms, although these are frequently crushed, and diffuse bulbs of percussion (Figure 5-5). In sum, they are entirely commensurate with debitage derived from a *façonnage* method of surface reduction/shaping by a soft hammer technique. There are only four exceptions among all of the debitage and tool blanks: these four pieces (Figures 5-16: *8, 11*; 5-17: *10*) are massive in all dimensions in comparison to the other flakes, with thick and broad platforms, salient bulbs of percussion, éraillure scars, and clear radial fissures. They appear to have been reduced from true cores by a hard hammer. Since three of these pieces have light patination, it is most likely that they were picked up elsewhere by the Level C occupants and brought to the site; they certainly were not produced at Buran-Kaya III.

Primary flakes—having more than 50% dorsal cortical coverage—are fairly common in the assemblage at just under 10%. In fact, a very high proportion of debitage and finished tools have at least some cortex on their dorsal surface. This is due to two important aspects of the *chaîne opératoire* used by the Level C inhabitants: raw material was invariably in the shape of oblong, thin plaquettes, and the raw material did not undergo a separate decortication stage before shaping/reduction began.

The blade-proportioned pieces in the Level C assemblage—pieces that are twice as long as they are wide—make up about 10% of the non-debris assemblage. These pieces should be viewed as elongated members of the flake assemblage—their lateral edges are wavy, they have small, semi-lipped to lipped platforms, arched ventral profiles, are very thin in cross-section, and do not deviate from the dorsal scar pattern characteristics seen on the flakes. Aside from their overall similarity to flakes in every aspect but their relative narrowness, none of the tool types is preferentially made on elongated pieces.

The Level C Tool Assemblage

One of the unusual features of the Buran-Kaya III Level C lithic assemblage is its decidedly high proportion of tools: 43.4% of the non-debris assemblage. If the eight unfinished bifacial pieces/preforms are excluded, the retouched tools still account for 40.1%. The tool assemblage is fairly simple and homogenous: bifacial knives, and their fragments and preforms account for 34.3% of the tool assemblage (Table 5-2), followed by bifacially retouched trapezoidal microliths (21.3%), various types of retouched pieces (15.7%), endscrapers (10.2%), diverse sidescrapers (8.3%), denticulates and notches (5.5%), and burins, varia, and a unifacial point together comprising less than 5%.

Table 5-2
Tool typology for Level C

	N	%
Preforms of bifacial knives	8	7.4
Bifacial knives	5	4.6
Distal end of bifacial knives	14	13.0
Trapezoids	23	21.3
Retouched pieces	17	15.7
Endscrapers	11	10.2
Sidescrapers	9	8.3
Denticulates	5	4.6
Notches	1	0.9
Burins	2	1.9
Unifacial points	1	0.9
Varia	2	1.9
Tool distal tips/fragments	10	9.3
Total	108	100.0

Bifacial Knives

The transformation of a raw material nodule into a bifacial piece is a continuous and reductive process, punctuated by changes in objective and technique (reducing volume, regularizing edges or surfaces, types of percussion) and it does not necessarily cease at some ideal, readily identifiable moment in time and form. Bifacial knives may be classified according to how "finished" they are, but this is a purely subjective division between so-called preforms and gradations of finished bifacial pieces. Level C contains a series of knives that grade into each other from one end of the reduction continuum to the other.

Initial stage preforms are irregular in plan view and in cross-section; their reduction has so far been limited to devising platforms along some or most of the edges of the plaquette and removing large flakes/blades from both surfaces (Figures 5-2, 5-3). Subsequent surface shaping of the piece was preceded by isolating platforms by grinding, allowing for fine control over thinning removals from both surfaces (Figure 5-6). Flakes removed during this stage of surface shaping were very thin, irregularly shaped, often narrow, flat to slightly arched in profile, and frequently had a slight hinge at the terminal end. The final stage of retouch was edge regularization of the knife, accomplished by grinding and short, non-invasive, semi-steep sub-parallel retouch (Figures 5-7–5-10).

There are eight pieces (7.4%) typed as preforms in the Level C assemblage (Figures 5-2, 5-3, 5-6: *2*), and a ninth was remade into a burin (Figure 5-18: *3*). Preforms range between 66.4–103.9 mm in length, 38.9–53.34 mm in width, and 13.5–25.8 mm in thickness. Their width/thickness index is variable: between 2.0 and 3.8. While these are classed as preforms because they lack the regularization in shape and cross-section seen on the "finished" knives, many carry tertiary

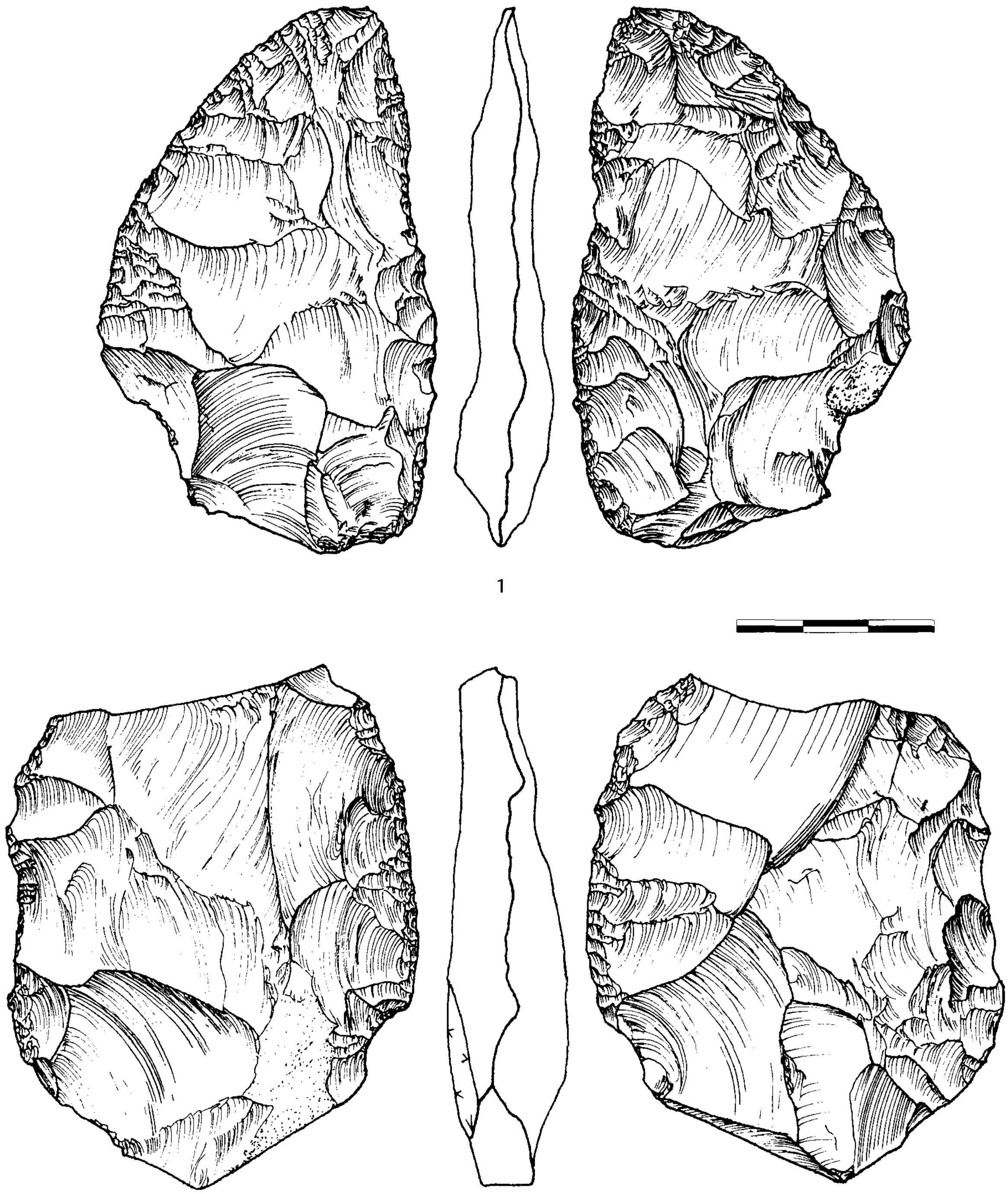


Figure 5-6—Bifacial knife (1) and preform (2) from Level C.

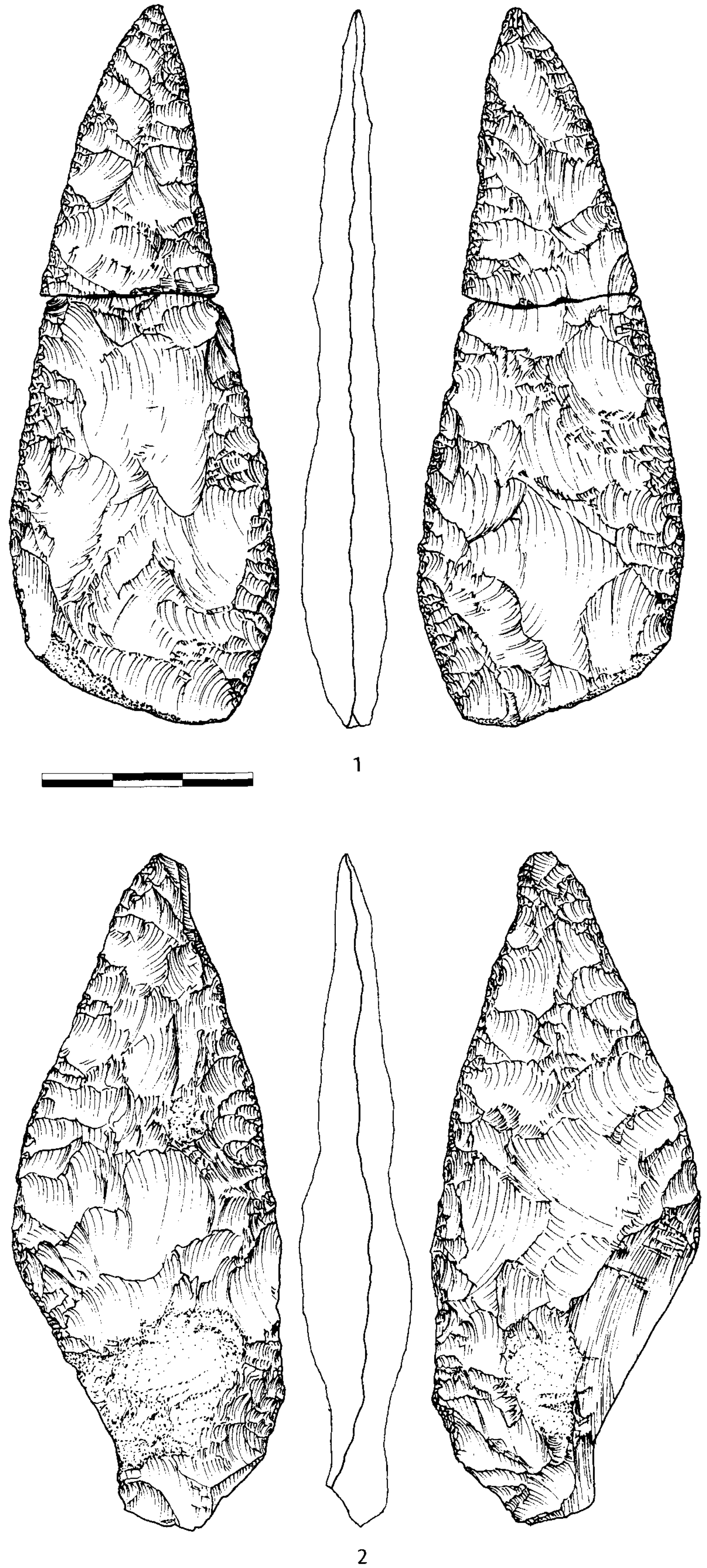


Figure 5-7—Finished bifacial knives from Level C.

retouch along part of one or more edges, suggesting in fact, that to the makers, they were finished tools (Figure 5-6). Residue and traceological studies carried out on some of these pieces do indicate that they were used. Figure 5-3: *3*, a fairly thin piece with a discontinuously bifacially retouched lateral edge, showed evidence of having been used as a cutting or scraping implement, as well as woody tissue indicative of having been hafted (Hardy et al. 2001:10975). The initial stage preform depicted in Figure 5-3: *2* had evidence for burin-type use, as well (Hardy et al. 2001).

Complete, finished bifacial knives account for 4.6% of the tool assemblage (Figures 5-7–5-10). They are mostly asymmetric in shape and elongated: their length/width ratios range between 1.6 and 2.5 (Figure 5-11). These pieces find their closest analogy in Königsaue type A *Keilmesser* (Bosinski 1967), although they are thinner and more finely crafted

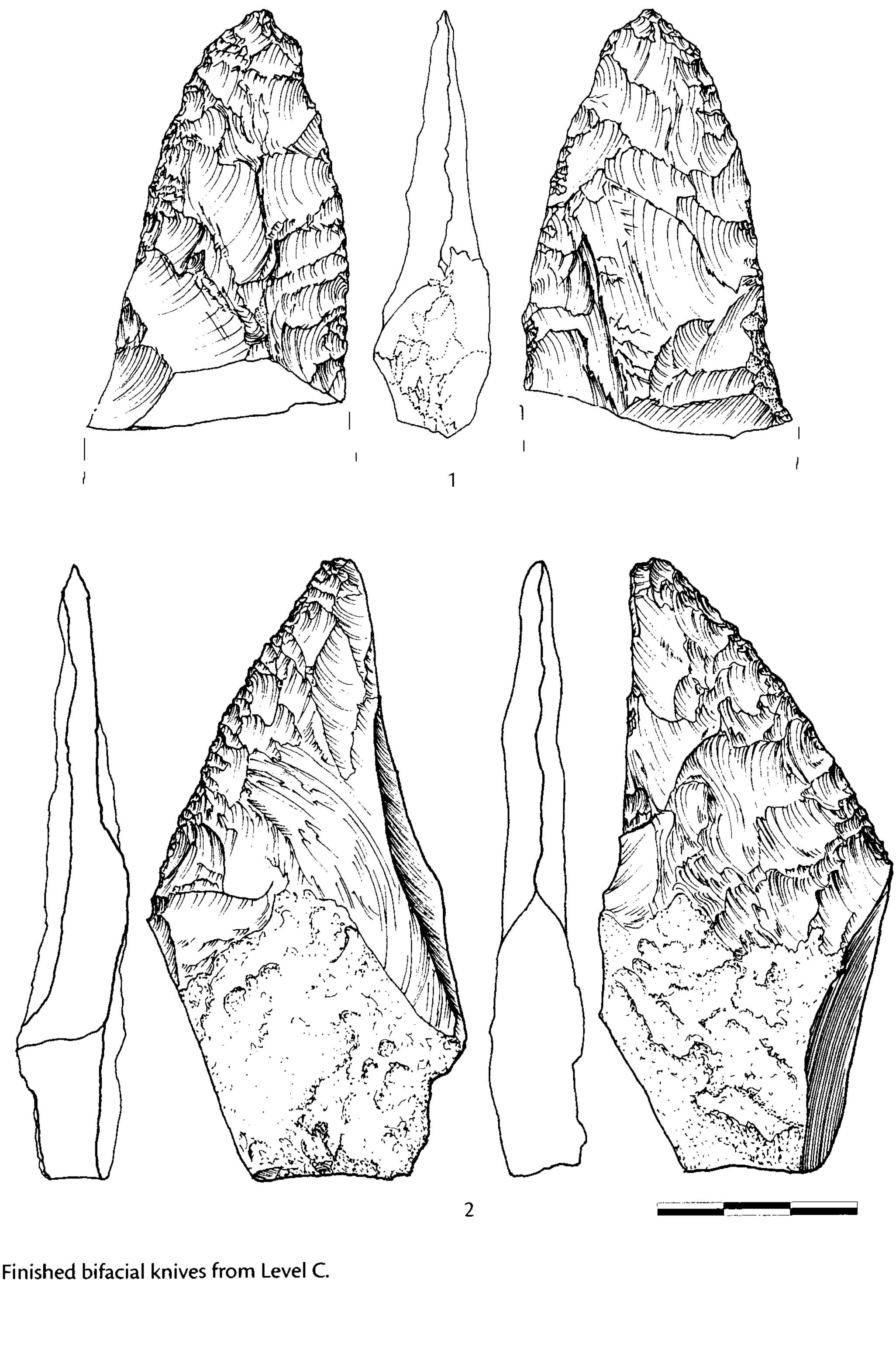


Figure 5-8—Finished bifacial knives from Level C.

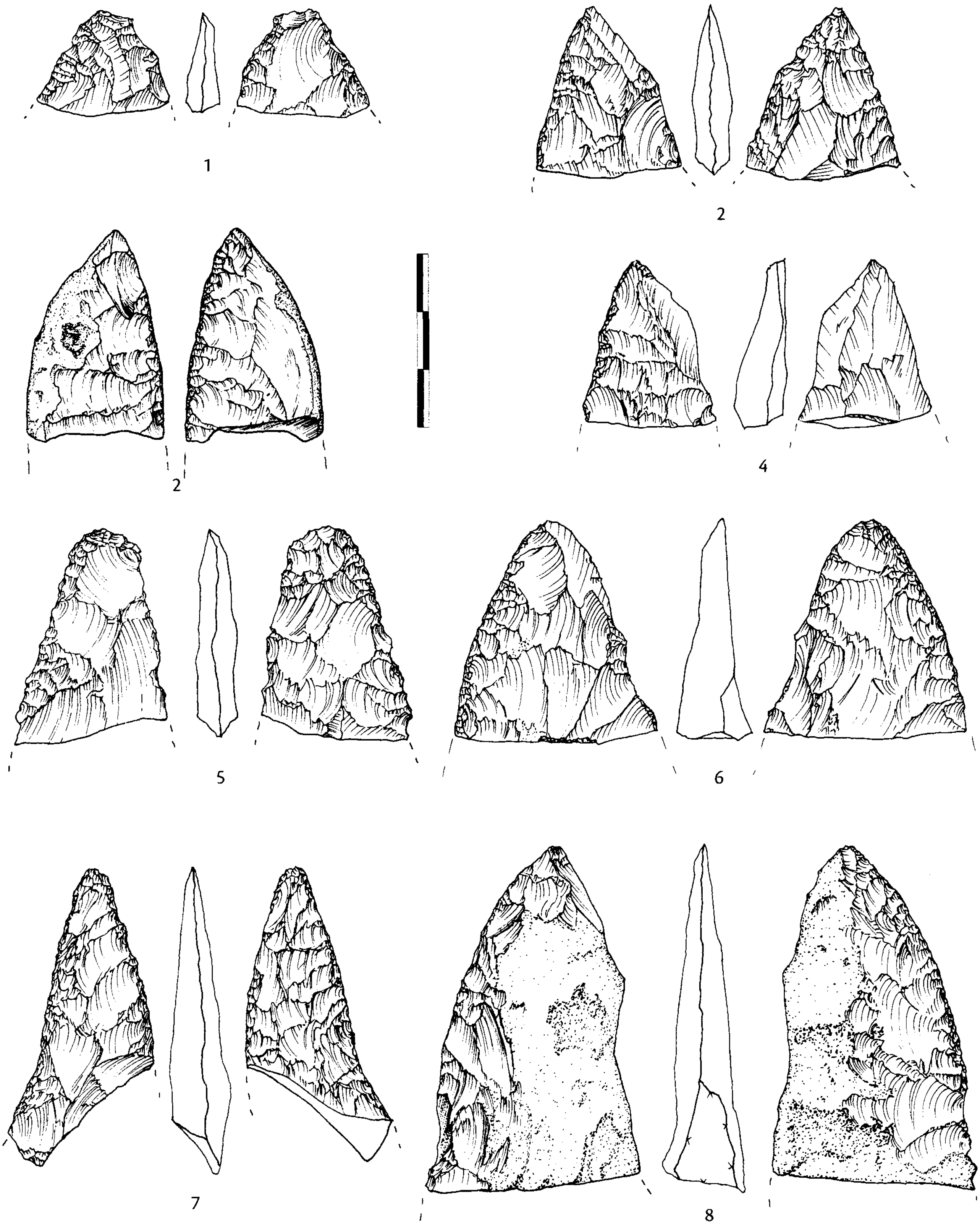


Figure 5-9—Distal ends of broken bifacial knives.

than those Middle Paleolithic pieces. One convex and one straight lateral edge converge to a point or sub-rounded point. Relatively thin at this pointed end, they broaden and thicken towards the proximal end and have an oblique base. In cross-section, the bifacial knives are lenticular to D-shaped, but always thin: the width/thickness ratios range between 3.31 and 4.45 (Figure 5-12). Two pieces (distal fragments) have cortical backs, while a third has a natural break that acts as a backing, but such accommodation appears to be the exception rather than the rule. The complete knives range between 62.3–97.5 mm in length, 31.4–50.3 mm in width, and 7.3–11.6 mm in thickness.

In addition to the complete specimens, there are 14 distal or distal + medial fragments of bifacial knives (Figure 5-9). Some of these, based on the extent of thinning and retouch, and their perverse fractures, obviously broke during manufacture. Others appear to have already undergone use and rejuvenation episodes, and their bending fractures suggest they broke while being used. Although all are roughly equivalent in thickness, both among themselves and to the complete knives, the variance in widths displayed by these pieces suggests that bifacial knives saw more breadth and width diversity than indicated by the complete knives alone (Figures 5-11, 5-12).

The smallest and thinnest of the bifacial knives stands somewhat apart from the others because of its remarkable symmetry and elegance (Figure 5-10). This foliated piece is elongate-ovoid in shape, with evenly convex edges converging to a point. Its maximum width is at the midpoint, and it tapers somewhat at the base, which is straight and unretouched. In cross-section, it is lenticular and it has an exceptionally regularized profile. Although this piece is thinner (7.3 mm) than the other knives (which average 11.6 mm), in all its other dimensional attributes, including a width/thickness index of 4.32 and a length/width index of 2.1, it falls squarely into the bifacial knives group (Figures 5-11, 5-12).

While this one piece might be considered outstanding in any Paleolithic context, it should be noted that

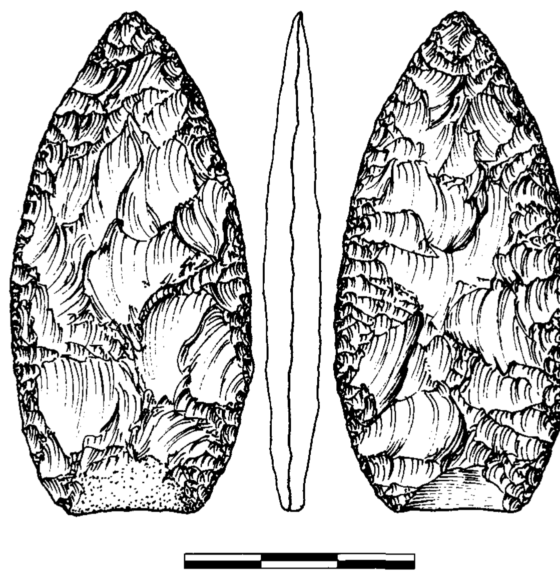


Figure 5-10—Bifacial foliate knife from Level C.

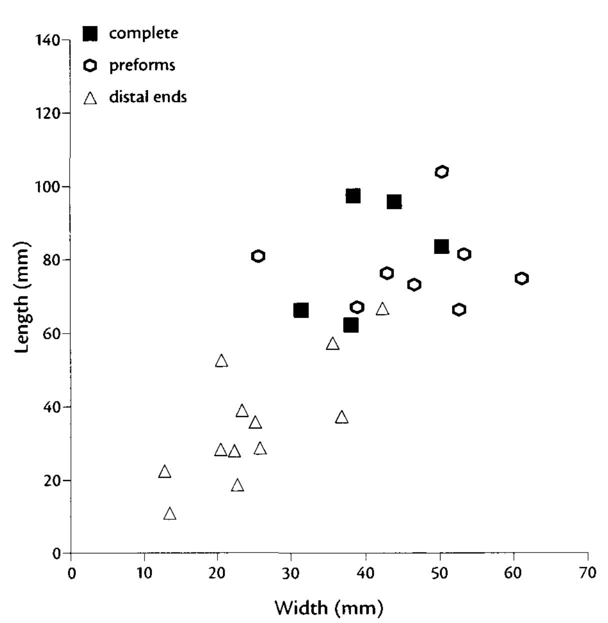


Figure 5-11—Length/width scatterplot of preforms, complete bifacial knives, and distal ends of knives.

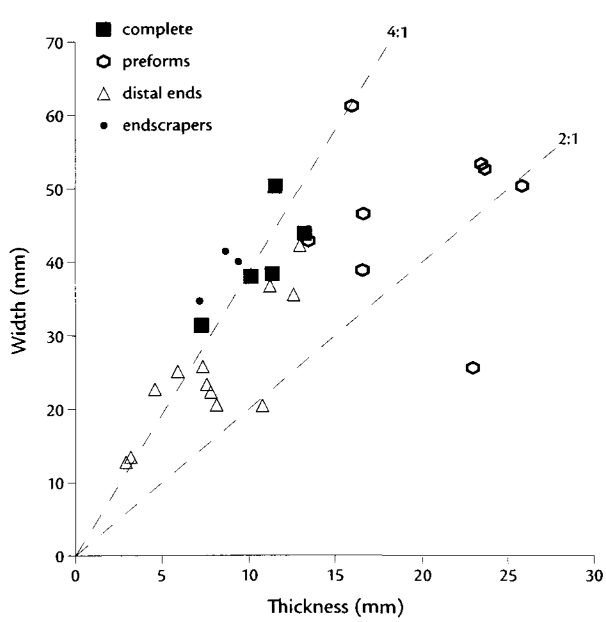


Figure 5-12—Width/thickness scatterplot of preforms, complete bifacial knives, distal ends of knives, and endscrapers on recycled bifacial pieces.

it is made on a translucent yellow-brown fine-grained raw material common in the Level C assemblage, it was shaped, thinned, and retouched with the same techniques and methods seen in the other bifacial pieces, and it is within the dimensional distribution of the other bifacial pieces. Instead of viewing this one piece as aberrant because it is so much more attractive and seemingly the product of an exceptionally gifted knapper, it should be seen as one extreme of the reduction continuum in which all preforms and knives are a part; this one foliate simply underwent extended thinning and retouching episodes.

It is impossible to subdivide all these preforms/knives into discrete types representing production endpoints. The flintknappers did not have an ideal in mind, but a thinned plaquette of appropriate size with a functional edge. When the edge became damaged or too blunt, it was thinned and retouched again. This process was repeated as necessary, eventually ending with a piece as finely worked as that in Figure 5-10.

Although there is a very high percentage of distal ends (points) of bifacial knives in the Level C assemblage, there are no proximal ends/bases to which they might belong. Only one very small, fragmentary piece in all of the assemblage might be a part of a knife base. It is evident, then, that tools were often resharpened, rejuvenated, reworked, and recycled by the Level C flintknappers. Resharpening accounts for at least a portion of the longitudinal asymmetry seen on some of the knives where the distal third of the point is considerably narrower than the midpoint and base section. Residue and traceological studies (Hardy et al. 2001) further suggest that the asymmetry was because the lower half to two-thirds of the tool was in a haft when it was resharpened.

Tool rejuvenation pieces that are at least a part of this knife resharpening process are common in the assemblage (Figure 5-5: *19-26*, Table 5-1), as are tiny distal points of bifacial tools (Table 5-2). The base of the knife depicted in Figure 5-7: *1*, for example, underwent some retouch after the tip was broken off. While the basal snap showed residue of plant material (Hardy et al. 2001:10974), this appears to have been ad hoc usage, since the break at the distal end of the base has only two spall-type removals and some incidental damage at either edge and since the base and tip were found in close proximity to each other. It is also possible that an entirely new pointed end was formed on a bifacial knife that had lost its distal portion. If this is the case, then these newly re-pointed pieces appear to have been carried away from the site—not unsurprising given how far away the raw material source for the plaquettes imported into the site and how ephemeral the Level C occupation was. In a few cases, the knife bases appear to have been recycled into entirely new tool forms, as in the case of the endscrapers (Figure 5-12), described below.

Trapezoidal Microliths

The most distinctive tool type in the Level C assemblage is the bifacially retouched trapezoidal microlith. These may be subdivided into two groups: finished examples, which appear fairly standardized (Figure 5-13: *1–12*) and unfinished pieces, which are larger and more variable, and grade into the forms classified as retouched pieces.

There are 12 finished trapezoids; these all have three bifacially retouched edges, and are square to rectangular in shape, often slightly narrower in breadth at the unretouched edge. With one exception, they are non cortical pieces, often retaining a significant portion of the original blank's ventral and dorsal surface features. The longer edges of the finished pieces are slightly convex (75%) to straight (25%), the unretouched edge is straight (83.3%) or irregular (16.7%), and the edge opposite this (shown as proximal in the illustrations of Figure 5-13) is very faintly concave (pronounced in 2 examples) (50%), straight (33.3%), or faintly convex (16.7%).

The trapezoids were made on flakes or elongated pieces with flat ventral profiles, and are quite thin, ranging in thickness from 2.1 to 3.8 mm (Table 5-3). Their blanks are consistent with initial bifacial shaping flakes, both in their thickness and in the dorsal scar patterns most of them carry. If this is the case, then small bifacial shaping by-products with fairly flat ventral profiles were specifically sought, and segmented, to arrive at a standardized, and dimensionally specific, shape. The blanks for trapezoids might also have been derived from the core (Figure 5-4) and endscrapers made on core-like pieces (Figure 5-17: *9, 11*). The facet dimensions visible on these latter pieces do mostly conform to the blanks used for trapezoid production

Table 5-3

Main dimensional features of finished and unfinished trapezoidal microliths

Finished (total = 12)	*Min*	*Max*	*Mean*	*S.D.*
Length (mm)	14.85	19.92	17.09	1.55
Width (mm)	13.48	22.78	16.47	2.26
Thickness (mm)	2.11	3.84	2.78	0.49
Weight (g)	0.60	2.20	1.02	0.47

Unfinished (total = 11)	*Min*	*Max*	*Mean*	*S.D.*
Length (mm)	15.96	30.52	23.38	4.37
Width (mm)	14.56	28.15	20.80	3.98
Thickness (mm)	2.25	5.05	3.52	0.94
Weight (g)	0.90	3.10	1.79	0.77

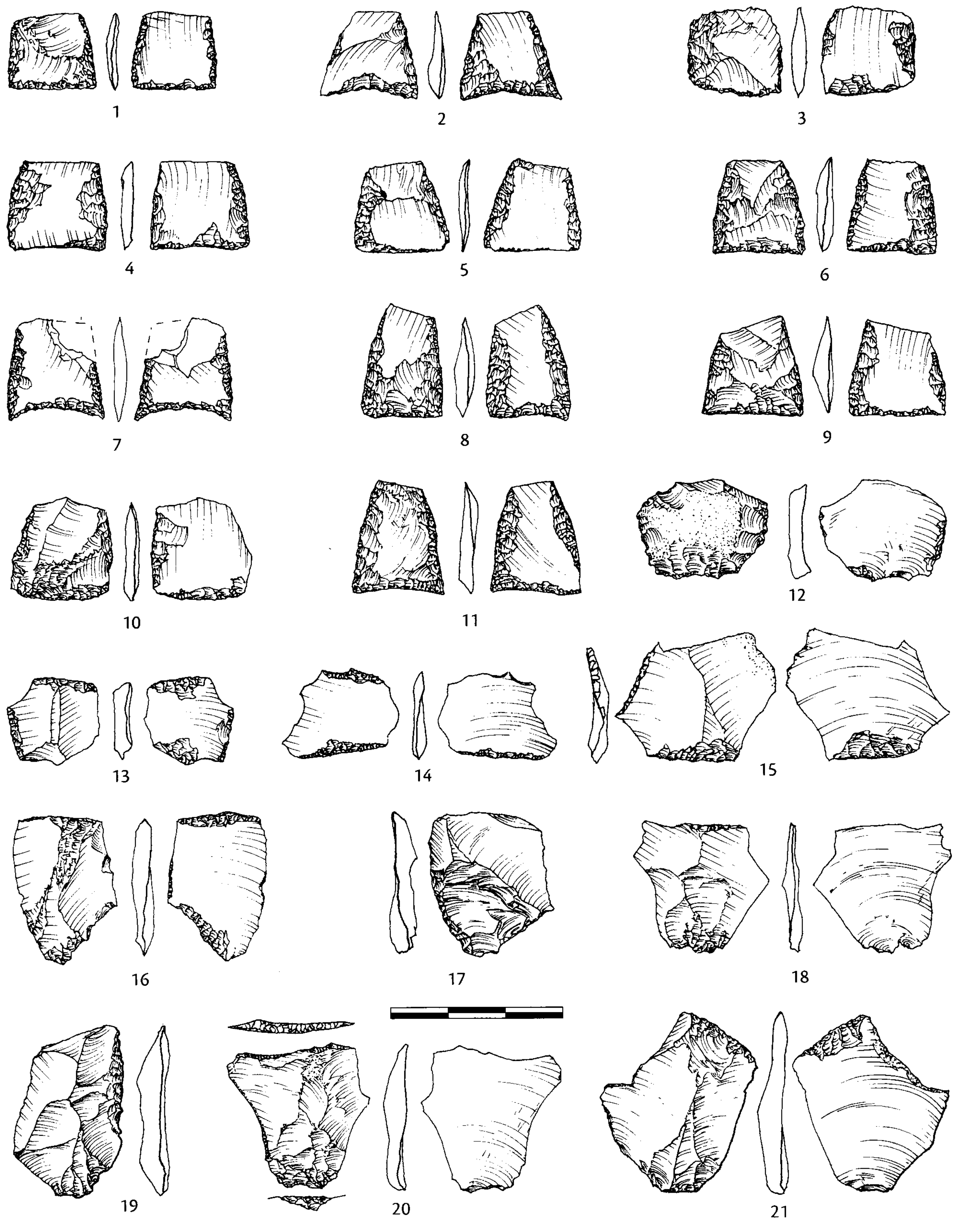


Figure 5-13—Bifacially retouched microlithic trapezoids (1–12) and unfinished trapezoids (13–21).

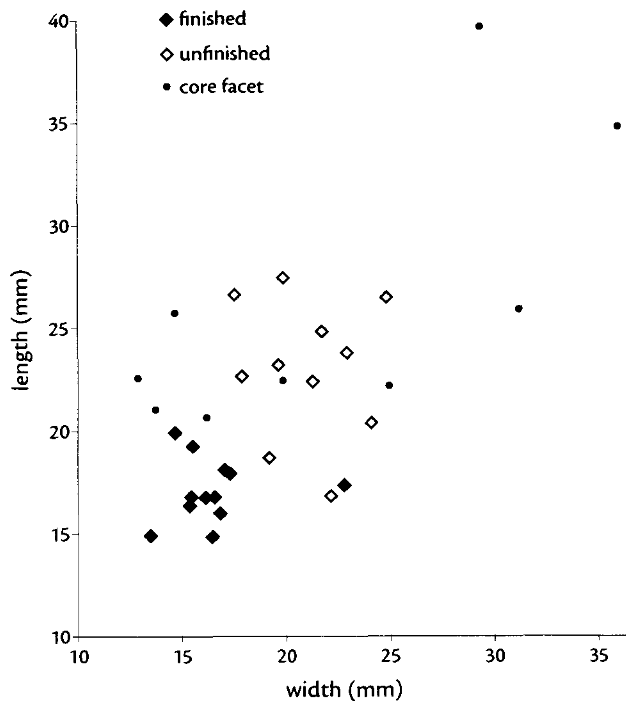


Figure 5-14—Length/width scatterplot of finished and unfinished trapezoids and core facets.

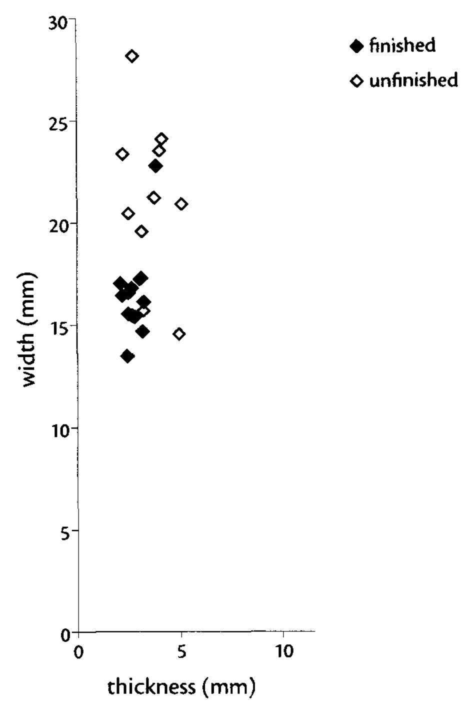


Figure 5-15—Width/thickness scatterplot of finished and unfinished trapezoids.

(Figure 5-14), and there is at least one instance of an unfinished trapezoid being refit onto an endscraper. Using a core-reduction technique would have been a superior way of obtaining the needed blank form, rather than searching among the detritus from bifacial tool production. Based on undulations and radial fissures visible on the ventral surfaces of the trapezoids, the blanks were quite short and narrow, and their size was not substantially changed by the tool retouch applied to them.

While this tool type is unknown in other Upper Paleolithic contexts, microliths of this variety do appear in the Final Paleolithic and Neolithic periods throughout Europe. The geometric microliths of the Epigravettian are always diverse in shape: crescent, triangle, rectangle, trapezoid, and rhomboid-shaped. They tend to have one long lateral edge versus a very short lateral edge, both unretouched, and retouched/truncated proximal and distal edges that are about two-thirds as long as the longest edge (Ferrari and Peresani 2003). Retouch is also more often in the form of direct truncation; that is, quite different from that applied to the Level C pieces.

Retouch on geometric microliths is used to adapt to hafting and to improve the efficacy of the working—non-retouched—edge (Nuzhnyj 1989). Late Mesolithic and early Neolithic trapeze-like microliths were made on blade-blanks from prismatic cores, and, due to the very standardized morphology of these blanks and the microburin technique used on them, had only limited retouch/truncation (Nuzhnyi 1993; 2000). During these later periods, the microliths were used as components in various types of composite arrowheads, including transverse, oblique, or piercing and with or without barbs. Geometrics of the Crimean Shan-Koba culture have been interpreted as part of the adaptation to closed mountain forest and used as both piercing arrowheads and as transverse arrowheads (Nuzhnyj 2000:100).

The Level C trapezoids are closer to the Final Neolithic and Eneolithic microliths of Europe, made on blanks derived not from microblade cores, but from large prismatic blade cores, which were shaped by flat retouch. These show more standardization in shape and typology than the geometrics of earlier periods, in part because their use was limited to chisel-ended and oblique arrowheads (Nuzhnyj 2000).

In contrast to the geometric microliths of the Late Paleolithic and Neolithic, the trapezoids of Level C were considerably simpler. These later periods used core reduction systems that were largely geared to producing blanks for microlithic projectile point weapons, and the microliths were fashioned by elaborate, multistep processes using truncation, micro-burin, and haft-adapted retouch techniques. Level C trapezoids on the other hand, were made on cores that were mainly recycled bifacial pieces, and the blanks were retouched simply with bifacial marginal to semi-steep retouch, without drastically changing the blanks original shape or size.

Four of the finished trapezoidal pieces (Figure 5-13: *1, 5, 6, 10*) underwent both residue and traceological analysis (Hardy et al. 2001). Two of these (Figure 5-13: 1, 6) had no residues at all, but were apparently used for cutting, with at least one being hafted (Hardy et al. 2001:10975). A third (Figure 5-13: *5*) had no use-wear evidence, but did have plant tissue residues of starch grains and raphides. The fourth (Figure 5-13: *10*) had plant tissue and evidence for hafting (Hardy et al. 2001:10975). Yet, whether they were used for the multi-component type projectile weapons seen at the end of the Paleolithic was not addressed by these studies, and their exact function for the Level C occupants remains ambiguous.

Retouched Pieces

Retouched pieces comprise 15.7% of the Level C tool assemblage and include a variety of forms, all on unifacial blanks. Of the retouched pieces, only 41% are complete; the others are classified, despite their fragmentary state, as retouched pieces due to their blank and retouch characteristics, although obviously, they might be fragments of some other tool type. One complete retouched flake displays steep inverse retouch, with additional discontinuous obverse retouch along a lateral edge (Figure 5-16: *7*). This piece is broken into two parts; if this breakage occurred soon after the blade's production, which seems most likely, the two pieces could easily be incorporated into the group of unfinished bifacial trapezoidal microliths based on their dimensional and morphological traits. There are three fragmentary pieces with bifacial retouch, which, due to their morphology, are not considered part of the tool rejuvenation/resharpening group. There are four steeply retouched (complete) flakes (Figure 5-16: *5, 6*), one of which (Figure 5-16: *5*) underwent retouch to two parts after it had been broken into three pieces; one or more of these pieces might be construed as commensurate with the unfinished bifacial trapezoids. Discontinuous retouch additionally is present on two complete flakes and seven broken flakes.

Endscrapers

Endscrapers (Figure 5-17) account for 10.2% of the tools in Level C, and fall into two distinct groups: unifacial tools on flake/blade blanks (73%) and those made on bifacial remnants/cores (27%). Most of the unifacial scrapers (Figure 5-17: *1–7, 10*) are made on primary blanks (63%) or on blanks with some cortex (25%); there is a single example without cortex. With one exception, a simple endscraper on a primary blade, the endscrapers are on flakes, and range in size between 30 and 40 mm; the one large piece (Figure 5-17: *10*) is 69 mm × 46 mm. In all cases, the unifacial endscrapers have additional retouch on the lateral edges of the tool, often a continuation of the scraper edge, but somewhat irregular and/or discontinuous. Other than the steep endscraper (Figure 5-17: *6*), the retouch is short and steep and did not significantly change the blank's overall morphology.

The remaining three endscrapers (Figure 5-17: *8, 9, 11*) are evidence of recycling bifacial/core-like pieces by the Level C occupants. All three are dimensionally similar, ranging in size between 35–41 mm × 28–37 mm × 7–9 mm. One of these (Figure 5-17: *8*) has the tool retouch applied to what appears to be a bifacial remnant, such as the base of a bifacial knife, while the other two (Figure 5-17: *9, 11*) undoubtedly served as cores before being reworked for the third time into endscrapers. These latter pieces are morphologically similar to the single core found in the level (Figure 5-4), and their larger facets are dimensionally similar to blanks used for the trapezoid production (Figure 5-14). All three pieces fall within the width and thickness dimensions of the bifacial knives (Figure 5-12). One of the unfinished trapezoids (Figure 5-13: *18*) has also been refit to the distal facet on the ventral surface of the endscraper in Figure 5-17: *11*.

Some of these scrapers have undergone residue and traceological studies. The large endscraper on the primary flake (Figure 5-17: *10*) was used as a plane for wood working (the endscraper portion) and was hafted (based on usewear traces on the unretouched proximal left edge) (Hardy et al. 2001). This piece also had a microscopic fragment of wood attached to its distal working end (B. Hardy, personal communication). Of the endscrapers made on recycled bifacial/core remnants, two have been interpreted as being used for wedges, based on use-wear results (Figure 5-17: *9, 11*), and the third, which has residue evidence of plant tissue hafting, may have been used as an adze (Hardy et al. 2001).

Sidescrapers

Sidescrapers comprise 8.3% of the tool assemblage, but given that more than half are broken, their typological classifications are provisional. One of the sidescrapers (Figure 5-16: *9*) is made on a bifacial piece that is thin in cross-section; the others are all on unifacial blanks. The complete, typologically identifiable specimens include two simple straight scrapers (Figure 5-16: *1, 2*), a transverse concave sidescraper on a small (< 20 mm) primary flake, and an off-axis convex sidescraper on a ventrally thinned piece. Broken sidescrapers that can be conditionally classified include a straight scraper made on a bifacial plano-convex piece, the distal portion of a convergent convex sidescraper (Figure

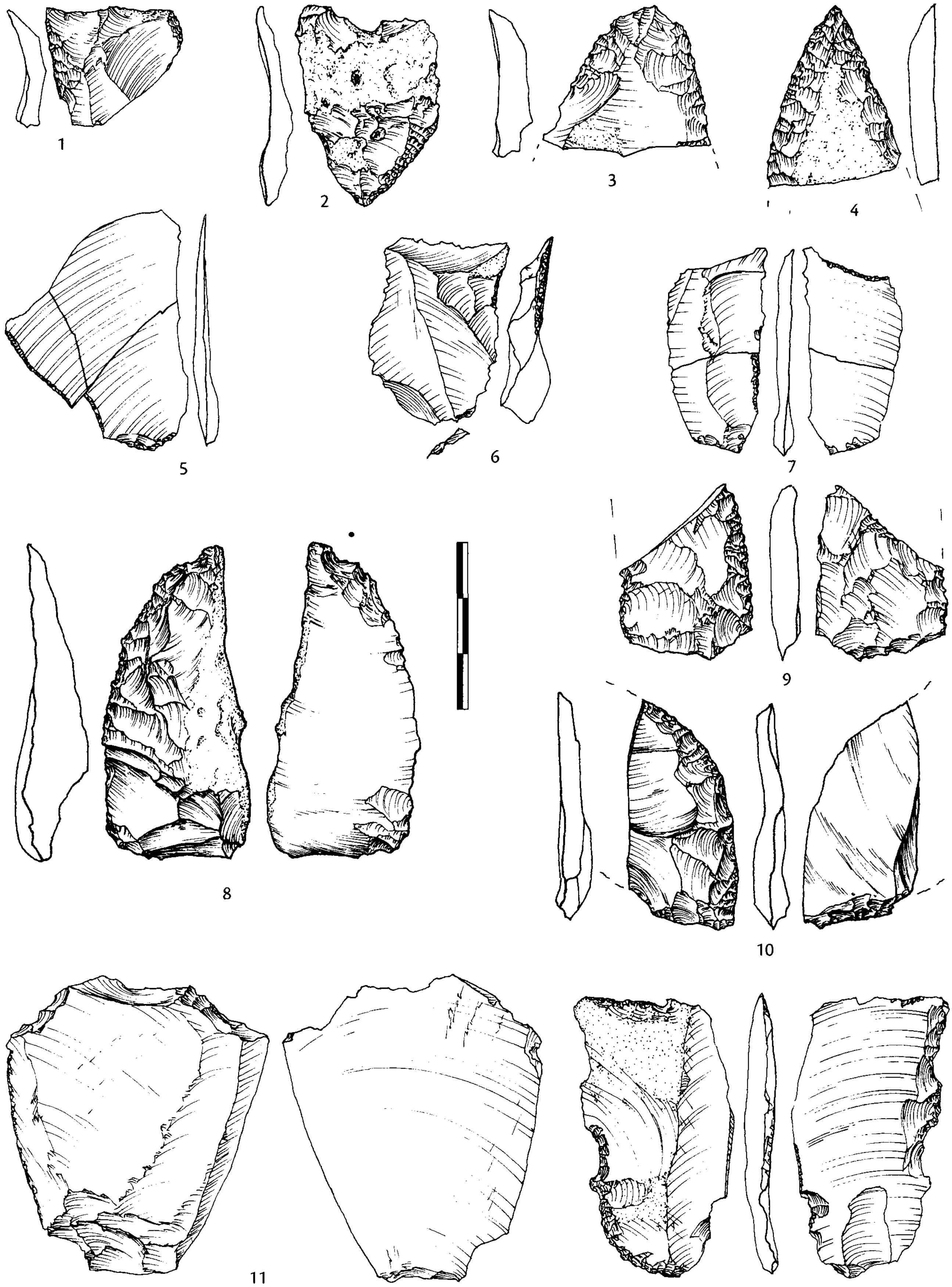


Figure 5-16—Straight simple sidescrapers (1, 2), convexo-straight convergent sidescraper (3), unifacial point (4), steeply retouched flakes (5–7), denticulates (8, 11, 12), and scraper fragments (9, 10) from Buran-Kaya III Level C.

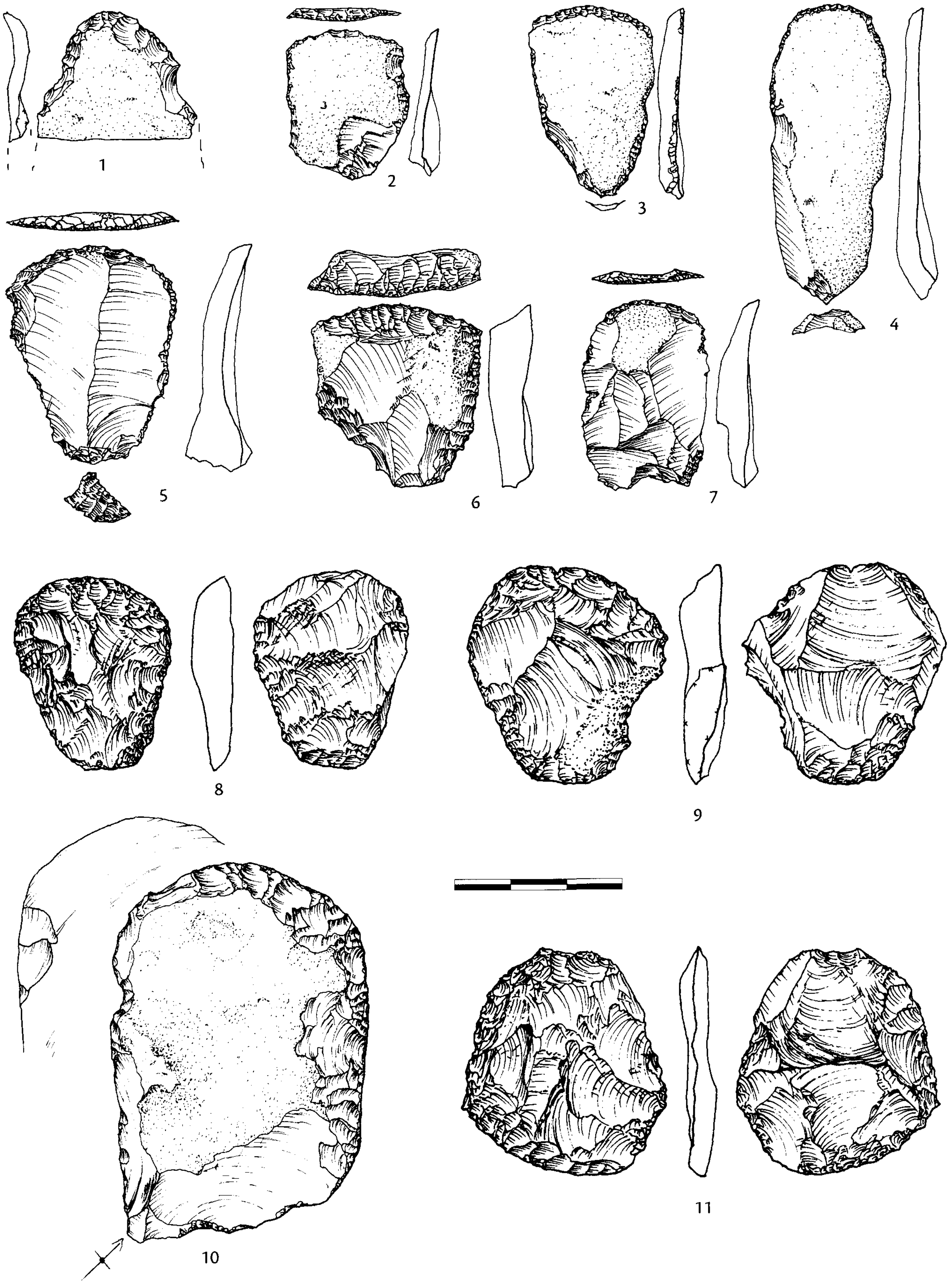


Figure 5-17—Unifacial endscrapers on bilaterally retouched flakes (1–7, 10) and endscrapers on bifacial knife remnants/cores (8, 9, 11) from Buran-Kaya III Level C.

5-16: *3*), a broken simple convex scraper with ventral thinning (Figure 5-16: *10*). Another two tool fragments probably belong to this sidescraper group.

Denticulates and Notches

There are five (4.6%) denticulates in the Level C assemblage. Three of these (Figure 5-16: *8, 11*) are made on large, thick flakes that seem to derive from true core reduction (averaging 50 mm in length and 8 mm in thickness), while the other two are on thin, gracile flakes. The single notch in the Level C tool assemblage is made on a bifacial shaping blade (47 × 21 × 8 mm). In all cases, these are complex notches, with tiny, internal retouch to each.

Burins

Two pieces (1.9%) in the Level C assemblage were classified as burins. One of these is a dihedral burin on a small (32 mm in length, 18 mm in width), apparently bifacially worked fragment. The second is also made on a large recycled piece—what appears to be a bifacial tool preform—that is 53 × 66 × 24 mm. In this case, one lateral edge was used for carinated-type removals of three to four bladelets (Figure 5-18: *3*).

Unifacial Points

A single, distal portion of a unifacial point was found in Level C (Figure 5-16: *4*). It is made on a primary flake that has a flat ventral profile and is relatively thin (3.9 mm) in cross-section. The piece was struck on-axis and has well-executed flat retouch.

Varia

Two pieces from the Level C tool assemblage fall into the varia category: a *pièce esquillée* (Figure 5-18: *1*) and a primary plaquette with some core-like removals and retouch (Figure 5-18: *2*). The *pièce esquillée* is fairly thick in cross-section (13 mm) and may have served as

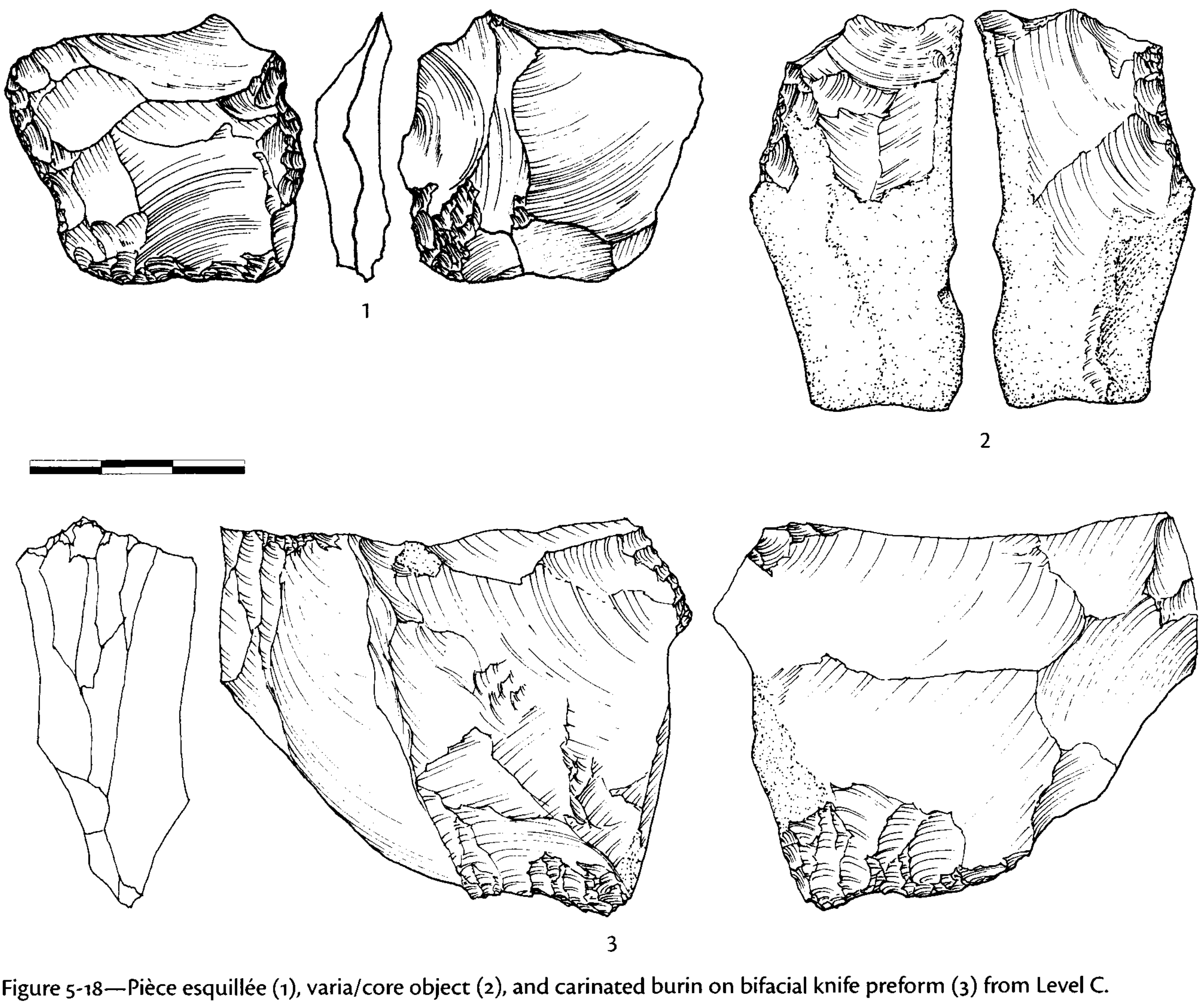


Figure 5-18—Pièce esquillée (1), varia/core object (2), and carinated burin on bifacial knife preform (3) from Level C.

a core or as a portion of a very early stage of a bifacial preform. There are broad, flake-sized removals from both its dorsal and ventral surfaces, overlain by semi-steep to steep discontinuous retouch. The core-like piece was made on a black, finger-shaped nodule of flint from which a few (testing?) removals were taken from the distal end, and which has bifacial retouch along one lateral edge.

Bone Tools

Level C also possesses a series of bone tools (Figure 5-19), including tubes and percussors. The bone tubes, in particular, demonstrate standardized dimensional and production characteristics. The tools are the subject of an extensive analysis by Laroulandie and d'Errico in Chapter 7.

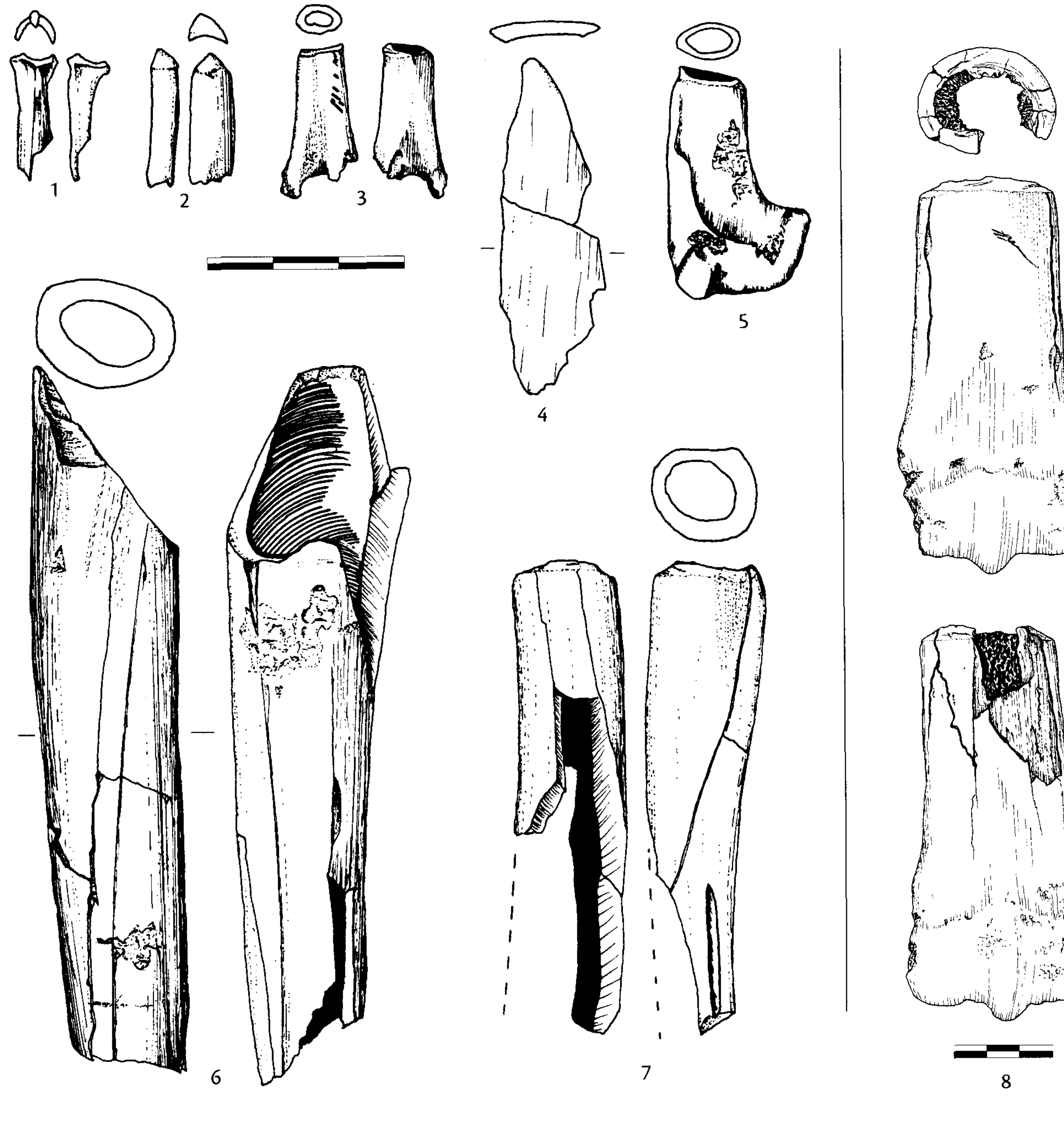


Figure 5-19—Bone tools and manufacture by-products from Level C.

Conclusion

Since the first artifacts of Level C were uncovered during the 1996 field season, many names have been applied to the assemblage in an attempt to understand it and pigeonhole it. Since it underlay the Kiik-Koba Micoquian of Layer B, during the initial days of that season it was presumed to be an Ak-Kaya type Micoquian. The Ak-Kaya is found at a number of sites nearby and always contains a substantial proportion of plano-convex bifacial knives and foliates. When the trapezoidal microliths and more bi-convex bifacial knives were discovered, and it was obvious Level C was not related to the Ak-Kaya, the least rude classifications of the assemblage included "mixed" and "Neolithic." Once the very substantial number of professional archeologists who worked and visited at the site agreed by the end of the 1996 season that Level C was completely and unquestionably in situ, that it predated an apparently late manifestation of the Kiik-Koba, and that the tool assemblage was not completely Middle Paleolithic in character, it was referred to as "transitional" (e.g., Marks 1998). Level C has most often been referred to in print (e.g., Marks and Monigal 2000; Monigal 2001) as "Eastern Szeletian," a term used (e.g., Efimenko 1956; Anikovich 1992) to group the post-Middle Paleolithic, non-Aurignacian assemblages with bifacial tools of Eastern Europe. This term does not enjoy widespread usage or understanding, and it is often assumed to mark consanguinity with the Szeletian of the Bükk Mountains, which it was never intended to do.

The Level C assemblage has most recently (Chabai 2003; Chabai, Marks, and Monigal, Chapter 25) been referred to as part of the "Streletskaya" group of assemblages found in the Mid and Lower Don region at Kostenki 12 layers Ia and III, Kostenki 1 layer V, and Kostenki 6 (Rogachev and Anikovich 1982c; Rogachev et al. 1997) and the Seversksy-Donets region at Birioutchia Balka 2 layer 3 (Matioukhine 1998), as well in the Northern and Central Urals at Garchi I and Byzovaya (Guslitzer and Pavlov 1993). The Kostenki sites, which are dated to between 36,000 and 28,000 BP (see Chapter 25), provide the largest and most extensively dated assemblages for the Streletskaya.

The Streletskaya assemblages of the Mid Don contain very well made, symmetric, bifacial bi-convex points made on large flakes and plaquettes that were occasionally heat treated and that were shaped, thinned, and retouched with a soft hammer, possibly pressure flaking, and edge grinding (Bradley et al. 1995), like Level C (with the exception of pressure flaking and heat treatment). Unlike Level C, these bifacial pieces are amygdaloid, poplar-leaf, and, most characteristically, triangular with a concave base in shape. The Streletskaya points are also much thinner than those of Level C: at Kostenki 1 layer V, the triangular point width/thickness average ratio is 5.7 (Bradley et al. 1995:996), while the Level C complete knives' width/thickness average ratio is 3.8.

It has been suggested (Chabai et al. 2000:81) that the trapezoids of Buran-Kaya III, two of which have a concave edge (Figure 5-13), are analogous to the concave-based micro-points which appear in small numbers in the later stage Streletskaya. As these micro-points have not been extensively described or illustrated in the literature it is impossible to know their average size and thickness (3 cm long based on illustrations in Rogachev and Anikovich 1984), or whether they were more often retouched only on their edges or bifacially. It is obvious, however, that they had three sides and not four, and assuming the concave longer edge is the working edge, were slotted with the point into the haft or shaft. The true type fossils of the Kostenki Streletskaya, these points and micro-points were part of a complex projectile weapon system that remained stable in its stylistic details throughout the Streletskaya occurrences in Kostenki-Borshevo, Seversky-Donets, and Urals regions; one that would not be expected to be manifested very differently, even with a move to Crimea.

Other tools found in these Streletskaya assemblages include small fan-shaped endscrapers that are usually unifacial with thinned bases, triangular and cordiform endscrapers, *pièces esquillées*, unifacial single, double, and convergent sidescrapers, retouched pieces, and rare burins (Rogachev and Anikovich 1982c; Rogachev et al. 1997; Bradley et al. 1995; Anikovich 1992). The most notable differences between this tool kit and that of Level C then, is in the types of endscrapers and sidescrapers. In addition, the Don and Seversky-Donets Streletskaya does not contain bone tools. True core reduction was common in these latter assemblages as well, from single-surface, non-volumetric, single or double platformed, for the production of flakes. There are no prismatic cores and only exceptionally rare blades. While this may be similar to that used in Level C, the Don Streletskaya flintknappers appeared to have used it much more extensively, as it provided the blanks for a substantial part and variety of the tool assemblage.

Given that stadial conditions prevailed around the time Level C was occupied, (Monigal, Chapter 1) Crimea would not have been a peninsula as it is today, but the southern extension of the mainland as the Sea of Azov and the Odessa Gulf shrank to nothing. Although the distance is over 700 km, it is conceivable that the peoples who inhabited the Streletskaya Kostenki sites traveled along the Don River Valley and found easy access into Crimea—and soon out of it, as Level C is the only possible southern instance of this industry.

The flintknappers of Level C had a very efficient technological system: thin plaquettes imported into the site were quickly shaped into bifacial knives, were used and resharpened. When broken, either in use or manufacture, the bifacial remnants were reworked as endscrapers or cores. By-products from bifacial knife production and from the cores were retouched into simple endscrapers, sidescrapers, retouched pieces, and trapezoidal microliths. Without a doubt, some of the bifacial pieces were imported into the site, and carried away when the occupants left after their brief occupation. Where they went, and how much the Level C cultural remains offer a true picture of their technological repertoire remains, however, unknown.

6

Golden Eagle Remains from Buran-Kaya III Level C

Gleb Gavris & Svetlana Taykova

Typically, when bird remains are found in a site, they are few in number for each species and represent but a small portion of all skeletal elements. It is therefore interesting that all of the bird bones recovered for Level C, numbering 208 pieces, belong to a single individual and, moreover, that they should belong to a bird of prey—the golden eagle (*Aquila chrysaetos* L.). Practically an entire eagle skeleton, still articulated, was found during the 1996 excavations of this level (Table 6-1). The skeletal elements discovered in this square of Buran-Kaya III in relation to the entire skeleton of the eagle are shown in Figure 6-1.

Fossils of Pleistocene birds were typically accumulated in caves and rockshelters by two principle manners: as the remains of the food of ancient humans ("kitchen garbage") and as the remains of the food of birds of prey (Falconiformes) and owls (Strigiformes) (Kurochkin 1979). Discoveries of virtually intact fossils of large birds of prey have not yet been described in such a Paleolithic context.

We compared most of the bones of the fossil golden eagle found at Buran-Kaya III Level C with modern examples from the collection of the Paleontological Museum of the Ukrainian Academy of Sciences (Tables 6-2 to 6-10). There do not appear to be any essential differences in the sizes of the fossil and modern bones; the Buran-Kaya III specimen falls within the average modern dimensions for nearly all skeletal elements.

Tugarinov (1937) has noted that the Pleistocene golden eagle was superior in size to modern golden eagles, based on two fragments of a tibiotarsus found in the Siuren I rockshelter (Crimea) during excavations in the 1920s. It is more than likely, however, that this reported size difference between Pleistocene and modern golden eagles is actually sexual dimorphism. Females are considerably larger than males in the Falconiformes order in general, and in the genus of *Aquila* in particular. In addition to the fossil from Siuren I, found in an Upper Paleolithic Aurignacian assemblage, one other fossil golden eagle find is known from Crimea. The fragment of a left tibiotarsus was found during the excavation of Kara-Koba cave in association with a Quaternary faunal assemblage and flints of uncertain association. The faunal assemblages of this multi-layered site (Paleolithic and Mesolithic) were studied and reported as a single unit, although some researchers consider it as only Upper Paleolithic (Voinstvenski 1967). Aside from Crimea, two separate finds of fossil golden eagle fragments are known from the Caucasus (Ossetia) region, which date to the Middle Pleistocene (Acheulian) and to the Late Pleistocene (Mousterian) (Baryshnikov and Cherepanov 1985).

At the present time, the golden eagle is only seen in Crimea during its migrations, when it winters there (Kostin 1983). In all probability, it inhabited the Crimean Mountains periodically through the middle of the nineteenth century, but there is no definite confirmation for this. Today, this species breeds very infrequently in Ukraine (mostly in the Carpathian Mountains), and it currently numbers no more than a few pairs in the region.

Given the completeness and the articulation of the golden eagle skeleton at the site, it is possible that it

Table 6-1
List of *Aquila chrysaetos* skeletal elements from Level C

	Fragments	*Complete*
Scapula, right	2	–
Humerus, right	3	–
Humerus, left	9	–
Ulna, right	11	–
Ulna, left	5	–
Radius, right	6	–
Radius, left	4	–
Metacarpus, left	2	–
Phalanx I, left	1	1
Triquetral, left	1	1
Scaphoid, left	1	1
Femur, left	10	–
Fibula, right	1	–
Patella, left	1	1
Cranium†	14	–
Mandible	3	–
Cervical vertebrae	2	1
Thoracic vertebrae	5	1
Coccygeal vertebrae	5	1
Sternal-costal bones	7	–
Vertebral column	2	–
Rib	9	–
Sternum	5	–
Coracoid bone	4	–
Ilium	3	–
Unidentifiable fragments	83	–

†Including fragments of the frontal bone and occipital with *protuberanta occipitalis, foramen magnum, foramen hypoglossi,* and *foramen vagi et glossopharyngici.*

Figure 6-1—The complete golden eagle (*Aquila chrysaetos*) skeleton (after Ilichev et al. 1982) in relation to bones identified at Buran-Kaya III Level C (in black).

Table 6-2
Dimensional comparison of Level C *Aquila chrysaetos* right scapula with modern specimens

	Fossil	*Modern*					
Total length	—	94.7	105.7	99.2	101.3	103.8	96.7
Proximal height I (humeral articular facet to coracoid tubercle)	22.8	21.3	24.7	23.0	23.1	24.9	21.8
Proximal height II (humeral articular facet to acromion)	25.4	24.0	26.9	25.8	26.6	27.2	23.7
Proximal width (acromion to coracoid tubercle)	9.3	9.6	10.2	11.7	9.7	11.9	9.5
Height of humeral articular facet	15.6	15.2	16.9	—	16.2	—	15.4

represents a sacred, purposeful ritual. Ethnographic examples of an eagle cult and its presumed origins have been described by some researchers (e.g., Propp 1986; Shternberg 1936). Notably, this cult was present among the inhabitants of ancient Siberia, where, after an eagle was caught, it had to be fed and kept for a period of time, and then ritually killed and buried. In this case, then, the eagle was a sacrificial animal. The aim of the ritual was to attract the eagle god and creator. At Buran-Kaya III, the presence of nearly all parts of the eagle skeleton, its position, along with the very good preservation of the many bones, suggest that its emplacement might have been purposeful and that it might be the result of a cult. This is a unique phenomenon for paleoornithology.

It appears that the absence of foot bones, claws, and beak of the *Aquila chrysaetos* at Buran-Kaya III might be the result of their removal from the carcass for religious purposes. These skeletal parts are symbols of power for the totem, imparting protection under the bird and assistance in the hunt. Special cultic use of the golden eagle by the prehistoric inhabitants of Buran-Kaya III Level C can be indirectly confirmed by the absence of remains of other birds. Moreover, among ancient peoples (Propp 1936) one of the functions of the eagle cult was so that the eagle spirit could convey other sacrificial animals to the various gods. represents a sacred, purposeful ritual.

TABLE 6-3

Dimensional comparison of Level C *Aquila chrysaetos* left femur with modern specimens

	Fossil	*Modern*			
Total length	—	127.3	127.4	128.1	129.0
Proximal width	29.2	27.7	29.3	27.3	30.0
Width of femoral head	12.0	10.7	11.1	11.0	11.3
Minimum width	10.9	9.5	9.9	9.7	9.8
Minimum diameter of shaft	12.1	11.7	13.0	12.0	12.7
Maximum diameter of shaft	14.4	12.5	13.5	12.6	14.0

TABLE 6-4

Dimensional comparison of Level C *Aquila chrysaetos* right humerus with modern specimens

	Fossil	*Modern*		
Total length	—	197.6	185.9	197.3
Width of articular head	10.3	10.9	9.7	10.3

TABLE 6-5

Dimensional comparison of Level C *Aquila chrysaetos* left humerus with modern specimens

	Fossil	*Modern*		
Total length	—	197.0	197.0	186.4
Distal width (flexor process to dorsal condyle)	33.5	34.3	36.8	31.9
Minimum diameter of shaft	11.0	12.1	12.2	11.4
Maximum diameter of shaft	16.2	14.0	14.7	12.9
Maximum diameter of ulnar condyle	9.7	9.3	9.1	9.1

Table 6-6
Dimensional comparison of Level C *Aquila chrysaetos* left ulna with modern specimens

	Fossil	Modern		
Total length	—	226.7	215.4	227.8
Minimum diameter of shaft	10.5	10.3	10.3	10.7
Maximum width of dorsal condyle	17.8	17.3	16.1	17.8

Table 6-7
Dimensional comparison of Level C *Aquila chrysaetos* right ulna with modern specimens

	Fossil	Modern	
Total length	214.8	228.5	214.9
Maximum proximal width	24.3	25.3	22.6
Height of dorsal cotyloid process	8.8	8.6	7.6

Table 6-8
Dimensional comparison of Level C *Aquila chrysaetos* left radius with modern specimens

	Fossil	Modern		
Total length	—	201.9	214.9	215.2
Height of bicipital tubercle	14.1	13.0	14.3	15.5
Maximum proximal diameter	11.7	10.8	8.2	8.7
Minimum proximal diameter	7.9	8.0	11.3	12.3
Minimum diameter of shaft	5.4	5.2	6.0	5.6
Distal width	15.7	14.3	15.3	16.0

Table 6-9
Dimensional comparison of Level C *Aquila chrysaetos* right radius with modern specimens

	Fossil	Modern
Total length	—	200.9
Height of bicipital tubercle	14.6	13.6
Maximum proximal diameter	11.4	11.5
Minimum proximal diameter	8.0	8.0

Table 6-10
Dimensional comparison of Level C *Aquila chrysaetos* left carpometacarpus with modern specimens

	Fossil	Modern	
Total length	—	101.9	109.0
Maximum width of distal part of lesser metacarpal	4.0	4.4	4.1
Length of distal symphysis	8.2	7.6	9.2
Maximum distal width	19.8	18.8	20.3

7

Worked Bones from Buran-Kaya III Level C and their Taphonomic Context

Véronique Laroulandie & Francesco d'Errico

Composite tools, hafting, and, in particular, the production of bone and ivory tools, with techniques specifically conceived for these materials, such as scraping, grinding, grooving, and polishing, are generally considered by archeologists to be important features characterizing modern human behavior (Mellars 1973; Klein 2000; McBrearty and Brooks 2000; Ambrose 2001). Complex bone technologies have long been seen as an invention of anatomically modern humans (AMH) during their spread across Europe, ca. 35,000 BP (Mellars 1973, 1992, 1996; Bar-Yosef 1992, 1998; Klein 1994, 1999; Harrold 1992; Stringer and Gamble 1993; Farizy 1994; Mithen 1996). In the last few years, however, several occurrences of worked bones and personal ornaments have been reported from sites attributed to transitional technocomplexes, such as the Châtelperronian in France and Spain, the Uluzzian in Italy, and the Szeletian in the east of Europe (Gioia 1990; Granger and Lévêque 1997; Gambassini 1997; d'Errico et al. 1998, in press; Palma di Cesnola 1993; F. Lévêque, personal communication). Formal bone tools have also been found in relatively old African Middle Stone Age sites, such as Katanda (Brooks et al. 1995) and Blombos (Henshilwood et al. 2001). Buran-Kaya III is one of the sites that has provided some of the most ancient evidence for bone tool manufacture in Eurasia.

Original publications by Marks and others (Marks 1998; Yanevich et al. 1997) reported the discovery of several bone rods and a possible bone handle from a layer (Level C) that also yielded an original stone tool assemblage (Marks and Monigal 2000a; Monigal, Chapter 5). This assemblage showed no Aurignacian affinities two millennia earlier than the first known Aurignacian in the region. They described three bone rods, one made of a small mammal bone and two made of bird bones, and a distal segment of an horse metatarsal cut in the middle of the diaphysis. While the bone rods found in 1996 unquestionably come from Level C, the stratigraphic provenance of the cut metatarsal found in 1994 is more uncertain due to the excavation technique adopted that year (horizontal arbitrary levels). It may come from the base of the lower Kiik-Koba Level B1 or from Level C. The latter hypothesis is supported by the AMS dating of this object (32,350 ± 650 OxA-6869), closer to that of a bone fragment (32,350 ± 700) and a rod from Level C (36,700 ± 1500 OxA-6868) than those obtained from two bones from the Kiik-Koba Level B1, both around 28,600 BP (Pettitt 1998a). Subsequently, the worked bone and the faunal assemblage from Level C of 1996 excavations were analyzed by us (d'Errico and Laroulandie 2000). We included in our analysis two previously undescribed cut epiphyses identified among the faunal material, a burnt bone flake found during our analysis of the faunal assemblage that refit onto one of the already mentioned rod fragments, and a fragment of another *Equus* metatarsal possibly used as an handle. We showed that the bone rods were made of hare rather than bird bones, reconstructed the manufacture techniques involved in the production of the rods and the handle, conducted a taphonomic analysis of the faunal assemblage from Level C recovered in 1996, and discussed the significance of this material for the debate on cultural and biological interactions between late Neandertals and the first anatomically modern humans. Here we complete the taphonomic analysis of Level C, including in our study the faunal remains recovered since 1996. One clear and one probable additional bone tubes were identified by us in the faunal material from the 2001 excavation. The second aim of this paper is to integrate these new artifacts in our previous analysis of the Buran-Kaya III worked bone assemblage and to propose a new evaluation of their significance for the debate on the origin of bone manufacturing techniques.

Taphonomic Analysis of the Faunal Assemblage

Level C yielded 2,600 faunal remains (Table 7-1), 97% of which consist of unidentifiable mammal bone fragments. Most are small fragments (less than 3 cm long) of ribs and limb bones of large-sized mammals. The others correspond to limb bone fragments of small sized mammals. The remaining 48 bones correspond to a few *Lepus*, fox, *Saiga tatarica*, *Equus* sp., large cervid, and wolf remains. The assemblage also includes few micro-mammals. None of the taxa has an NMI exceeding 1 or 2. Although most of the remains carry traces of root etching and chemical diagenesis, this did not significantly affect the identification of the taphonomic agent responsible for the accumulation of the bone assemblage. Carnivore tooth marks are present on only four specimens, the cut horse metatarsal (see below), a distal epiphysis of a tibia of *Alopex*, and two shaft fragments from unidentified mammals. The dimension of punctures and scoring suggests that carnivores of different sizes were responsible for the traces on these four specimens. Typical etching produced by carnivore gastric acids (d'Errico and Villa 1997) was recorded on 17% of the remains (Figure 7-1). Clear signs of heating were observed on 8% of the fragments of large size mammals. One burned fragment was identified as hare and refitted onto a tube fragment (see below). Apart from the sawed bones (see below), anthropic modifications consisting of cutmarks (Figure 7-2) and percussion pits (Figure 7-3) are present on 0.6% and on a single specimen respectively.

Figure 7-1—Bone fragments digested by carnivores from Buran-Kaya III Level C. Scale = 1 cm.

Table 7-1
Faunal remains from Buran-Kaya III Level C

	NISP	*MNI*	*Burnt*	*Cutmarks*	*Percussion*	*Sawing marks*	*Tooth marks*	*Digested*
Canis lupus	1	1	–	–	–	1	–	–
Alopex lagopus	1	1	–	–	–	–	1	–
Vulpes/Alopex	12	–	–	–	–	–	–	3
Large deer	1	1	1	–	–	–	–	–
Saiga tatarica	10	2	–	2	–	–	–	3
Caprinae	5	–	–	–	–	–	–	4
Equus	4	1	–	–	–	1	1	–
Lepus sp.	14	2	–	2	–	5 +1?	–	1
Micro-mammals	17	–	–	–	–	–	–	–
Macro-mammals	2,535	–	212	13	1	–	2	431
Total	2,600	8	213	17	1	7 + 1?	4	442

NISP - number of individual specimens; MNI - minimum number of individuals.

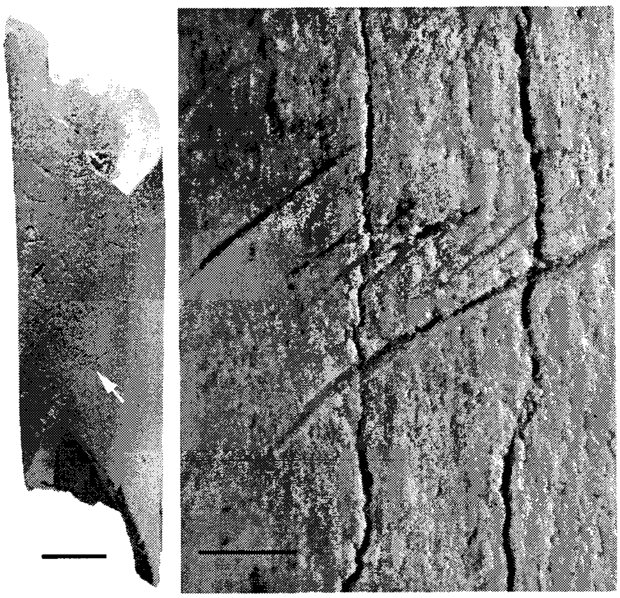


Figure 7-2—Cutmarks on the anterior aspect of a *Saiga tatarica* radio-ulna from Buran-Kaya III Level C. Left: scale = 1 cm; right: scale = 1 mm.

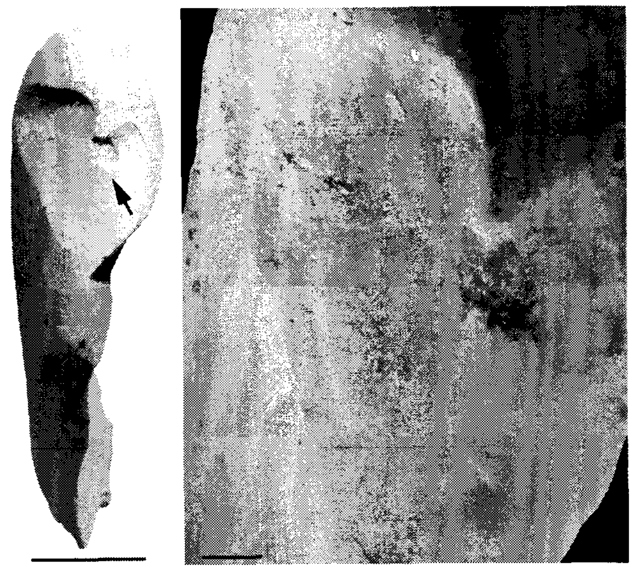


Figure 7-3—Percussion pit and related flake removal on a long bone shaft fragment from Buran-Kaya III Level C. Left: scale = 1 cm; right: scale = 1 mm.

Zooarcheological and Technological Analysis of the Worked Bones

Worked bones from Level C consist of one complete tube, four fragmentary tubes, and two by-products of tube manufacture. The other worked bone attributed to Level C is a distal portion of horse metatarsal, cut by sawing. Another distal epiphysis of horse metatarsal, heavily damaged, may have been modified in the same way and used as a handle.

One tube is made from the left tibia of a wolf (Figures 7-4: *1*; 7-5: *2*). Two others, described in the first report on the worked bones as being bird bone, come, in fact, from the right femur and left tibia of a hare (Figures 7-4: *2*, *4*; 7-5: *1*, *4*). This last tube is represented by two conjoinable fragments, one of which shows clear traces of heating. One of the two tubes we found in the 2001 material was made from the femur of a hare (Figures 7-4: *3*; 7-6). The other is made from a right hare humerus (Figures 7-4: *7*; 7-7). The identification of this last piece as a manufactured tube is based on the presence of scraping marks similar to those seen on the other specimens, and on the possible remnants of traces of sawing on a tiny portion of the distal fracture. The two by-products are the proximal epiphysis and the distal segment, respectively, of a right and a left hare humerus (Figure 7-4: *5*, *6*). Therefore, they resulted from the production of two different tubes. In sum, the manufacturing remnants represent a minimum of six tubes from Level C.

The tube made from the wolf tibia comes from a sub-adult individual—a fact demonstrated by the great number of vascular openings, indicating the

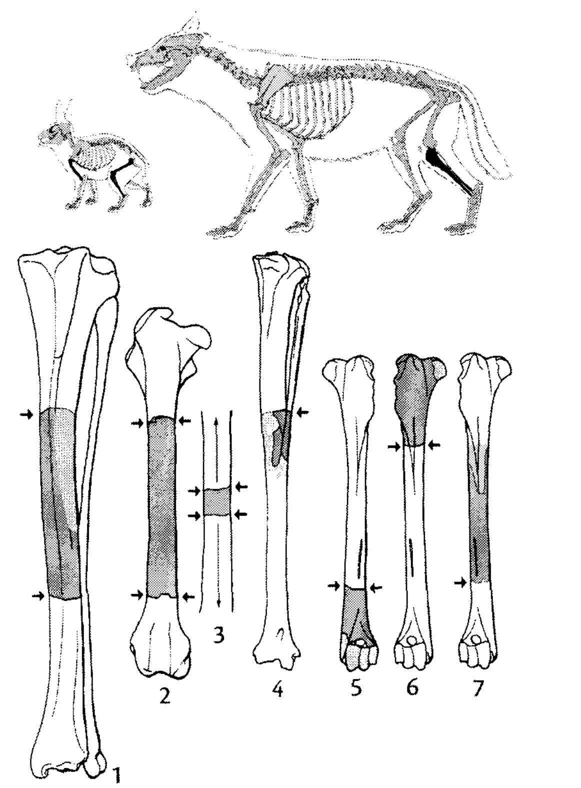


Figure 7-4—Anatomical provenance of the bone tubes and by-products of bone tube manufacture: *1*–left wolf tibia; *2*–right hare femur; *3*–hare femur; *4*–left hare tibia; *5*–left hare humerus; *6*, *7*–right hare humeri. Light gray pattern indicates missing area. Black arrows indicate the area whence the tube comes. Small arrows indicate the location of the sawing.

Figure 7-5—Bone tubes and by-products of bone tube manufacture from Buran-Kaya III Level C found during 1996 excavations. 1–hare femur; 2–wolf tibia; 3, 4–hare humeri; 5–hare tibia. Scale = 1 cm.

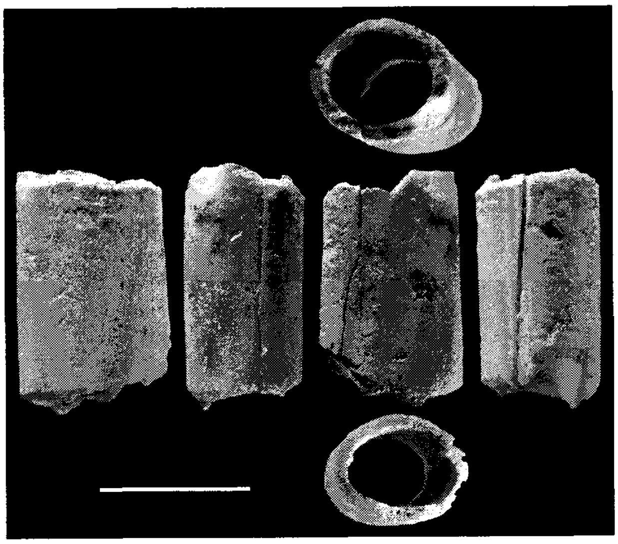


Figure 7-6—Bone tube made on a hare femur from Buran-Kaya III Level C, 2001 excavations. Scale = 1 cm.

high degree of vascularisation typical of immature animals.

All of the worked hare bones may come from a single animal. The closure of the epiphyses and the high density of the cortical bone, in all cases, indicate an adult individual. Its carcass was brought to and processed at the site before the bones were cut. The former is suggested by the identification of conjoining proximal segments of a right ulna and radius with a cut-mark crossing both epiphyses (Figure 7-8); the latter by the presence of the by-products of tube manufacture. Microscopic analysis of manufacturing traces and their experimental reproduction has allowed a detailed reconstruction of the craftsperson's technical behavior.

The two best preserved hare tubes (Figure 7-5: *1*, *2*) and both by-products (Figure 7-5: *3*, *4*) show scraping marks, indicating that entire long bones had been extracted from the carcass and cleaned before being cut (Figures 7-9: *1*; 7-10). In all cases, the scraping was made with a flint point or an irregular cutting-edge that produced single overlapping striations. The tubes were then produced by first cutting several intersecting notches around the circumference of the bone and subsequently snapping the residual uncut bone

Figure 7-7—Possible bone tube made on a hare humerus from Buran-Kaya III Level C, 2001 excavations. Scale = 1 cm.

Figure 7-8—Proximal epiphysis of a left hare radius and ulna crossed by an oblique cutmark (arrow) from Buran-Kaya III Level C. Scale = 1 cm.

by flexion. The use of this technique is demonstrated by the fact that the notches never completely saw through the bone and leave, in places, a thin uncut bridge broken by flexion, still visible on by-products and tubes (Figure 7-9: *3*). In three cases the notches were not perfectly aligned and in one case we find notches a few millimeters from the edge of the cutting (Figure 7-9: *4*). This is the consequence of an accidental side-skipping of the tool during the sawing action, as demonstrated by the accidental production of the same features during the experimental sawing of similar small bones (Figure 7-9: *2*). Experimentation also suggests that the Level C notches were made with a thick retouched cutting edge. This is demonstrated by the comparison of the section of the archeological notches with that of notches experimentally made with different types of tools. The notch profile is obtained through an image analysis system linked to a low power microscope (d'Errico 1991, 1998; d'Errico and Nowell 2000). Notches made with retouched tools can be distinguished from those produced by unretouched blanks by examining the notch morphology and measuring the angles formed by the notch walls. In our experiments, retouched tools produced notches between 60° and 91°, while unretouched ones resulted in angles between 39° and 67°. Overlapping of the two populations covers only 10% of the two samples and does not include the values obtained by measuring the Buran-Kaya III notches (74° and 92°), which clearly fall within the retouched sample (Figure 7-11).

The new tubes contradict the impression of size homogeneity suggested by the pieces available at the time of our previous study (d'Errico and Laroulandie 2000). The new complete tube made of hare femur is just 1.5 cm long, much shorter than the 7 cm length of the specimen made on the same bone and of that manufactured on the wolf tibia.

No traces indicating the function of the tubes have been detected. The ends of the tubes show the same unworn appearance as the by-products and the technological marks are very fresh. This may be due to the fact that the tubes were abandoned before being finished or that they were used in a way that did not produce any detectable wear. The refitting of two fragments of the same tube (Figure 7-5: *5*), one of which was burnt, indicates that the fracture of the object took place during the apparently short human presence associated with Level C and that, after break-

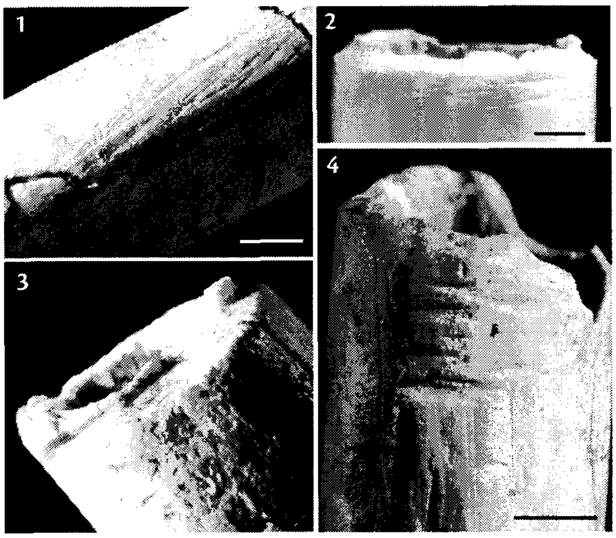


Figure 7-9—Traces of manufacture on archeological (1, 3, 4) and experimental (2) bone tubes: *1*–scraping marks on the tube made of hare femur, indicating that the bone was cleaned before being cut; *2*–rabbit limb bone experimentally sawed and snapped, showing cutmarks a few millimeters from the tube end, similar to those present on the archeological specimens; *3*–adjacent notches made to produce a groove around the hare femur before snapping it. Note the presence of a bridge broken by snapping the bone after sawing it; *4*–scraping marks parallel to the object's main axis and notches produced accidentally during the sawing of the bone. Scales = 5 mm.

Figure 7-10—Traces of sawing (top) and scraping (bottom) on a bone tube from Buran-Kaya III Level C, 2001 excavations. Top: scale = 5 mm; bottom: scale = 1 mm.

age, one or both fragments were displaced, probably by trampling.

The size of the horse metatarsal (Figure 7-12) suggests that it comes from an *Equus ferus* or *caballus* rather than from a *hydruntinus*, as was proposed by Uerpmann (Yanevich et al. 1997). No scraping marks like those described on the tubes are present on this bone. However, our experimental butchery of an adult horse foot, with the aim of recovering and cutting the metatarsal, has shown that it is difficult to clean the bone, especially its distal epiphysis, without leaving tool marks. The absence of these marks on the archeological specimen, the virtual absence of other horse remains from the same level, and the fact that this is the only bone from Level C with damage produced by a large carnivore, suggest that the metatarsal was acquired by scavenging a bone already weathered and damaged by carnivores.

The horse metatarsal was cut slightly below the middle of the diaphysis (Figure 7-12). The technique used to saw it was the same applied to produce the tubes. However, experimental sawing and snapping of an adult horse metatarsal (Figure 7-13) and of two adult cow tibiae indicate that the manufacture of this object was a far more complex and time consuming operation. In order to produce a clean cut perpendicular to the bone's main axis like that visible on the archeological specimen, the artisan first had to engrave a continuous circular groove around the bone, before deepening it and eventually breaking the remaining bridge.

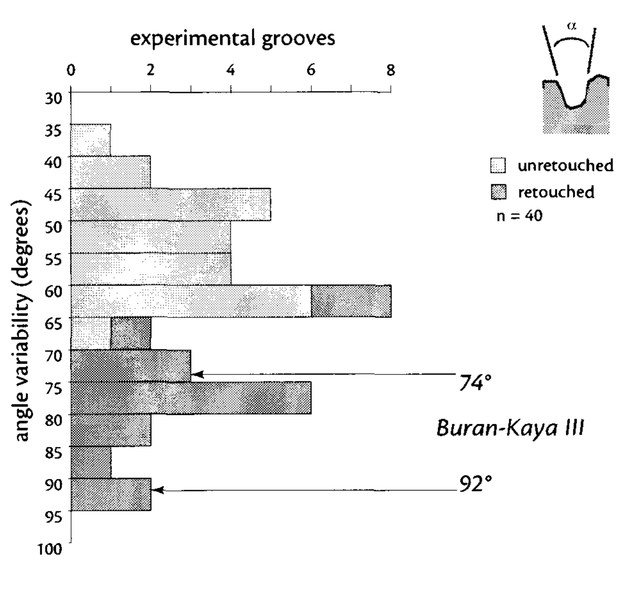


Figure 7-11—Angle variability of notches made experimentally by retouched and unretouched flakes. Values recorded on the Buran-Kaya III Level C notches adjacent to the tube ends fall within the range of notches made by retouched tools.

Figure 7-12—Horse metatarsal cut by sawing, with damage by a large carnivore on the distal epiphysis, from Buran-Kaya III Level C, 1994 excavations. Scale = 1 cm.

Several retouched artifacts were certainly used to deepen the groove, since unretouched blanks would have become quickly ineffective as they were used to saw thick compact bone. In our experiment, the sawing of the 1-cm-thick bone shaft took an hour and a half and required the use of seven unifacially or bifacially retouched artifacts between 7 and 14 cm long, all of which were used on both sides and were resharpened three to five times each during the process (Figure 7-13). The thickness of the uncut bone, broken by this action, suggests that the snapping of the metatarsal was done by a robust adult. The time and energy required by the production of this object rules out, in our view, the possibility that this might have been done just to recover the marrow.

It is more likely, as suggested by Yanevich et al. (1997), that this bone was used as a handle. The dimension of the medullar cavity, which is 3 cm deep by 2 cm wide, is perfectly compatible with the size of some of the endscrapers made of cortical flakes from Level C. Yet, no traces of its use as a handle are detectable on the metatarsal. The absence of spongy bone inside the bone shaft can be due to a taphonomic process or to a deliberate cleaning out, although no traces of this action are visible and the residual spongy bone does not appear crushed, as one might expect, by the pressure exerted by a hafted tool. Therefore, we cannot rule out the hypothesis that this object represents the by-product of the manufacture of another object, not found at the site. Another distal segment of an adult horse metapodial comes from Level C (Figure 7-14). This bone lacks the portion of the shaft where the sawing line is located on the cut metatarsal, which makes its identification as a worked bone speculative. The inner spongy tissue, however, shows a shallow regular pit that might be the result of a deliberate cleaning of the medullar cavity to insert a stone tool.

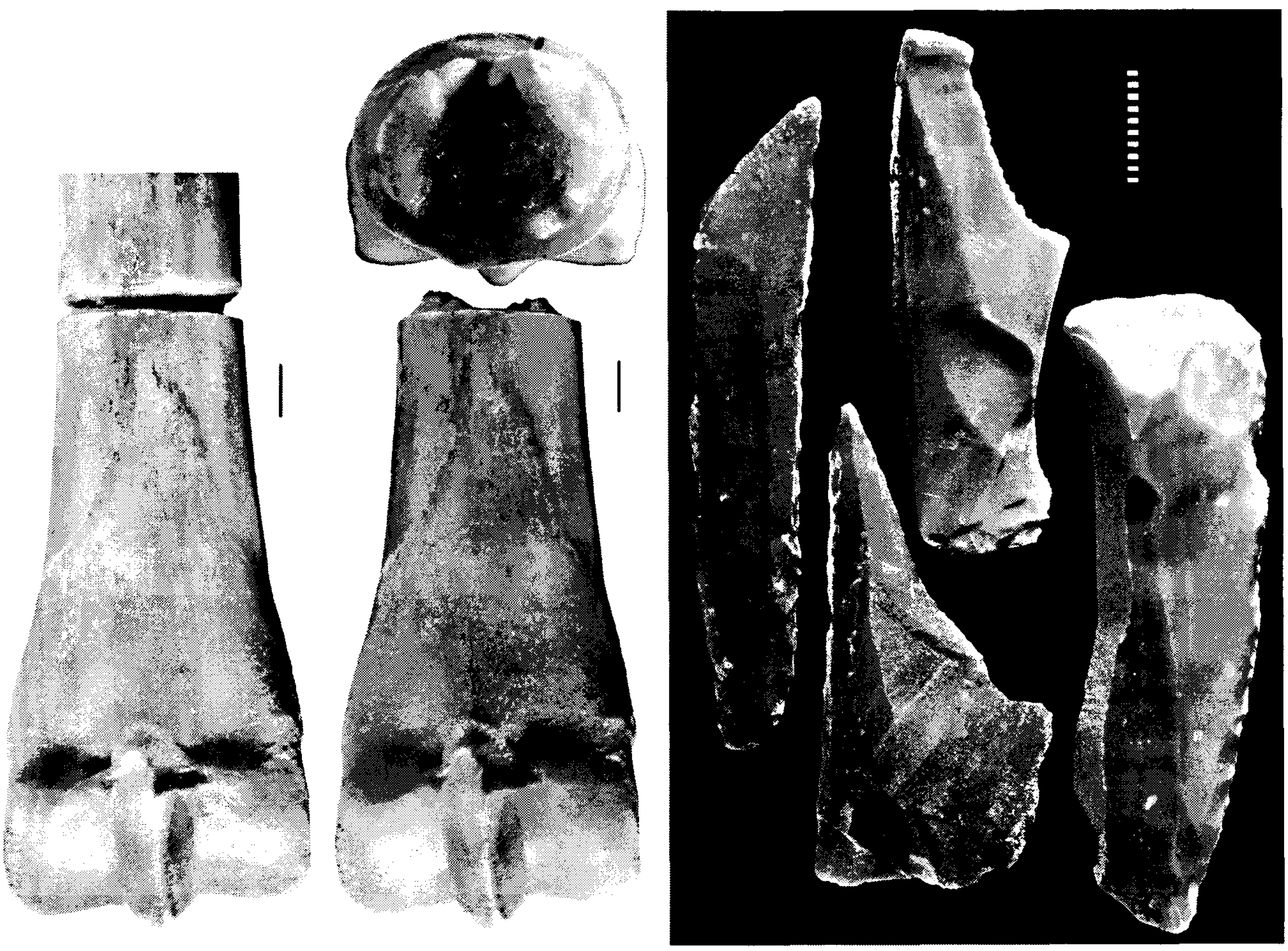


Figure 7-13—Left: adult horse metatarsal experimentally sawed and snapped. Note the striations left on the cut surface by the retouched artifacts used to deepen the circular groove. Right: experimental tools used to cut the bone. This technique leaves residues of bone (white area) on the tool edge. Left: scale = 1 cm.

Figure 7-14—Distal epiphysis of a horse metatarsal showing a conical pit that might be the result of a deliberate cleaning of the medullar cavity to insert a stone tool from Buran-Kaya III Level C. Scale = 1 cm.

Discussion

Both carnivores and humans were responsible for the accumulation of the Level C bone assemblage. The crucial role of carnivores is demonstrated by the high proportion of digested fragments and the debris of coprolites found during the screening of the faunal material. The low percentage of bone with carnivore tooth marks is probably due to the highly fragmented nature of the assemblage. The above observation suggests that humans may not have contributed much to the bone accumulation. This is also indicated by the low proportion of bone with percussion and cut marks and the relatively small volume of recovered burnt bone. In sum, results of our taphonomic analysis are consistent with the hypothesis that, on one hand, the faunal assemblage from Level C represents a palimpsest, recording one or a few short human occupations during which limited processing of mammal carcasses took place and, on the other hand, the use of the shelter as a carnivore den.

Our study shows that the human group responsible for the Buran-Kaya III Level C assemblage was in possession of a technology specifically conceived for working bone. They knew the species and the bones to be used for producing tubes of cylindrical morphology. This implies that animals were not only hunted for consumption, but that an appropriate treatment of the carcasses was applied in order to recover the bones to be used as raw material for bone tool manufacture. These bones were worked with the same techniques and using similar retouched tools. In our previous study, we emphasized the size similarity of the tubes available at the time and proposed that the goal of the Buran-Kaya III artisans was that of producing bone tubes of the same length, irrespective of the species and the type of bone used. The small size of the best-preserved new specimen demonstrates instead that different sizes of bone tubes were sought, suggesting a higher degree of technical complexity. Evaluation of the significance of such complexity, however, is difficult, considering that we have no idea of the final use of these artifacts.

In cases such as the cut metatarsal, their production required a certain experience, skill, time, strength, and the waste of a relatively large number of stone tools. Experimental manufacture of these objects reveals that Buran-Kaya III artisans were affected by the same neuromotor constraints as were the modern experimenters. Some of these objects, such as the probable handle, were certainly meant to be carried and repeatedly used. Although one might argue that similar planning and technical ability is suggested by the elaborate bifacial reduction sequence found in the same layer, it is a fact that clear evidence of specialized bone working has been sparse in the Middle Paleolithic archeological record, so far.

What is the significance of these behaviors? It is difficult to evaluate the implications of the Buran-Kaya III bone technology for the Middle/Upper Paleolithic transition of Eastern Europe; no human remains were found in Level C. As a consequence, we have no direct information on the human type responsible for the production of the bone industry.

The Level C assemblage (Marks 1998; Marks and Monigal 2000a) shows no taxonomic similarity with the local Aurignacian, which, in addition, does not seem to appear in the region before 30,000 BP. In contrast, bifacial foliates of this assemblage show some analogies with Kostienki-Streletskaya assemblages of the Middle Don region (Bradley et al. 1995), but it lacks some types, such as the concave base bifacial points. Level C bifacial tools also show very general affinities with geographically closer Ak-Kaya Middle Paleolithic assemblages of the eastern Crimea (Chabai et al., 1995), but do not include, in this case too, the

Middle Paleolithic tools that one would expect to find associated with the foliates. Even if the lack of Middle Paleolithic tools may be attributed to the specialized nature of the site and the ephemeral character of the occupation, still the numerous characteristic geometrics made on the by-products of bifacial reduction remain a peculiar feature of this assemblage, suggesting that only future research will establish sound cultural links.

If a relation with the Streletskayan is established, this might suggest that AMHs were the authors of the Buran-Kaya III assemblage, since this human type is responsible for the more recent phases of this industry. In contrast, a local Mousterian origin might suggest that they were Neandertals. As far as we know now, however, the Level C assemblage may have been produced by Neandertals, by Non-Aurignacian Anatomically Modern Humans, or even by a hybrid population, as recently suggested for Portugal (Duarte et al. 1999).

For the time being, the Buran-Kaya III worked bones confirm what it is already known for other industries at the Middle–Upper Paleolithic transition: specialized techniques to produce bone objects were not the monopoly of the Aurignacian, but rather a component of various industries of the transition. Bone and ivory tubes, often decorated with incisions, are well known, of course, in Aurignacian contexts from France, Belgium, Germany, Italy, and Russia (Figure 7-15). At Isturitz and Geißenklösterle, tubes produced by sawing bird bones were used to make flutes (Buisson 1991; Hahn and Münzel 1995; Lawson and d'Errico, in press). The only known unfinished tube, from Fumane Cave (Bartolomei et al. 1994), in northern Italy, shows a circular groove, indicating the use of the same technique described for Buran-Kaya III. Production and use of bone tubes, however, is not peculiar to the Aurignacian. Tubes decorated with notches made of swan long bones were found in the Châtelperronian layers of the Grotte du Renne, at Arcy-sur-Cure, in northern France (Leroi-Gourhan and Leroi-Gourhan 1965; d'Errico et al. 1998). As at Buran-Kaya III Level C, the tubes from Arcy were produced at the site, a fact demonstrated by the presence in the same layers of waste from their manufacture and by a possible refitting. As at Buran-Kaya III, long bone shafts of purposefully selected species were used to produce perfectly cylindrical tubes. Human remains associated with this material suggest that Châtelperronian Neandertals were the authors of these objects. Arcy is not the only site proving the use of tubular elements by late Neandertals. Several cut dentalium shells were found at Saint-Césaire in the Châtelperronian level that has yielded the Neandertal skeleton (F. Lévêque, pers. comm.), confirming that late Neandertals used personal ornaments, and suggesting that decorated bone tubes from Arcy may also have had this function. Dentalium shells were also found in Uluzzian sites of the Italian Peninsula (Gambassini 1997).

A number of Upper Paleolithic handles made of cut long bone and antler segments, some of which still have flint tools embedded in the medullar cavity (Absolon and Czizek 1932; Gerasimov 1958), are known from Eastern Europe. We know, however, that stone tools were also hafted during the Middle Paleolithic, a fact suggested by use-wear studies (Beyries 1987; Shea 1988; Friedman et al. 1995), as well as by the recent publication of traces of bitumen on Middle Paleolithic stone tools, and by the discovery of a Levallois point embedded in a wild ass cervical vertebra from the site of Umm El Tlel in Syria (Boëda et al. 1996, 1999). Two possible bone handles come from the Middle Paleolithic levels of the Vaufrey cave, in France. One is a fragment of antler, cut perpendicularly to the object's main axis with the same technique described at Buran-Kaya III. This object shows several deep notches, probably made to facilitate hafting (Vincent 1988). The other is a piece of antler which appears longitudinally split, with the spongy bone purposely taken out. Two birch-bark pitches have been recently found at the Middle Paleolithic site of Königsaue, Germany (Grünberg 2002). These pieces come from two different layers dated to 43,800 BP and 48,400 BP. One shows the imprint of a wooden haft, the other that of a bifacial tool.

In sum, recent discoveries indicate that hafting techniques were not limited to the Upper Paleolithic and that we are far from having a reliable picture of their use in earlier times.

Conclusions

Scholars who have a reductive view of Neandertal cognitive abilities have often considered that they were incapable of using sophisticated techniques specifically conceived for bone materials, based not just on percussion but on shaping by cutting, scraping, grinding, and polishing. The evidence presented above suggests, in contrast, that there is no reason to assume that the Buran-Kaya III artisans were AMHs just because they produced bone tools. The fact that similar objects are found in the Aurignacian should not be automatically considered, as it has in the past, as proof that Neandertals were acculturated by Aurignacian moderns. This interpretation, not supported by the archeological record, is based on the

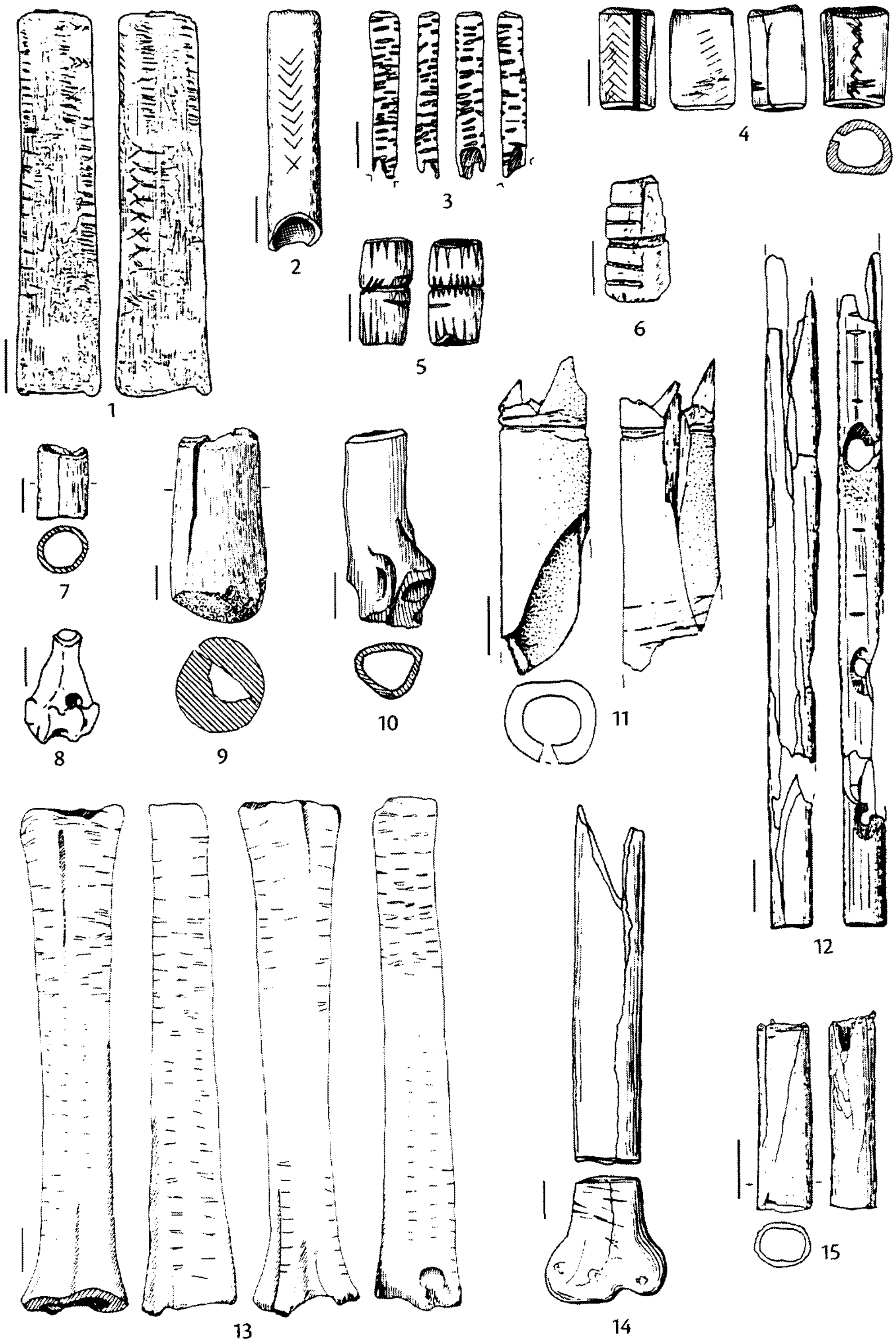


Figure 7-15—Bones tubes from Aurignacian and Châtelperronian sites: *1*–Spy, bone tube (Lejeune 1987, fig. 15); *2, 4*–Spy, bone tube (Otte 1979, fig. 127); *3*–Spy, bird bone tube (Otte 1979, fig. 127); *5*–Spy, ivory cask (Otte 1979, fig. 123); *6*–Spy, ivory cask (Lejeune 1987, fig. 11); *7*–Tarté, bird bone tube (Bouyssonie 1939, 193); *8*–Kostienki I, by-product of bone tube manufacture (Sinitsyn 1993, fig. 12); *9*–Tarté, reindeer antler armhole (Bouyssonie 1939, fig. 9); *10*–Spy, by-product of bone tube manufacture (Otte 1979, illus; 121); *11*–Fumane, bone shaft fragment with groove produced by sawing (Bartolomei et al. 1994, fig. 28); *12*–Geißenklösterle, bird bone flute (Hahn and Münzel 1995, fig. 4); *13*–bone tube (Otte 1979, fig. 54); *14*–Grotte du Renne, bird bone tube and the possible by-product of its manufacture (redrawn after d'Errico et al. 1998, fig. 4); *15*–Vogelherd, bone tube (Otte 1993, fig. 4). Items 1-12 and 15–Aurignacian, 14–Châtelperronian. Scale = 1 cm

assumption that industries such the Châtelperronian and the Uluzzian are contemporary with the first Aurignacians or even that they developed after the arrival of AMH. This contemporaneity, however, neither seems demonstrated by the stratigraphic evidence, nor by the radiocarbon evidence (Zilhão and d'Errico 1999; Bordes 2002). The Buran-Kaya III stratigraphic pattern, with a thick Kiik-Koba Middle Paleolithic assemblage separating the Upper Paleolithic from the level which has yielded the worked bones, provides further corroboration that, if made by Neandertals, Level C worked bones might represent the material expression of an independent cultural development of Eastern European late Neandertals.

8

Archeozoological Analysis of Large Mammal Fauna from Buran-Kaya III Layer B

Marylène Patou-Mathis

The sample of faunal material from Buran-Kaya III Layer B used in this study was drawn from the 1996 excavations and comprised 16,680 pieces. Of these, 16,671 bones are attributable to herbivores, or 99.9% of the total number of identifiable remains (Table 8-1). Since the excavated area of this particular sample was about 31 m², the average density per square meter was 539 bones. Of the total sample, 15,328 bones could not be identified, but their dimensions and thickness of the cortex allowed a cautious attribution to a species (Table 8-2).

The identifiable faunal remains are from at least 32 individuals: 29 herbivores (6 species) and three carnivores (3 species). The identified species are: *Equus*

TABLE 8-1
Large mammal fauna of Buran-Kaya III Layer B

	NR	*MNE*	*MNIf*	*MNIc*	*Age*
Equus hydruntinus	3	3	1	1	old
Bison cf priscus	18	>7	1	1	adult *sensu lato*
Coelodonta antiquitatis	4	3	1	1	young
Mammuthus primigenius	38	>7	1	1	very young
Mammuthus/Coelodonta	2	–	–	–	
Cervus elaphus	19	14	1	1	old male
Saiga tatarica	1,259	>747	19	24	
Artiodactyla†	15,328	–	–	–	
Total herbivores	16,671	>>781	24	29	
Canis lupus	1	1	1	1	young adult
Vulpes corsac/Alopex lagopus	4	4	1	1	old
Mustelidae (small)	2	2	1	1	adult *sensu lato*
Vulpes /Alopex /Mustelidae	2	2	–	–	
Total carnivores	9	9	3	3	
Total (NRT)	16,680	>>790	27	32	

†See table 8-2.

NR - number of remains, MNE - minimum number of skeletal elements, MNIf - minimum number of individual animals by frequency, MNIc - minimum number of individual animals by combination.

hydruntinus, *Bison* cf. *priscus*, *Coelodonta antiquitatis*, *Mammuthus primigenius*, *Cervus elaphus*, *Saiga tatarica*, *Canis lupus*, *Vulpes corsac/Alopex lagopus*, and a small Mustelidae. Some rodent and bird bones (including one large bird) were also discovered (Chapters 3 and 6 of this volume).

Saiga antelope is the dominant species among the herbivores, accounting for 93.7% of the total number of remains (NR) in the Layer B sample, 95.6% of the minimum number of elements (MNE), and 82.7% of the minimum number of individuals by combination (MNIc) (Table 8-1 and Figure 8-1). Among the carnivores, the remains of fox are the most abundant, accounting for 44.4% of the NR, 44.4% of the MNE, and 33.3% of the MNIc (Table 8-1 and Figure 8-2).

TABLE 8-2

Buran-Kaya III Layer B: anatomically indeterminate bones sorted by size

Artiodactyla	*Number of remains (NR)*
Size *Bison*	38
Size *Equus hydruntinus/Cervus*	310
Size *Cervus*	111
Size *Saiga*	14,869
Total	15,328

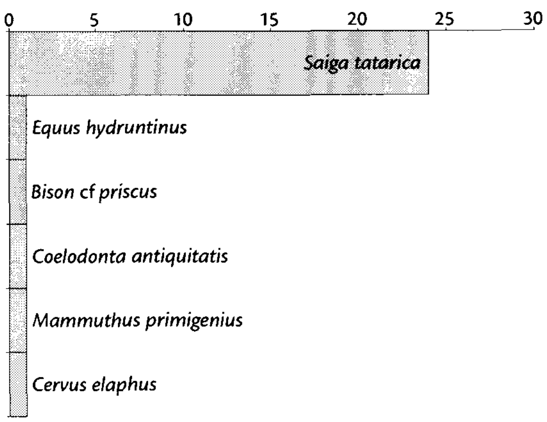


Figure 8-1—Herbivore species in minimum number of individuals by combination (MNIc).

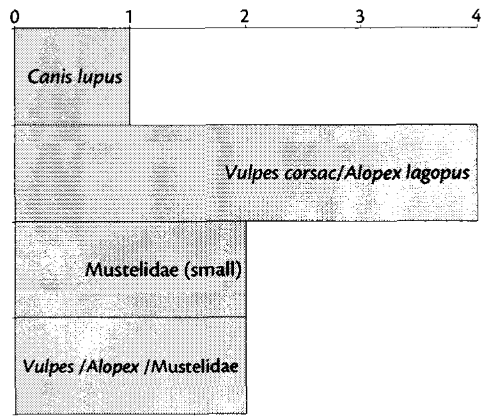


Figure 8-2—Carnivore species, number of remains (NR).

Paleoecology

Most of the herbivore species identified in Buran-Kaya III Layer B are well adapted to an open environment and dry climate (Table 8-1). Only *Cervus elaphus* and *Equus hydruntinus* provide a hint of a more temperate climate and a more wooded environment.

Saiga tatarica, or saiga antelope, is strongly affected by its biotope, which has resulted in its having several physical particularities. For example, its nostrils have voluminous cavities lined with a mucous membrane that warms incoming cold air during the winter and filters airborne dust during the summer. Its hooves are small and pointed, and are unsuited to snow-covered ground; the animal does not take well to permafrost.

Saiga antelope inhabit plains and avoid areas with uneven terrain. They are unaffected by altitude—they can live at sea level (the coast of the Caspian Sea) as well as up to 1,600 meters. Their predilection is towards arid steppe and semi-desertic environments and their geographical movements are determined by the available vegetation. Saiga populations undertake two major seasonal migrations for grazing grounds and sometimes smaller migrations if water holes or vegetation become rare. They consume more than one hundred different plants. During the spring, grasses and ephemerals are the mainstay of their diet, while during the summer, grasses and *Chenopodiaceae* are eaten. Water is essential in their choice of territory.

The landscape near the site of Buran-Kaya III likely corresponded then to a semi-arid steppe with a few wooded areas near streams or rivers. The climate would have been harsh, especially in the winter months, and, above all, dry.

Origin and History of the Bone Assemblage Attributed to Saiga Antelope

To understand the origin and the history of the bone assemblage of Buran-Kaya III Layer B, we have closely analyzed the bones attributable to saiga antelope, which is the dominant species in the assemblage. This analysis includes the preservation, fragmentation, and dispersal of the material, as well as extrinsic marks observed on individual bones.

Bone Preservation of Saiga Antelope

In this report, the basic indices of skeletal element and species abundance are used, including MAU (minimum animal units), which is the minimum number of elements (MNE) divided by the number of times the relevant skeletal element occurs in one animal (specific coefficient of each considered element for a given species: spQ); modified MAU (MAU ÷ the largest MAU); and in percentages of survival, which is calculated by the equation ((MNE × 100) ÷ (spQ × MNIc)). These survival rates of bones are reported in three ways: globally, for adults, and for juveniles. The counts for skeletal elements of saiga antelope are presented in Table 8-3.

Overall Preservation of Saiga Antelope

According to the indices derived from MNE ÷ MNIc and from the number of teeth ÷ number of bones × 100, which are 31.1% and 30.5% respectively, a dearth of saiga bones in Layer B seems apparent. Given, however, the high number of indeterminate remains (NRindet), which make up 92% of the assemblage (Figure 8-3) and which are mostly long bone fragments, this bone scarcity is not as severe as it initially appears. As a whole, the bone material is relatively well preserved.

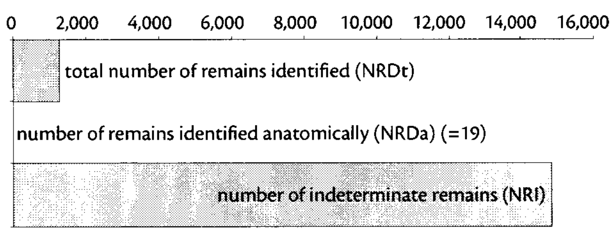


Figure 8-3—Buran-Kaya III Layer B: total number of *Saiga tatarica* remains.

Relative Preservation of Major Saiga Skeletal Units

The cranial parts of saiga antelope are well represented in the bone assemblage (Figure 8-4). As seen in Figure 8-5, other than the axial skeleton, all units are well preserved, especially the upper portion of the rear limbs and the cephalic skeleton.

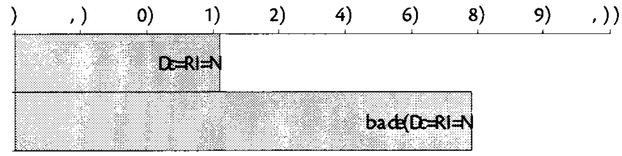


Figure 8-4—Relative percentages of cranial and post-cranial remains of *Saiga tatarica*.

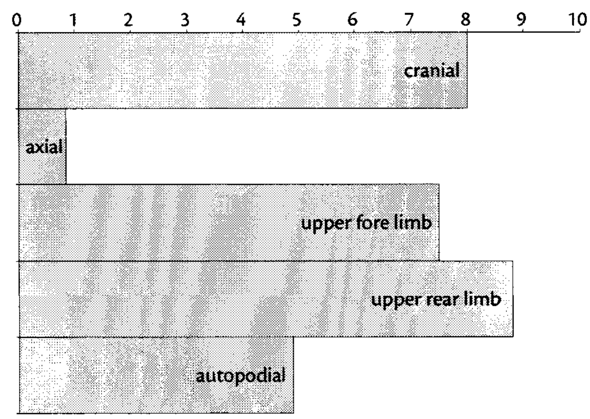


Figure 8-5—Preservation of major skeletal units in minimum animal units (MAU) of *Saiga tatarica*.

Relative Preservation of Saiga Anatomical Elements

CEPHALIC SKELETON

Taking into account the fragility of certain elements (skull bones, maxillae, hyoid bones), the cranial material is, overall, rather homogenous (each type of element yields the same number of individuals). The preservation of isolated teeth and of mandibles is good (Table 8-3). The most well preserved part of the mandible is the condyle. The labials are the best represented of the teeth (their MAU = 8; cheek teeth MAU = 4.9). The premolars, especially the lower ones, are decidedly more rare than the molars, probably because the premolars loosen before the molars do. For the same reason, the lower cheek teeth (MAU = 4.9) are more abundant than the upper ones (MAU = 3.4). This is also confirmed by the notable scarcity of maxillas (MAU = 1). Hyoid bones are present and further testify to the very good preservation of the *Saiga tatarica* cranial bone material.

TABLE 8-3
Buran-Kaya III Layer B: quantification of *Saiga tatarica* remains (MAU)

Element	*NR*	*MNE*	*MAU*	*MNIf*	*MNIc*	*Young*	*Adult*
Cranial bones	29	3	1.5	3	3	–	3
Maxilla	2	2	1.0	1	1	–	1
Upper teeth	41	41	3.4	10	17	3	14
Mandible	51	14	7.0	7	8	3	5
Lower teeth	150	123	8.0	14	16	1	15
Teeth indeterminate	111	–	–	–	–	–	–
Hyoid bone	4	3	–	1	1	–	1
Total cranial	388	>186	8.0	17	21	6	15
Pelvis	23	15	7.5	8	10	2	8
Vertebra	25	13	0.5	3	4	1	3
Rib	81	26	1.0	1	2	1	1
Costal cartilage	7	5	–	1	1	–	1
Sternum	1	1	0.16	1	1	–	1
Sacrum	1	1	0.2	1	1	1	–
Total axial	138	61	0.86	8	10	2	8
Scapula	16	8	4.0	5	6	–	6
Humerus	43	20	10.0	10	15	3	12
Radius	60	20	10.0	10	11	3	8
Ulna	43	12	6.0	7	8	4	4
Total upper fore limb	162	60	7.5	10	16	4	12
Femur	31	13	6.5	7	8	3	5
Tibia	46	26	13.0	13	15	4	11
Patella	20	20	10.0	10	10	3	7
Malleolus	12	12	6.0	9	9	–	9
Total upper hind limb	109	71	8.8	13	15	4	11
Carpal	85	85	7.0	10	12	4	8
Metacarpal	37	17	8.5	9	10	3	7
Tarsals	104	101	10.1	19	22	4	18
Metatarsal	49	20	10.0	10	11	2	9
Metapodial indeterminate	28	8	–	2	2	–	2
1st phalanx	85	65	8.1	9	9	1	8
2nd phalanx	42	42	5.2	6	6	2	4
3rd phalanx	31	30	3.7	4	4	2	2
Phalanx indeterminate	1	1	–	–	–	–	–
Large sesamoid	12	12	0.75	1	2	1	1
Small sesamoid	3	3	0.37	1	1	–	1
Total autopodium	462	369	4.9	19	22	4	18
Grand total	1,259	>747	5.02	19	24	6	18

NR - number of remains, MNE - minimum number of skeletal elements, MAU - minimum animal units, MNIf - minimum number of individual animals by frequency, MNIc - minimum number of individual animals by combination.

AXIAL SKELETON

All of the elements that make up the axial skeleton are present, even the very fragile bones such as the sternum and costal cartilage. The innominate bone is by far the most well preserved element, the other axial elements being very rare (Table 8-3 and Figure 8-6). For the innominate, the percentage of survival estimate (Table 8-4) is average, except for the juvenile innominates where it is poor (i.e., there is a lack of immature innominates).

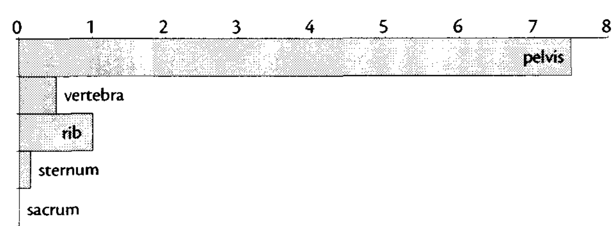


Figure 8-6—Preservation of axial skeletal elements (in MAU) of *Saiga tatarica*.

UPPER FORESKELETON

Saiga humeri and radii are well preserved, while scapulae, which are more fragile, are rarer (Table 8-3 and Figure 8-7). The percentages of survival for the upper foreskeleton elements (Table 8-4) shows that other than the scapulae, where the percentages are low (and null for juvenile bones), and the adult ulnae, the preservation rates are average.

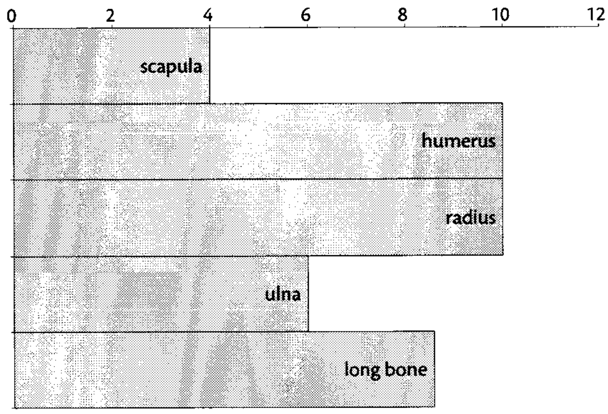


Figure 8-7—Preservation of upper fore limb elements (in MAU) of *Saiga tatarica*.

UPPER HINDSKELETON

The tibia is the most well represented element of the upper hindskeleton, while there is a relative lack of femora and malleolae (Table 8-3 and Figure 8-8). The percentages of survival indicate a good preservation for tibiae (global and adult) and of juvenile patellae, but an average survival rate for all other upper hind elements—except those for juvenile malleolae, which are null (Table 8-4).

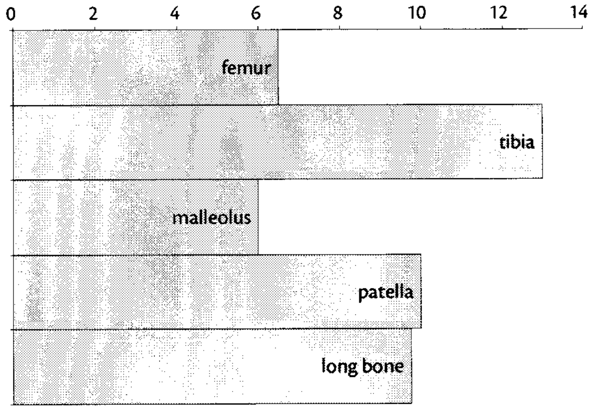


Figure 8-8—Preservation of upper hind limb elements (in MAU) of *Saiga tatarica*.

TABLE 8-4

Saiga tatarica: percentages of survival of post-cranial bones

Element	*Global*	*Adult*	*Young*
Scapula	16	22	–
Humerus	41	47	41
Radius	41	47	41
Ulna	25	19	25
Pelvis	29	38	8
Femur	27	27	25
Tibia	55	58	41
Patella	29	38	50
Malleolus	25	25	–
Carpal	29	29	30
Metacarpal	35	36	8
Tarsal	41	42	41
Metatarsal	42	50	5
Phalanx	23.9	28.7	9.7
Sesamoid	2.6	3.4	–

METAPODIA

The metatarsal bones are better preserved than are the metacarpals (Table 8-3 and Figure 8-9). The percentage of survival calculations show a good survival rate for adult metatarsals, an average survival rate for the metatarsals globally and for the metacarpals globally and for adults, but a poor survival rate for the juvenile bones of both of these (Table 8-4).

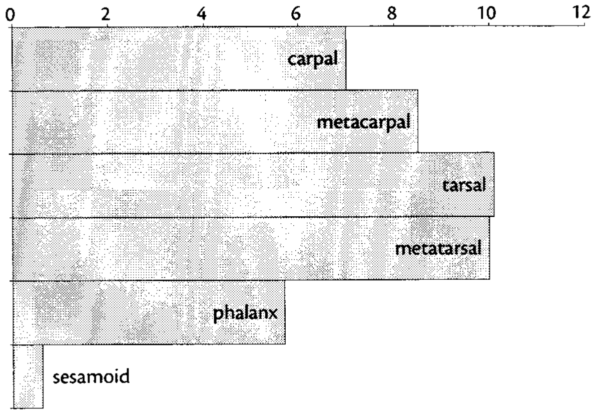


Figure 8-9—Preservation of autopodial elements (in MAU) of *Saiga tatarica*.

CARPAL AND TARSAL BONES

The carpal bones of *Saiga tatarica* are relatively well preserved (Table 8-3 and Figure 8-9). The capitate bone (belonging to the upper row of the carpal bones) is the best preserved of the carpals, and the lunate bone is the most poorly preserved (Table 8-5 and Figure 8-10). The bones in the lower carpal row are better preserved than those of the upper row (MAU

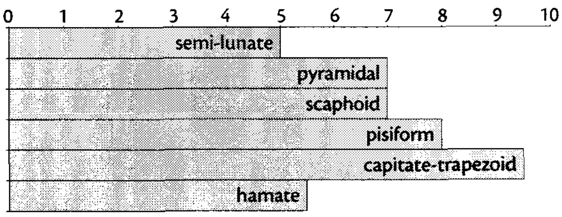


Figure 8-10—Preservation of carpal elements (in MAU) of *Saiga tatarica.*

TABLE 8-5
Quantification of *Saiga tatarica* carpal remains

Carpals	*NR*	*MNE*	*MAU*	*MNIf*	*MNIc*
Semi-lunate	10	10	5.0	7	8
Pyramidal	14	14	7.0	9	9
Scaphoid	14	14	7.0	8	8
Pisiform	16	16	8.0	8	8
Capitate-trapezoid	19	19	9.5	10	11
Hamate	11	11	5.5	6	6
Indeterminate	1	1	–	–	–
Total	85	85	7.0	10	12

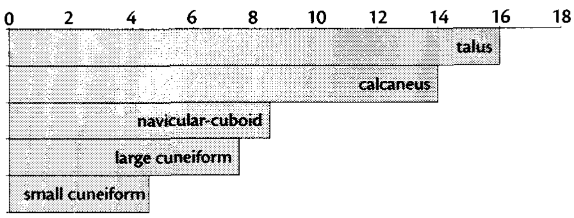


Figure 8-11—Preservation of tarsal elements (in MAU) of *Saiga tatarica.*

TABLE 8-6
Quantification of *Saiga tatarica* tarsal remains

Tarsals	*NR*	*MNE*	*MAU*	*MNIf*	*MNIc*
Talus	32	32	16.0	19	22
Calcaneus	31	28	14.0	14	16
Navicular-cuboid	17	17	8.5	12	14
Large cuneiform	15	15	7.5	8	8
Small cuneiform	9	9	4.5	5	5
Total	104	101	10.1	19	22

= 7.5 and 6.75, respectively), which is also the case for the carpal bones in the medial position with respect to those in the lateral position (MAU = 8.25 and 6.25, respectively). Overall, the survival rate for carpals is average (Table 8-4).

The tarsal bones are very well preserved (Table 8-3 and Figure 8-9), especially the astragalus and the calcaneum (Table 8-6 and Figure 8-11). The small cuneiform bone is present in the assemblage. The upper row of tarsal bones is better preserved than the lower row (MAU = 15 and 6.83, respectively), as are the lateral tarsal bones in comparison to the medial bones (MAU = 11.25 and 9.33, respectively). Globally, the survival rate for tarsals is middling.

SESAMOIDS AND PHALANGES

The preservation of saiga antelope sesamoids is poor (Table 8-3 and Figure 8-9). These are bones that are small in size and quickly lost when the hooves are disarticulated, especially the small sesamoids. Their survival rate is poor, and null for young saiga (Table 8-4).

Phalanges show a fairly good preservation (Table 8-3 and Figure 8-9). The proximal phalanx is the best represented, while the distal phalanx, which is intrinsically the most fragile, is rarer (Table 8-3 and Figure 8-9). The survival percentages show that globally the survival is poor for phalanges, except for adult phalanges (Table 8-4). The survival rate of the proximal phalanges is moderate, except for the juvenile saiga, where it is poor. The survival rate for the second phalanx is poor, except for the adults, where it is average. The survival rate for the distal phalanx is poor.

RELATIVE PRESERVATION OF THE POST-CEPHALIC SKELETON

The post-cranial skeletal elements of saiga antelope are fairly well preserved; taking into account the number of unidentifiable splinters, they amount to 33% of the bone assemblage in MNE and 5.76 in MAU. Long bones are well preserved, their MNE = 25.6% and MAU = 9.71. The analysis of the relative preservation of long bones shows a different preservation than that which is normally expected given the inherent properties of these bones (Figure 8-12). This is evidence of the human role in the preservation state of these bones. The bones of the pelvic and pectoral girdles (scapulae and innominates) represent 4.3% in MNE and 5.75 in MAU (Figure 8-12). The short bones represent 70% of the total post-cranial skeleton; their MAU = 5.01 (Figure 8-12).

The survival of these elements is, at the most, one-half of the total number of estimated individuals, and, at the least, one-quarter (with the exception of a few elements, Table 8-4 and Figure 8-13).

All of this evidence indicates that, for a bone assemblage deposited in a rockshelter, it is very well preserved.

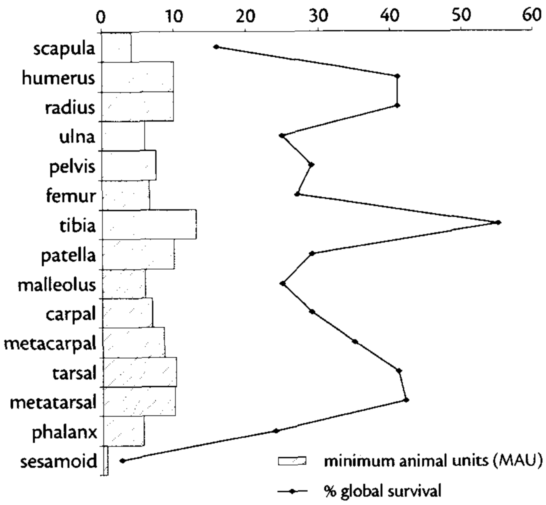


Figure 8-12—Comparison between the minimum animal units (MAU) and the global survival percentage of skeletal elements of *Saiga tatarica.*

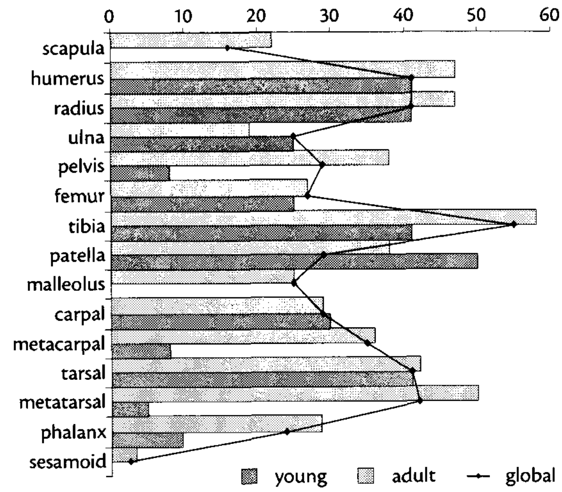


Figure 8-13—Comparison of the global, adult, and young survival percentages for various skeletal elements of *Saiga tatarica.*

Relative Preservation of the Different Units of the Post-Cephalic Saiga Skeleton

The glenoid on the scapula and the acetabulum on the innominate are the best preserved parts of these two elements (100%); they are also the most robust and most easily identifiable parts in any bone assemblage. Long bones are, overall, relatively well preserved (in MAU), with the exception of the distal extremity of the ulna (small and fragile), and the proximal extremities of the femur and tibia (Figure 8-14). This preservation, which is different from that expected given the inherent properties of these bones, is evidence of human action. For the upper part of the foreskeleton, the proximal extremities are more abundant than the distal extremities, and for the upper portion of the hindskeleton, the inverse is the case. For the other parts of the long bones (proximal, medial, and distal diaphyses), there is a global deficit (in MNE). These are, for the most part, among the unidentifiable splinters. Aside from the femur, where it is absent, the distal diaphysis is the dominant part of all diaphyses of the saiga assemblage.

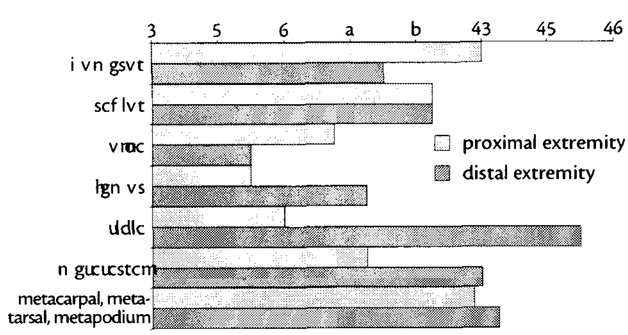


Figure 8-14—Buran-Kaya III Layer B: preservation of *Saiga tatarica* distal and proximal long bone extremities (MAU).

The analysis of the preservation of the saiga antelope bone assemblage indicates (1) that the bone material is relatively well preserved, (2) that this rockshelter did not serve as a carnivore den (based on the percentage of the cranial elements—2.3% of the total including indeterminate splinters—and the presence of short bones and the extremities of the long bones), (3) that anthropic agency (at the carcass treatment stage) is preponderant (based on the preservation of the different skeletal units, the preservation of the post-cranial skeleton, and on the preservation of the different parts of these units).

Bone Fragmentation of Saiga Antelope

Among the indeterminate splinters, at least 14,869 are from saiga antelope, based on the thickness of the cortex and their dimension (Table 8-2). During the quantification of these pieces, those that could not be attributed with certainty to saiga were separated out. The indeterminate splinters represent more than 92% of the faunal assemblage reported for this antelope (Figure 8-3). Among these indeterminate splinters, 19 correspond to cranial or vertebral elements and only 5 to the spongy parts of long bones. The indeterminate splinters are therefore mostly fragments of long bone shafts, and they have been divided into size classes (based on the largest dimension of the fragment); 97.8% belong to size class II (2–5 cm), of which 78% (of the total) are about 2 cm long.

Overall Fragmentation

Three indices were used to evaluate the degree of fragmentation of the bone material:

(1) The quotient of the total number of identifiable remains by the total number of remains, expressed as a percentage: NRDt ÷ NRT × 100, or 1,259 ÷ 16,128 × 100 = 7.81%;

(2) The index of fragmentation (IF) described by Richardson (1980:111), calculated as the quotient of the total number of identifiable remains by the minimum number of elements, or calculated as the quotient of the total number of remains by the minimum number of elements: IF = (NRDt ÷ MNE) or 1,259 ÷ >747 = <1.68. Alternatively, IF = NRT ÷ MNE or 16,128 ÷ >747 = <21.59;

(3) The total number of identifiable remains (NRDt), calculated as the quotient of the post cranial elements by the total number of remains minus the number of cranial remains, expressed as a percentage: NRDt bone = (NR bone ÷ NRT – NRT cranial bones) or 871 ÷ (16,128 – 388) × 100 = 5.53%.

These results indicate that there was a high degree of saiga bone fragmentation in Layer B.

Fragmentation of Skeletal Elements

The cranial skeletal elements, especially those of the upper part—skull bones and maxillae—are extremely fragmented based on their poor state of preservation (*cf. supra*). The same is true of the scapulae and innominate bones.

All of the short bones are complete, with the exception of 9.7% of the calcanei and 23.2% of the phalanges.

Among the long bones, none was recovered in a complete state. The ulna, metapodia, and femur appear to be the most fragmented, based on the NR ÷ MNE ratio (Table 8-3).

According to the presumed place of breakage (Figure 8-15) and the preservation of different parts of the long bones (*cf. supra* and Figure 8-14), for all of the bones other than the femur, tibia, and the metatarsal, breakage occurred on the proximal diaphysis (usually on the lateral face for the humerus and the radius and on the medial face for the metacarpals). For the femur, the blow was on the distal diaphysis. For the tibia and metatarsal, the blow was on the medial diaphysis (towards the distal diaphysis, usually the medial side for the tibia and lateral side for the metatarsal).

Most of the unidentifiable splinters belong to Class II (2–5 cm in length). No diaphyseal "cylinders" were found; the fragments retain more or less a quarter of their original diameter. These results are quite different from remains typically seen in a carnivore den. They do demonstrate that humans were mostly responsible for the fragmentary state of this material.

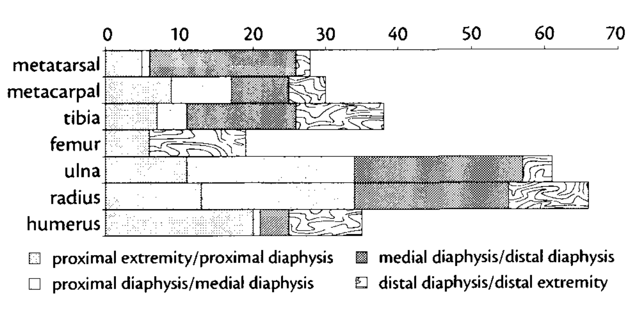


Figure 8-15—Types of fracture locations on long bones (in MNE) of *Saiga tatarica*.

Articular Reconstruction of Post-Cephalic Skeletal Elements of Saiga (Dispersal of Bone Materials)

The analysis of the potential articular reconstruction of the post-cranial skeleton provides a good portrait of the dispersal of the bone material. The articular reconstruction index (AR) used in this analysis is calculated as the quotient of the number of articulated bones and the total number of bones by element, expressed as a percentage (Table 8-7): AR = articulated bones × 100 ÷ number of bones by element.

The assemblage displays a significant articulation index, between 20.2% (radius/upper row of carpals) and 47% (metacarpals/proximal phalanges). This indicates a relatively weak dispersal rate. Globally, 244 articulated remains were found (AR = 48.1%). When the spatial distribution of these articulations is examined, it is evident that a great many were found within the same square (Table 8-7).

The relatively limited dispersal indicates that there was little post-depositional disturbance, and virtually none that can be attributed to carnivores.

Table 8-7
Articular reconstruction for *Saiga tatarica* remains

Elements	*AR*	*% AR/ MNE*	*AR in same square*
Scapula/humerus	8	28.5	7
Humerus/radius	14	35.0	10
Humerus/ulna	11	34.3	6
Radius/ulna	12	37.6	9
Radius/carpal	15	20.2	12
Carpal/metacarpal	17	36.1	15
Pelvis/femur	6	21.4	6
Femur/tibia	8	20.5	7
Tibia /patella	20	43.4	13
Tibia/malleolus	12	31.5	9
Tibia/tarsal	26	30.2	21
Tarsal/metatarsal	13	21.3	13
1st phalanx/2nd phalanx	42	39.2	33
2nd phalanx/3rd phalanx	30	41.6	23

Surficial Bone Damage

Marks were noted on some of the bones; they were the result of several different agencies: climato-edaphic, non-human biologic (plants and carnivores), and human. The following discussion pertains to the entire faunal assemblage, not just the saiga remains.

Climato-Edaphic Agencies

Longitudinal fissures, often associated with the exfoliation of the bone surface, as well as the presence of some frayed bone splinters, are evidence of weathering and the effects of climate. These were weak effects, only observed on 9 pieces (6 of which were saiga antelope). Since the site was a rockshelter, it is reasonable to assume that the material was protected from intemperate weather and that it was also probably rapidly covered by sediments. The absence of surficial damage from percolating water in the sediments suggests that after the material was deposited, a dry climate prevailed.

Damage by Plants

Only three bones (of which one is saiga) have vermiculation (traces formed by plant rootlets), or 0.02% of the material. This indicates that the material was deposited in a shelter where it was not possible for a substantial vegetational cover to develop—probably due to a dry climate.

Damage by Carnivores

Eleven indeterminate bone splinters (eight of which are from short bones), a humerus, a talus, and a proximal phalanx of saiga antelope, or 14 bones, have gnawing marks from a young hyæna or wolf. A scapula and a proximal saiga phalanx have fang marks from a wolf. A humerus and 7 short bones of saiga have teeth marks from small carnivores (fox or small Mustelid). All told, 24 bones (0.14% of the total number of remains) display damage by carnivores, particularly by Canids. Eighteen are autopodial bones, 1 corresponds to a fragment of flat bone, and 5 correspond to fragments of long bones.

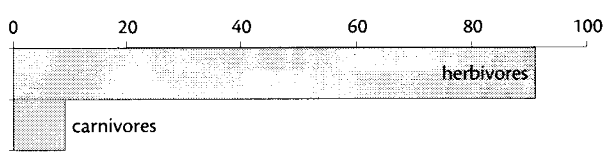


Figure 8-16—Buran-Kaya III Layer B: ratio of herbivore to carnivore remains (percentage of MNIc).

Carnivore action on this material was therefore modest. The weak representation of carnivore species within the faunal assemblage further confirms this (Table 8-1 and Figure 8-16).

Anthropic Modifications

Numerous bones display evidence of human activities: breakage, butchery, and burning (Table 8-8).

Breakage

Among the indeterminate splinters, 30 bone flakes resulting from percussive blows, 2 diaphyseal fragments with internal splintering, and 1 diaphyseal fragment with external splintering indicative of intentional fracture by percussion were identified. These splinters are from animals the size of deer (14), bison (2), either deer or *Equus hydruntinus* (16), and from mammoth (1). Among the identifiable bones, a medial diaphysis of a bison metatarsal has internal splintering on its frontal face, while a distal diaphysis of a deer right humerus has external splintering on its posterior face. Altogether, 35 bones have traces of percussion, or 0.22% of the faunal assemblage (Table 8-8).

Butchery

Eight indeterminate bone splinters from animals the size of saiga display striae resulting from defleshing.

A fragment from a hemi-mandibular ramus the size of deer or *Equus hydruntinus* has a groove resulting from the cranio-mandibular disarticulation.

A proximal extremity of a right fox ulna has a groove resulting from the disarticulation of the humerus and ulna.

Bones attributed to saiga antelope have the most butchery striae: 39. They correspond to the disarticulation of various anatomical elements (Table 8-8).

Altogether, 49 bones have "butchery" marks, or 0.30% of the bone assemblage. These striae were, for the most part (83.6%), produced during disarticulation.

Burning

Among the indeterminate splinters, 317 have traces of calcination. Based on their dimensions and the thickness of the cortex, 306 probably belong to saiga antelope, 8 to deer and/or *Equus hydruntinus*, and 3 to deer. The majority of these fragments belong to the class size I (0–2 cm). In addition, an indeterminate carpal, a G pyramidal, a proximal extremity of metapodial, a proximal extremity of a calcaneum, a proximal phalanx, and a vertebral fragment, all belonging to of saiga antelope show traces of burning.

Altogether, 323 pieces have traces of burning: 2% of the faunal assemblage (Table 8-8).

The faunal material with anthropic modification (407 bones) represents 2.52% of the total faunal assemblage. Burned bones are the most abundant (Figure 8-17). These are more frequent than bones with other anthropic marks (Figure 8-18) and confirm that humans are responsible for this material, and that their role was the most important in the history of the assemblage.

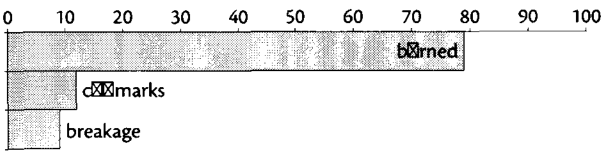


Figure 8-17—Relative percentages of anthropic damage to the faunal assemblage by burning, butchery, and fracture.

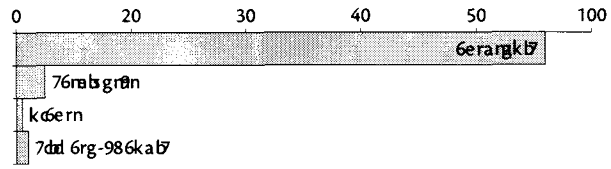


Figure 8-18—Relative percentages of types of taphonomic damage to the faunal assemblage: all human-caused modification combined, carnivores, plants, and climato-edaphic.

TABLE 8-8
Numbers and types of bones with anthropic modification

Element	*Breakage*	*Filleting*	*Disarticulation*	*Burned*
Long bone indeterminate	33	8	mandible	317
Metatarsal bison	1			
Humerus red deer	1			
Humerus saiga			humerus/radius	
Humerus saiga			humerus/radius	
Radius saiga			humerus/radius	
Radius saiga			radius/carpal	
Ulna saiga			humerus/ulna	
Ulna saiga			humerus/ulna	
Semi-lunate saiga			radius/carpal	
Pyramidal saiga			radius/carpal	
Capitate-trapezoid saiga			carpal/metacarpal	
Hamate saiga			carpal/metacarpal	
Hamate saiga			carpal/metacarpal	
Pisiform saiga			radius/carpal	
Metacarpal saiga			metacarpal/1st phalanx	
Metacarpal saiga			metacarpal/1st phalanx	
1st anterior phalanx saiga			metacarpal/1st phalanx	
Tibia saiga			tibia/tarsal	
Tibia saiga			tibia/tarsal	
Tibia saiga			tibia/tarsal	
3 Calcaneus saiga			3 tibia/tarsal	
16 Talus saiga			16 tibia/tarsal	
Greater cuneiform saiga			tarsal/metatarsal	
Metatarsal saiga			metatarsal/1st phalanx	
Vulpes/Alopex			humerus/ulna	
Carpal saiga				1
Pyramidal saiga				1
Metapodial saiga				1
Calcaneus saiga				1
First phalanx saiga				1
Vertebra saiga				1
Total	35	8	41	323

Acquisition and Processing of Saiga Antelope

Based on the preceding taphonomic analysis, we can assume that the presence of saiga antelope in Buran-Kaya III Layer B is the result of human actions. In addition, the taphonomic analysis enables a more detailed understanding of the subsistence behavior undertaken by the occupants of the rockshelter. The following section analyzes the techniques used by the prehistoric inhabitants of the site to acquire then treat this game.

Acquisition of Saiga Antelope

Saiga antelope was the preferred game species for the humans of Layer B. Based on the evidence for the faunal elements described above, it appears that complete animal carcasses were brought to the rock shelter. Based on the analysis of butchery marks and their prevalence, it appears that the animals were hunted. These interpretations are further confirmed by the indices for Bovids defined by R. Potts (1983). Index A (expressed in MNE) is calculated as the quotient of the axial skeleton and the upper part of the fore and hind skeletons. Index B (expressed in MNE) is calculated as the quotient of the upper part of the foreskeleton and the upper part of the hindskeleton. At Buran-Kaya III Layer B, these indices are: A = axial/upper appendages = 0.47 (< to 1.6) and B = upper foreskeleton/upper hindskeleton = 1.17 (> to 1.0). Both of these values are indicative of hunting, rather than scavenging.

No horn cores were discovered within the faunal assemblage, which would suggest that no male saiga antelope were slaughtered. On the other hand, among the post-cranial material, there are bones the robustness and dimensions of which suggest the presence of at least 2 saiga males.

The age of the antelopes that were slaughtered at Buran-Kaya III Layer B was estimated following Bannikov et al. (1967). The remains of six young antelopes are present in the faunal assemblage: at the time of death, two of these were around 11 months of age, one was 13–15 months, two were 18–24 months, and one was 25–29 months old (Figure 8-19). The remains of eighteen adults were also identified: at the time of death, seven of these were 3–4 years old, seven (of which one was male) were 4–7 years old, three (of which one was male) were 3–7 years old, and one was 8–10 years old (Figure 8-19). Adult saiga in the prime of life, then, are abundant in the assemblage, which confirms that their remains were the results of hunting, and not of scavenging.

In sum, the slaughtered saiga population obtained by the inhabitants of Buran-Kaya III Layer B was composed of 6 juveniles (25%), 2 adult males (11% of adults), and 16 adult females. The adult male to female sex ratio is therefore, at the most, 1 to 8.

Based on the estimated age for the juveniles, and the birthing period for saiga (end of April through the beginning of May, according to A. G. Bannikov et al. 1967), it appears that these saiga were hunted between the end of April and July, probably after the spring migration and calving. During this period—late spring and summer—the herds are small to medium in size and composed of females, young, and a few males (Bannikov et al. 1967). Since saiga antelope move across the landscape based on the available vegetation, their presence at Buran-Kaya III attests to good quality pasture and watering points in the vicinity of the rockshelter. The immediate environment of the site, then, served as a summer range for saiga antelope. The presence of these saiga herds here was most likely the impetus for the prehistoric inhabitants of Buran-Kaya III Layer B to visit this particular valley.

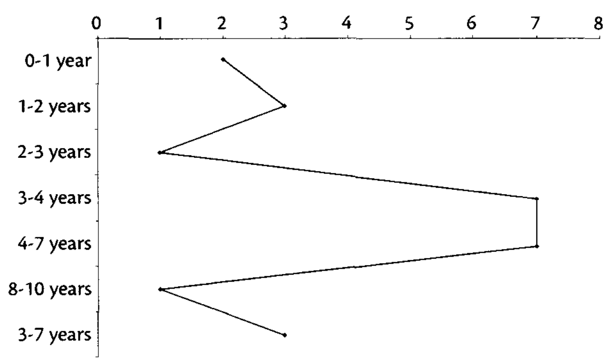


Figure 8-19—Buran-Kaya III Layer B: mortality profile of *Saiga tatarica*.

It is evident that the humans at the site practiced a specialized hunting of saiga antelope, which is easy to hunt, especially near water holes. During the summer period, the hominids were able to slaughter mainly females and youngsters from a herd that was small to medium in size.

Processing of Saiga Antelope

The preservation analysis (see above) indicated that all skeletal elements are present in Buran-Kaya III Layer B for saiga antelope. Animals that were killed, then, were brought intact to the site to be dismembered, probably just outside the rockshelter (based on the preservation of the skeletal units, Figure 8-3).

According to the cranial remains present in the analyzed sample, the skull was disarticulated and broken open to take out the brain—hence the rarity of skull bones and their significant fragmentation. Likewise, given the state of the hyoid bones, the tongue was removed. The presence of axial skeleton bones—of which sterna and costal cartilage are especially noteworthy—indicate that the thorax was dismembered in, and in close proximity to, the rockshelter.

The long bones, especially those that are meat-heavy, are well preserved (Figures 8-7 and 8-8). Based on their preservation and the "butchery" mark analysis (Table 8-8), part of the disarticulation phase for the limbs took place inside the rockshelter itself. This was also the case for the foot extremities, based on the high frequency of autopodial bones (Figure 8-5).

Since complete saiga carcasses were brought to the rockshelter, it is possible to estimate the weight of the meat that this game provided for the Layer B inhabitants. The data used for this calculation is derived from A. G. Bannikov concerning Russian saiga antelopes (Bannikov et al. 1967:156, tab. 32), which suggest that these saiga provided a total of 410 kilograms of meat.

The analysis of bone fragmentation discussed above suggests that the marrow in the mandibles, and especially that in the long bones, was systematically recovered by the inhabitants (Figure 8-15). On the other hand, marrow in the proximal and medial phalanges—elements that have relatively little marrow—was not recovered.

To better understand the nutrient strategies used by the prehistoric inhabitants of Layer B, curves were plotted for the ratio of minimum animal units deduced for each animal element (%MAU) to the percentages of the modified general utility index (%MGUI) defined for deer by Binford (1981). Although the gross values of MGUI are probably not the same for saiga antelope and deer, the ratio of elements for the two species is identical. It should be noted beforehand, that to verify our result, we have analyzed the relation between the preservation rate of anatomical elements and their density. Since the correlation is weak, at 0.261, we could carry out these calculations (Figure 8-20). The indices corresponding to the global nutritive strategy and to the meat-procuring strategy (Figures 8-21 and 8-22) reflect the "inverse bulk strategy," while the index for marrow procurement corresponds to the "bulk strategy" (Figure 8-23). These results confirm that the site during the formation of Layer B was both a butchery site—where the processing of game was complete—as well as a consumption site.

The modus operandi for saiga antelope processing in Layer B appears to have been complete and recurrent. The saiga antelope carcasses were cut up in, and in the immediate proximity of, the rockshelter (in front of the entry?).

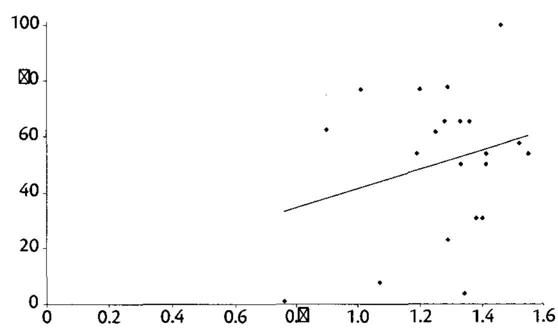


Figure 8-20—Density profile of *Saiga tatarica* bones.

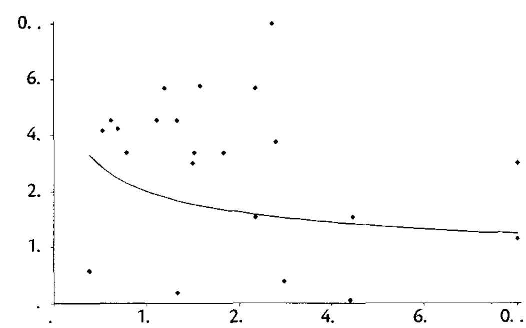


Figure 8-21—Modified general utility index (MGUI) profile of *Saiga tatarica*.

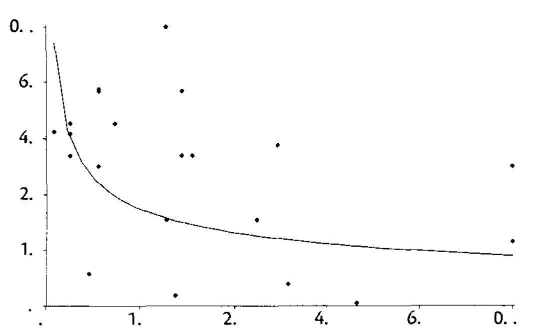


Figure 8-22—Meat index of *Saiga tatarica*.

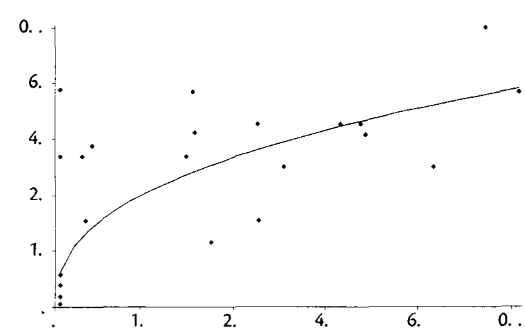


Figure 8-23—Marrow index of *Saiga tatarica*.

Analysis of Remains of Other Species

Aside from the saiga antelope that so dominates the identified species in Layer B, five other species of herbivores (mammoth, woolly rhinoceros, bison, *Equus hydruntinus*, and deer) and three species of carnivores (wolf, fox, Mustelid) were present in the bone assemblage (Table 8-1).

Mammoth

Among the 38 remains attributed to mammoth, 31 belong to the cranial skeleton. These include 11 tusk fragments, 19 tooth fragments, and 1 petrous bone; the ensemble could have belonged to a skull of a young mammoth carrying two tusks and two molars. In addition, an intermediate phalanx from a juvenile and 6 long bone diaphyseal fragments (perhaps metapodial) were identified. The prehistoric human inhabitants of the site therefore brought at least one skull and the end of one foot to the shelter. It is unclear whether the mode of acquisition for mammoths was hunting or scavenging.

Woolly Rhinoceros

Four tooth fragments corresponding to the upper deciduous teeth of a young woolly rhinoceros were discovered. By what means they came to be present on the site remains unexplained. As in the case of the mammoth remains, these might represent the import of the skull.

Bison

No bones from the cranial skeleton of bison were identified in the Layer B bone assemblage. On the other hand, 18 adult post-cranial bones were attributable to this species. These are: 17 long bone fragments (from one each of a humerus, ulna, tibia, and metacarpal and from two metatarsals) and a tarsal fragment (either the navicular-cuboid or the large cuneiform). Other than the last, these bones all correspond to those bison parts that are rich in meat and marrow. Furthermore, among the indeterminate fragments for this layer, 38 long bone diaphyseal fragments could correspond to this species as well (Table 8-2). The metatarsal fragment has internal splintering from a blow made by humans (Table 8-8). The Layer B prehistoric inhabitants brought quarters of an adult bison to Buran-Kaya III, probably after dismembering it at the kill site itself.

Equus hydruntinus

Three teeth, including a third incisor and a second molar, both lower, from an aged *Equus hydruntinus* were identified in the sample. As was the case for the rhinoceros, the presence of these teeth on the site is unexplained (import of skull?).

Deer

Seven cranial remains, corresponding to a skull and a mandible of an old deer, were identified. As no antler fragments were present, this individual was either a male without antlers or a female. Eleven bone fragments from one each of an innominate, humerus, radius, tibia, metatarsal, metacarpal, either a femur or a humerus, and a large sesamoid are also attributable to this species. For the most part, these are bones from meat- and marrow-rich parts of the deer. Among the assemblage's indeterminate splinters, more than 100 might belong to deer as well, based on their size (Table 8-2). The diaphyseal humerus fragment has external splintering that resulted from percussion of an anthropic origin (Table 8-8). The prehistoric humans of Layer B probably hunted an aged deer, and then transported it *in toto* to the rockshelter to dismember it.

Carnivores

Nine bones from three species of carnivores were identifiable among the Layer B material. These are: a dental bud of the upper first molar of a wolf, a premolar, a metapodial fragment, the humeral head and the ulnar proximal extremity of a fox (*Vulpes corsac* or *Alopex lagopus*), two distal extremities of a humerus and one of a tibia from a small mustelid, and 2 canine tooth fragments from either a fox or a small Mustelidae. The proximal end of the fox ulna has a groove from the disarticulation of the ulna and humerus (Table 8-8). The prehistoric peoples of this layer might have hunted and butchered this fox, perhaps in order to get its fur and meat.

The non-saiga bone assemblage of Buran-Kaya III Layer B demonstrates that the prehistoric inhabitants of the site did little hunting for these other herbivores and carnivores, which seem to play only a minor role as game. The hominids probably seized the opportunity during their routine movements to bring fresh sections of such carcasses back to their camp.

Analysis of Spatial Patterning

Since the bone assemblage from the 1996 excavations at Buran-Kaya III Layer B is relatively well-preserved and suffered little post-depositional degradation (see above), it is possible to study the horizontal distribution of the bones at the site. Not having the precise x, y coordinates of each bone, this analysis is based on the relative density of material in each excavated square meter.

In the central part of the 1996 excavated area of Layer B, in squares Г8, Д8, В8, Д7, Г7, and E8, there is a significant concentration of bone material (Figure 8-24). For the most part, this high density is due to saiga antelope, the dominant species in the assemblage (Figure 8-25). Remains of the other species are principally concentrated in three squares: Д8, Г8, and E8 (Figure 8-26). The only variation visible between the distribution of the saiga anatomically indeterminate remains (Figure 8-27) and the saiga identifiable remains (Figure 8-28) is a higher density of the former in square Г7, and of the latter in square Д9.

The analysis of the distribution of saiga antelope bones as a function of their major skeletal units shows little variation (Figures 8-29 to 8-33). All elements of the saiga skeleton are represented, more or less in significant numbers, in the squares Г8, Д8, and Д7. It is notable, however, that post-cranial elements—in

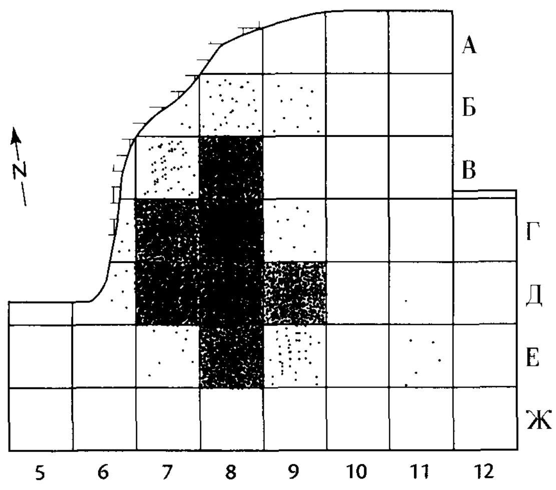


Figure 8-24—Buran-Kaya III Layer B: spatial distribution of all faunal remains.

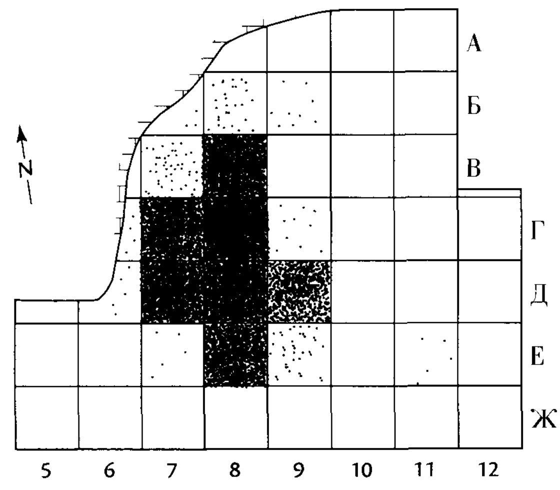


Figure 8-25—Distribution of *Saiga tatarica* remains.

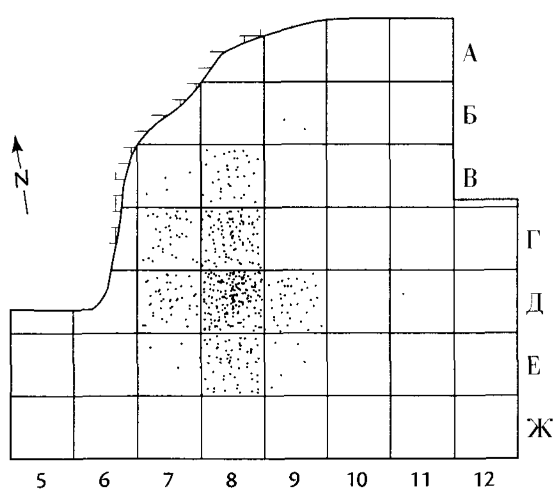


Figure 8-26—Distribution of the remains of other (non-saiga) species.

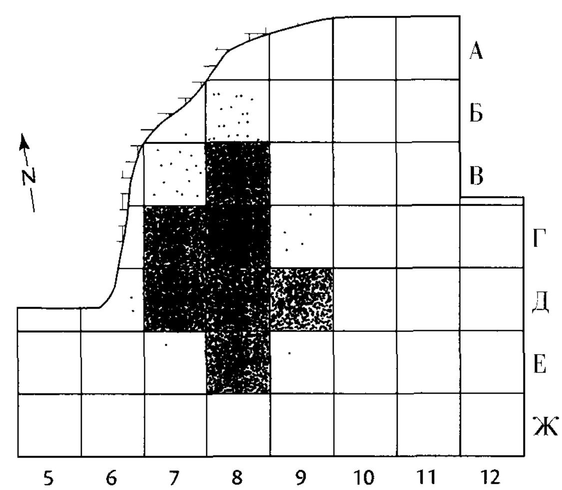


Figure 8-27—Distribution of *Saiga tatarica* anatomically indeterminate remains.

contrast to cranial elements—are quite abundant in square E8; that bones of the axial skeleton and of the upper part of the limbs have a similar distribution; and that the autopodial bones—in contrast to the other bones—are very abundant in square Г7. The spatial distribution of bones carrying butchery marks shows that there is a more significant density of these in three squares: Г8, Д8, and Д7 of the 1996 excavations (Figure 8-34).

Based on the spatial distribution analysis, and taking into account the results furnished by the bones showing unequivocal marks of disarticulation done by humans (Table 8-8), we can venture the hypothesis that there was a specific zone in the rockshelter around square Д8 (which also included squares E8, Г8, and Д7) that served as the center for butchery activities. Squares Д9, B8, E9, and Г7 correspond to toss zones for the waste that resulted from this butchery.

The frequency of burnt bones in Layer B was underlined in the preceding discussion. Their distribution, however, shows a markedly higher density in five of the squares in the sample—Д8, B8, Г7, Г8, and Д7—which represent a total of 72.6% of all burnt bone for this sample (Figure 8-35). This suggests the presence of one or more small hearths (unconstructed), which were correlated with the butchery activities.

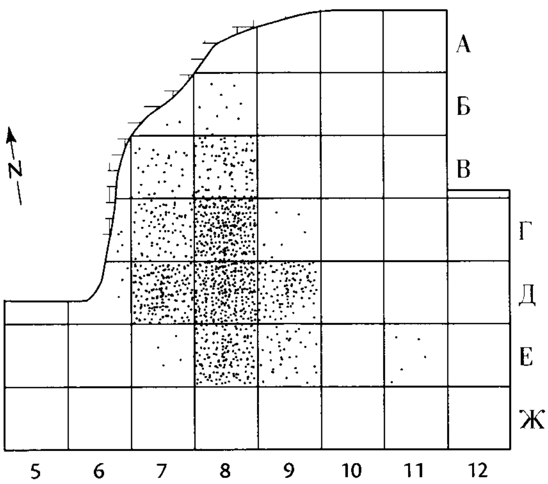


Figure 8-28—Distribution of *Saiga tatarica* anatomically identified remains.

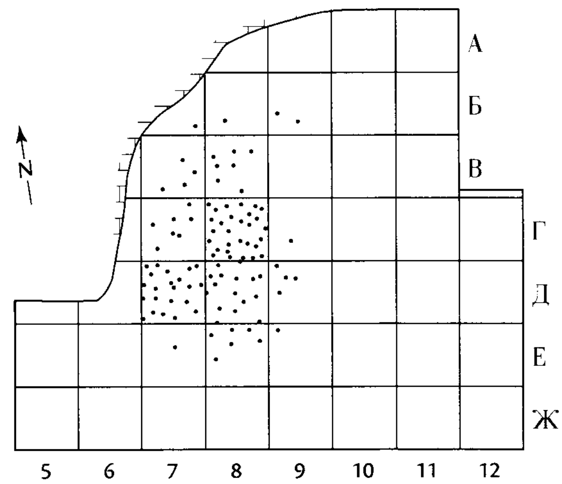


Figure 8-29—Distribution of *Saiga tatarica* cranial skeleton remains.

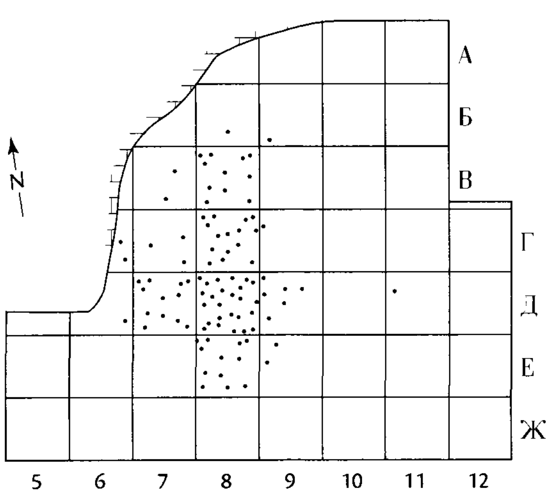


Figure 8-30—Distribution of *Saiga tatarica* axial skeleton remains.

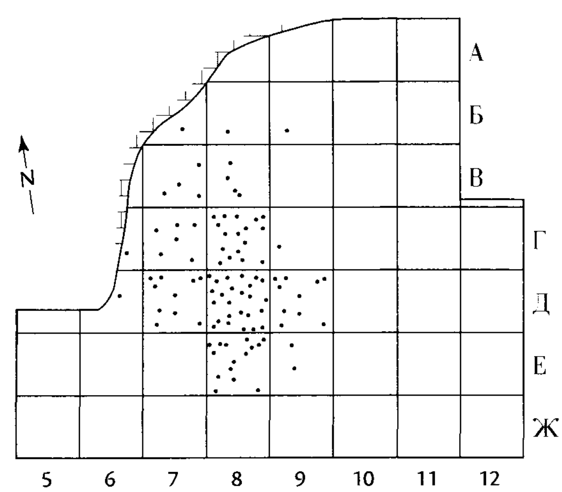


Figure 8-31—Distribution of *Saiga tatarica* upper fore limb remains.

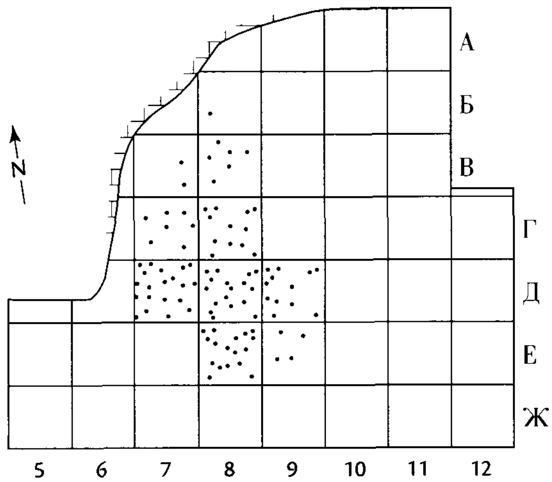


Figure 8-32—Distribution of *Saiga tatarica* upper hind limb remains.

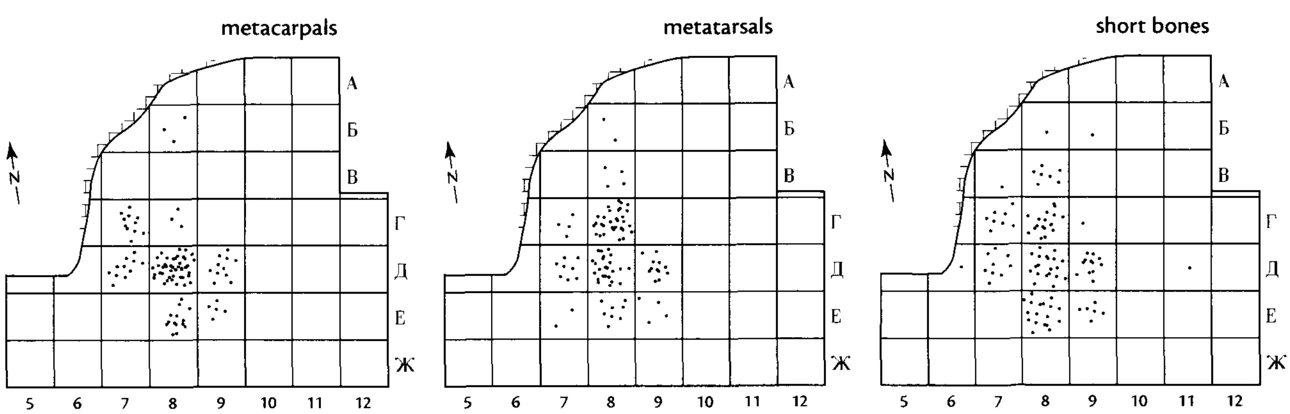


Figure 8-33—Relative spatial distributions of *Saiga tatarica* autopodial remains (metacarpals, metatarsals, and short bones).

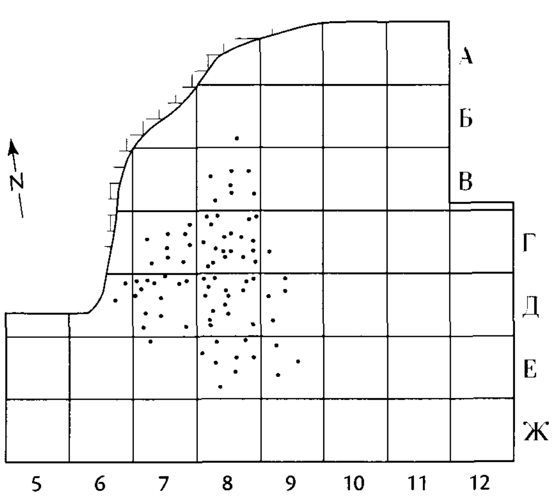


Figure 8-34—Distribution of bones with anthropic marks.

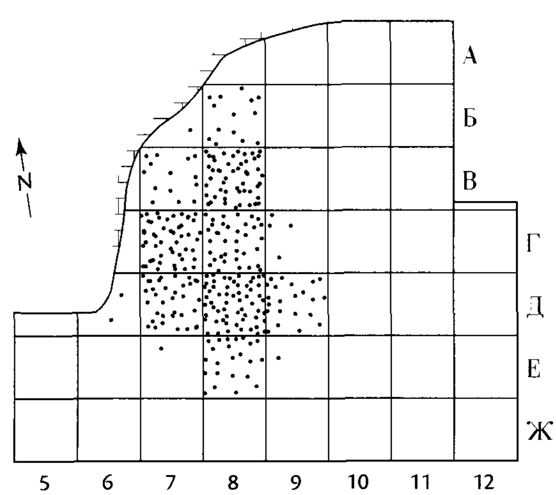


Figure 8-35—Distribution of burnt bones.

Discussion

The prehistoric inhabitants of Buran-Kaya III Layer B settled themselves in the rockshelter during a cold and dry climatic phase. In the neighborhood of the site, the environment was a semi-arid steppe with a few wooded areas near the river. The inhabitants practiced a specialized hunting for saiga antelope. Being well acquainted with the habits of this animal, especially during its migration periods, the hominids knew that the area served as a summer pasture for saiga. The presence of this species appears to have been the primary motivation for the humans to use the rockshelter as a camp. They essentially slaughtered females and youngsters from herds that were small to medium in size. They exploited this game completely, but not to an exaggerated extent, which suggests that the occupation did not take place during a period—or periods—of dietary stress. A significant part of the cutting up and culinary preparation of the animals occurred inside the rockshelter, within a circumscribed zone. Buran-Kaya III, during the occupation of Layer B, was a seasonal habitat, probably with recurrent occupations.

(*Translated, from the French, by Katherine Monigal.*)

9

Buran-Kaya III Layer B: The Lithic Assemblage

Yuri E. Demidenko

Layer B of Buran-Kaya III was excavated during three periods of the site's field investigations (Figure 9-1). First, some 5 m² were uncovered in a sondage in 1990 by A.A. Yanevich, then about 6 m² were excavated in 1994 by A.A. Yanevich and M. Yamada, and finally, somewhat more than 12 m² were excavated between 1996 and 2001 by the Ukrainian-American expedition. Because of excavation techniques that resulted in some mixing of different archeological levels during the first two seasons of work (Yanevich et al. 1997; Chabai et al. 2000:61–64), only the materials from the 1996–2001 excavations will be described here.

During 1996, 1997, and 2001, clearly in situ Layer B deposits were excavated in the western and central sectors of the rockshelter in squares E8–9, Д6–9, Г6–9, B7–8, Б7–11, and A8–11, and in the eastern sector of the rockshelter in squares B12, Г12, and Д12. Because of the variable bedrock configuration, the total excavated areas of Levels B and B1 of Layer B vary and sometimes do not coincide in certain squares. As a whole, Level B (usually 0.10–0.15 m thick) was excavated over an area of ca. 13.2 m², while Level B1 (ca. 0.20 m thick) was excavated over an area of ca. 11.2 m². If the earlier excavations are considered, covering some 9 m², then the overall excavated in situ area of Buran-Kaya III Layer B covered about 20 to 22 m². Given the erosional patterns and the wall of the rockshelter, it is likely that this area is very close to the extant in situ surface.

Lithologically, both Levels B and B1 of Buran-Kaya III Layer B (geological Unit IV of the rockshelter's lower part of the depositional sequence in Figure 9-2) are characterized by the same sandy silt fill with a large number of fresh, angular small limestone debris derived as *éboulis sec* from the rockshelter's roof and walls. The difference between Levels B and B1 lies in their color: Level B (upper) is a yellow-brown color, while Level B1 (lower) is dark brown and ashy-black. The coloration of B1 gives the level the appearance of a humus rich stratum, formed by a high content of organic substrate, burnt bones, and most likely, a fill of disturbed hearths and/or fireplaces. Aside from a very localized and thin (0.02–0.03 m) archeologically sterile lens of rounded limestone debris between

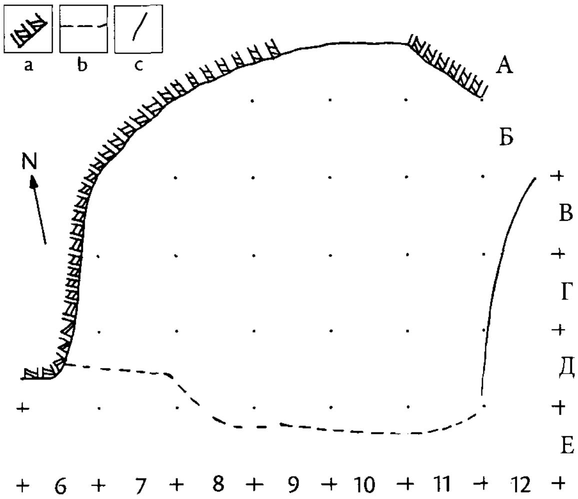


Figure 9-1—The site's plan for Layer B finds maximum distribution within the rockshelter's inner part, limited in the south by the drip line, in the east by natural washing away processes, and in the north and west by the back wall: a–back wall; b–drip line; c–line showing eastern edge of Layer B.

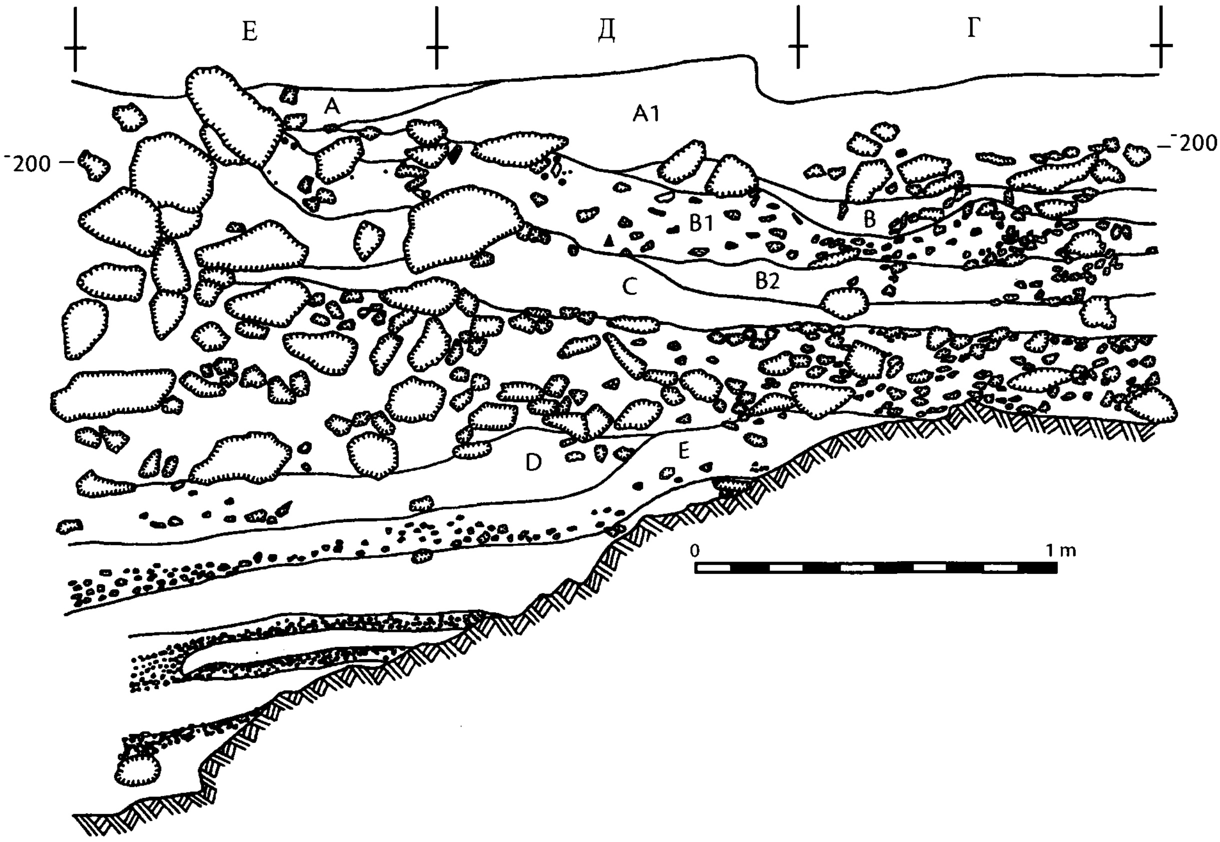


Figure 9-2—Partial western profile of the rockshelter's lower depositional sequence along line 8/9.

Levels B and B1 observed during the 2001 excavations in square Б9, there were no clearly visible sterile lenses between these two levels over the rest of the excavated areas. On the other hand, the Layer B deposits are separated from earlier and later archeological remains by sterile sediments. In the southern part of the excavation area, Layer B is separated from the overlying Aurignacian/Epigravettian (?) Level 6-5 by Layer A, which is a redeposited sediment (Figure 9-2). Near the back wall, Layer B is separated from the overlying occupations by an archeologically sterile clay lens 2 to 3 cm thick. Layer B is separated from the underlying Level C by a sterile lens of the dark brown sandy silt of Level B2 (2 to 10 cm thick), seen most clearly in the rockshelter's western sector.

Among all excavated Layer B areas, the most typical was in the rockshelter's western sector investigated in 1996, where both Levels B and B1 are notable by an almost horizontal position. Here, they are spatially well-represented by a great number of artifacts (17,342 items) and animal bones throughout the area. This area provided the sample reported here. The Level B sample (2,127 items) came from squares Б7–8, В7–8, Г7–9, Д7–9, and E9 (ca. 6.4 m^2), while the Level B1 sample (15,215 items) came from ca. 6.9 m^2 of squares Б7–8, В7–8, Г6–9, Д6–9, and E8–9. No constructed features, including pits, hearths, fireplaces, or special bone concentrations were recognized in Layer B. The Level B1 sediment color, however, indicates the presence of fire areas; owing to intense and repeated occupations, these could not be spatially distinguished.

Because of such artifact and bones densities, only artifacts 3 cm and greater in length and bones 5 cm or greater in length were mapped. Even with the "noise" of the small chippage and bone splinters removed, densities were such that no spatial patterns were discernable.

Two absolute AMS dates from Level B1 are 28,840 ± 460 years BP (OXA-6673) and 28,520 ± 460 years BP (OXA-6674). These dates are consistent with underlying and overlying dates. At two standard deviations, P. Pettitt has recognized a chronological interval of 29,760/29,440–27,920/27,600 years BP for the Kiik-Koba layer (Pettitt 1998a:332). Taking these age ranges into consideration, we suggest that Crimean Micoquian Neanderthals visited the Buran-Kaya III rockshelter during the Arcy Interstadial (Gerasimenko, Chapter 2; Markova, Chapter 3).

Raw Material Variability and Availability

High quality flint sources are well known in eastern Crimea where the main outcrops are primarily confined to Upper Cretaceous chalk-like marlacious limestones (Petrun 1969). The most widely distributed and abundant natural flint sources are mainly in the form of plaquettes (usually 1 to 4 cm thick). Such deposits occur most commonly at the border of the steppe and the northern foothills of the Second Ridge of the Crimean Mountains, forming a so-called "flint belt," extending from the west (near the village of Tsvetochnoye) eastward to the northern outskirts of Belogorsk (around the Sary-Kaya cliff), for a total distance of ca. 15 km east to west and some 3 to 4 km wide. Some secondary deposits are also known around Belogorsk, as well as along the Biyuk-Karasu River, to the north of Belogorsk. The Middle Paleolithic sites of Zaskalnaya, Krasnaya Balka, and Sary-Kaya are all situated near these high quality flint sources. Buran-Kaya III, however, is not located in immediate proximity to any flint outcrops. The nearest known sources of high-quality flint are found ca. 10 km down the Burulcha River, at the northern edge of Tsvetochnoye. These outcrops are characterized by plaquettes with a wide variety of colors—black, brown, and grey tints. From an archeological point of view, the most important feature of all these flint outcrops is that, as a rule, no one flint variety is restricted to one outcrop. Therefore, lithic artifacts from archeological sites situated up to 20–25 km from the eastern Crimean "flint belt" cannot be precisely connected to any one particular flint source just by color. The only definitive observation that can be made about the flint is the cortex condition, which indicates whether it came from a primary or an alluvial source.

In the case of Buran-Kaya III Layer B, the flint is consistent in its range of color with the Tsvetochnoye-like outcrops. In a sample of 1,008 pieces (all objects of primary flaking processes, flakes, blades, and tools, excluding two fragments of bifacial tools and sixteen unidentifiable and tiny fragments of unifacial tools' retouched edges), 17.8% were black, 60.9% were brownish, 2.2% were grey, 18.5% were heavily patinated, rendering their true color indistinguishable, while 0.6% were a brown chert of poor quality, as opposed to the high quality flint which characterized all other pieces. These proportions are consistent with percentages by artifact categories obtained for the entire assemblage. This indicates that brown flint was predominant, with only a moderate representation of black flint. The small number of grey flint artifacts is not significant because this color of flint comes from the same outcrops as do the brown and black flint. On the other hand, the few pieces of poor quality brown chert are worth noting because this source is restricted to distinct Paleogene limestones, the closest of which is in the Kuchuk-Karasu River valley, some 25 km from Buran Kaya III as the crow flies. Of course, it cannot be excluded that this chert came from a presently unknown but closer source. A more detailed examination of the assemblage by raw materials can be found in Chapter 14 by M. Kurbjuhn and Chapter 12 by T. Uthmeier.

The flint varieties present at Buran-Kaya III Layer B indicate that their source was no less than 10 km from the site, but in reality, given local topographic features, closer to 20 km. Thus, there is no doubt that flint was not immediately available to the site. The high density of artifacts and animal bone from Levels B and B1 cannot therefore be interpreted as a base camp occupation(s), as was initially done for other sites with a Kiik-Koba type industry (e.g., Demidenko 1996; Chabai et al. 1995; Chabai and Marks 1998). This interpretation was subsequently corrected to intensively and recurrently occupied "short-term camps," which are usually compacted into one or two dense archeological cultural layer(s) due to slow sedimentation rates (e.g., Chabai 1999a; Chabai et al. 2000; Demidenko 2000).

The Layer B Lithic Assemblage

A total of 17,342 flint artifacts was recovered during the 1996 excavations from slightly less than 7 m^2 (Level B = ca. 6.4 m^2, Level B1 = ca. 6.9 m^2): an extremely high density per square meter. The assemblage has been subdivided into seven general categories: chips (< 1.5 cm), large chips (1.5 cm–2.9 cm), flakes, blades, tools, specific waste of tool rejuvenation, and heavily burnt pieces. This division shows the dominance of chippage: some 89.2% while no other category reaches even 5% (Table 9-1). On the other hand, excluding what is normally considered debris (chips, tool rejuvenation pieces, and heavily burnt pieces), leaves 1,026 flints from the remaining four categories: objects of primary flaking processes (3.6%), flakes (38.5%), blades (4.8%), and tools (51.3%). The striking structural feature of this assemblage is the truly high percentage of retouched tools, which actually exceeds all debitage combined at 53.1% versus 43.3%. This pattern is consistent even when the assemblage is subdivided into Levels B and B1, in spite of the marked difference in total items (2,127 in Level B and 15,215 in Level B1 (Table 9-1). Aside from small chips

Table 9-1
Flint artifacts structure in Layer B of Buran-Kaya III

	Level B		*Level B1*		*Total Layer B*		
	N	%	*N*	%	*N*	%	*ess %*
Objects of primary flaking processes:	12	0.6	25	0.2	37	0.2	3.6
flint plaquettes	2		3		5		
preforms	1		1		2		
core-like pieces	6		15		21		
bifacially treated fragments of core-like/bifacial preforms	3		6		9		
Chips (≤ 1.5 cm)	1,200	56.4	9,449	62.1	10,649	61.4	
Chips (> 1.5–2.9 cm)	576	27.1	4,241	27.9	4,817	27.8	
Flakes	73	3.4	322	2.1	395	2.3	38.5
Blades	4	0.2	45	0.3	49	0.3	4.8
Tools:	132	6.2	413	2.7	545	3.1	53.1
bifacial tools (complete & fragments)	17		56		73		
unifacial tools (complete)	50		132		182		
unifacial tools (fragments)	31		137		168		
retouched pieces (complete)	19		45		64		
retouched pieces (fragments)	15		43		58		
Specific waste of tool rejuvenation:	24	1.1	110	0.7	134	0.8	
rejuvenation pieces of unifacial tools' tips	13		75		88		
rejuvenation pieces of bifacial tools' tips	11		35		46		
Heavily burnt pieces	106	5.0	610	4.0	716	4.1	
Total Flints	2,127		15,215		17,342		

(< 1.5 cm) and tools, the other six artifact categories from Levels B and B1 have percentage deviations of no more than 1.3%. Tool percentages differ only by 3.5%, while the proportions of small chips vary just by 5.7%. These differences between the two levels are even less marked when only the two chip classes and the debitage are considered. In this case, the differences between Levels B and B1 respectively are: chips (< 1.5 cm) 64.8% and 67.2%, chips (1.5–2.9 cm) 31.1% and 30.2%, debitage 4.1% and 2.6%. This structural similarity between Levels B and B1 is reinforced by fully comparable techno-typological characteristics, as will be shown below. In addition, since these two archeological levels surely do not represent just two occupational events, but rather the remains of a series of visits there, the combination of the assemblages of Levels B and B1 into one united Layer B lithic assemblage for analyses and description seems to be quite reasonable. Thus, the following data are based on the entire combined sample of 17,342 artifacts.

Objects of Primary Flaking Processes

Objects of primary flaking processes represent the initial stage of the flint-knapping process and are composed of plaquettes, preforms, core-like pieces, and bifacially treated fragments of either core-like pieces or bifacial preforms (Table 9-1).

Plaquettes

Plaquettes indicate the form of unmodified raw material used for primary flaking processes at the site. Given the reduction intensity seen on the artifacts, as expected, none of the plaquettes is whole. All are fragments, two of which bear a few clear small flake scars from supposed testing blows on their otherwise cortical surfaces. It is obvious that the plaquettes were broken during their initial testing. Because of their fragmentation, only general measurements were taken, with length measured as the longest edge. Lengths range from 3.1 to 4.9 cm, widths from 1.4 to 3.6 cm, and thicknesses from 0.7 to 1.6 cm. The thickness measurement is the most important, as it may represent the typical initial blank volume of pieces destined for further reduction: the mean thickness for all plaquettes is 1.1 cm.

Preforms

There is one typical (e.g., Chabai and Demidenko 1998:39) complete preform on a plaquette with a few "testing" negatives on its surfaces (Figure 9-3: *7*). It has neither a striking platform, characteristic of precores/cores, nor the clear treatment typical for bifacial preforms. It is 5.3 cm long, 5.1 cm wide, and 2.1 cm thick. As such, it may be a better indicator of initial raw material package size than are the fragmentary plaquettes.

A second preform is almost completely covered by small flake scars struck from three weakly developed striking platforms. Neither the scars nor the striking platforms can be attributed to any core feature because of the absence of any regular core-like flaking. At the same time, it also does not bear clear signs of bifacial tool elaboration. Therefore, it is classified as a preform. Because of the many small scars, the blank type is unidentifiable. It is 4.3 cm long, 3.8 cm wide, and 2.3 cm thick. Again, its dimensions are considerably larger than those of the plaquette fragments.

Core-Like Pieces

Cores are poorly represented both numerically and morphologically, consisting of 1 radial, 1 discoidal, 9 parallel, and 10 unidentifiable types. All cores need rather detailed morphological descriptions and interpretative explanations because their classification does not really reflect any role or technological importance of different flaking methods implied by the strictly typological definitions.

RADIAL CORES

The radial core is ovoid with a convex undersurface (Figure 9-3: *1*). It has a crudely faceted striking platform and an advanced, intensive centripetal reduction, resulting in the core's exhaustion with both a concave flaking surface and an overall small size (length = 3.6 cm, width = 2.8 cm, thickness = 1.4 cm).

DISCOIDAL CORES

The discoidal core (Figure 9-3: *3*) is also ovoid with, by definition, two opposite flaking surfaces. There is some cortex on both flaking surfaces indicating that a plaquette was the blank type. It too is exhausted and small: length = 1.2 cm, width = 3.1 cm, and thickness = 1.5 cm. It has removal scars of centripetal reduction around its circumference on one side and just a single pronounced removal scar on other side. The limited reduction of the second face places it as atypical.

PARALLEL CORES

The parallel cores are the most numerous identifiable core type and they are represented by four subgroups: parallel of irregular shape (5), parallel transverse of irregular shape (2), parallel of triangular shape (1), and parallel unidentifiable (1).

PARALLEL CORES OF IRREGULAR SHAPE Parallel cores of irregular shape (Figure 9-3: *2, 4, 5*) are so-called "peculiar not specially organized" cores with either a naturally flat (3) or flat (2) undersurface, crudely faceted (4) or finely faceted (1) striking platforms, and which produced unidentifiable (4) or flake (1) blank types. They bear only one large scar of the last removed flake on the flaking surface. These last scars cover 80% to 100% of each core's flaking surface, making continued reduction problematic. Additional flaking would call for significant and difficult repreparation of each core's flaking surface. The last removals for three of the cores overpassed (Figure 9-3: *4, 5*), while on the two others the flaking surfaces were highly concave (Figure 9-3: *2*). Given the small size of the cores (length = 3.5 to 4.0 cm, width = 1.8 to 3.2 cm, thickness = 1.1 to 1.4 cm), significant rejuvenation would have been impossible.

It is impossible to tell on three of these cores if other reduction strategies were initially used, due to the lack of other striking platforms and scars (Figure 9-3: *5*). Two cores, however, are more informative in this respect. One (Figure 9-3: *4*) has the remains of a finely faceted striking platform, as well as the upper portion of a flake scar struck from it. The combination of these reduction features suggests that the core had either an orthogonal or a partially centripetal flaking history. The second core, made on a flake (Figure 9-3: *2*), has no signs any previous flaking and therefore seems to have undergone just a single reduction episode. Such reduction of small-sized cores, either at the end of their multiple reduction history or just as a single flaking event, definitely indicates the attempt to derive blanks from even very small pieces of flint.

PARALLEL TRANSVERSE CORES OF IRREGULAR SHAPE Parallel transverse cores of irregular shape (Figure 9-3: *6*) are similar to those described above but the width of their flaking surface is greater than the length of their flaking surface, making them typologically transverse. One core is 2.5 cm long and 4.6 cm wide with a thickness of only 0.6 cm (Figure 9-3: *6*). It has a strongly overpassed flaking surface from the removal of one large flake, and another small and narrow removal scar, and the original cortex-covered ventral surface of the blank that was used for this reduction. Thus, a primary flake's convex ventral surface served as the core's flaking surface, while its abrupt lateral edge was used as an unprepared plain striking platform. Its undersurface is naturally flat—the flake's dorsal surface with primary cortex. Technologically, it is a kind of ad hoc reduction of a core-on-flake with quick exhaustion. It is analogous to the parallel core illustrated as Figure 9-3: *2*.

Another core on an unidentifiable blank also has only two parallel scars on its flat flaking surface, though it has traces of previous crudely faceted striking platforms all around its convex undersurface. Therefore, it is quite possible that the observed parallel-like reduction is only the last reduction stage for the core. Thus, this core is not systematic or intentionally parallel. It looks similar to the parallel core illustrated in Figure 9-3: *4*. Its abandonment may have been connected to its small size (length = 3.2 cm, width = 3.6 cm, thickness = 1.8 cm).

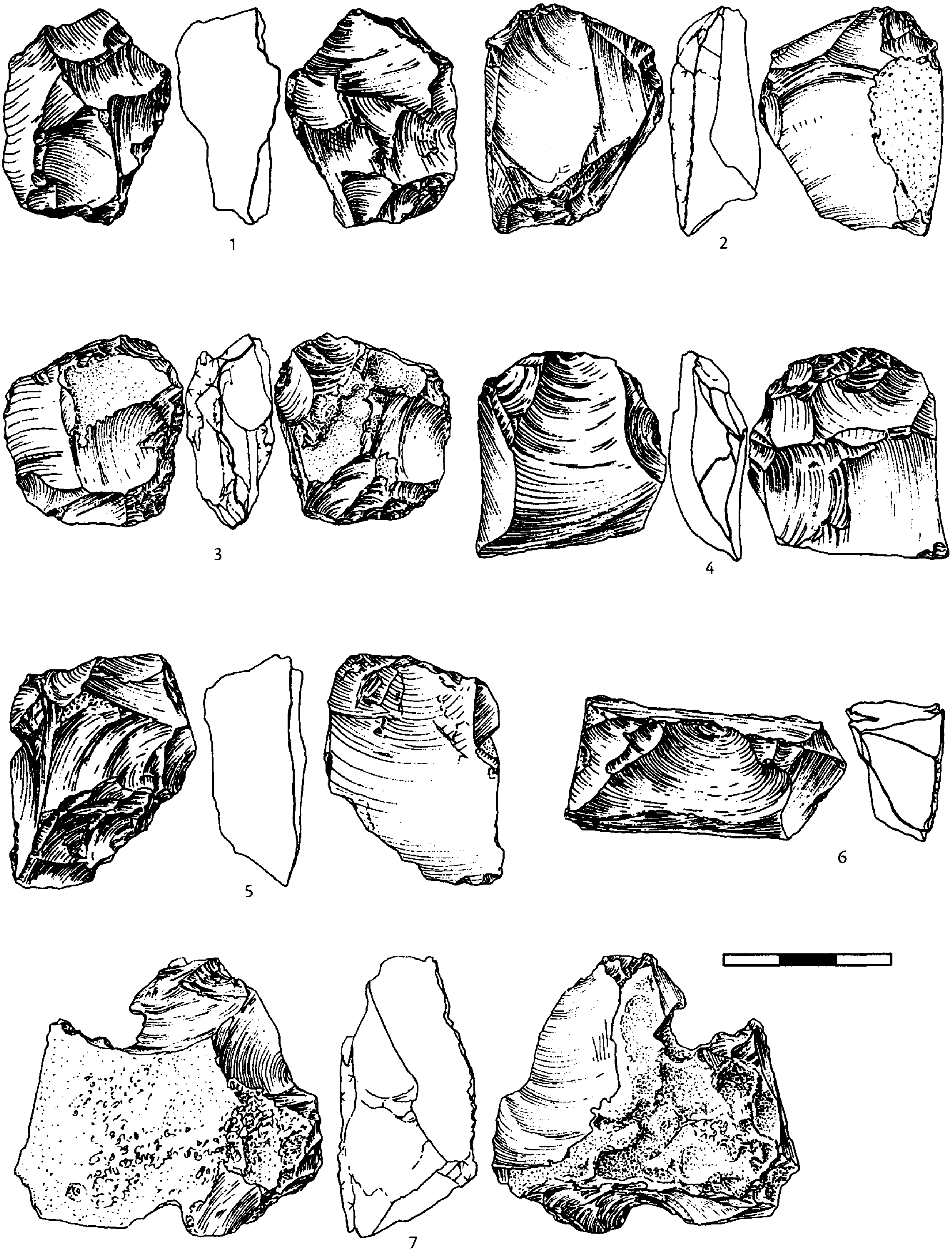


Figure 9-3—Buran-Kaya III Layer B objects of primary flaking processes: *1*–radial core; *3*–atypical discoidal core; *2, 4, 5, 6*–parallel cores; *7*-preform. Items 1-2, 4-7 from Level B1; item 3 from Level B.

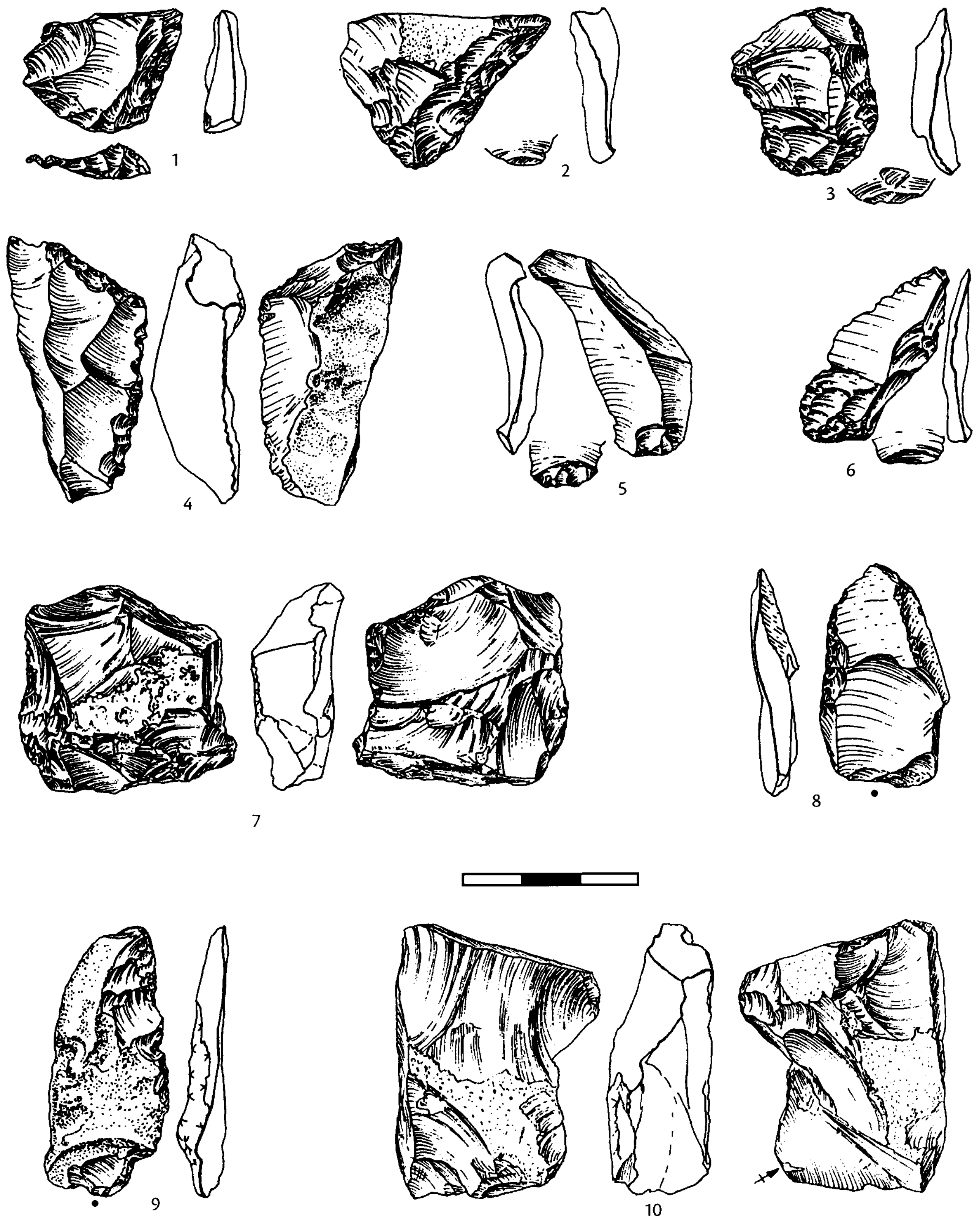


Figure 9-4—Buran-Kaya III Layer B unifacial tools (1, 2, 3, 8, 9), objects of primary flaking processes (4, 7, 10), and bifacial reduction pieces (5, 6): *1, 2, 3, 8, 9*–simple scrapers; *4*–parallel core; *5, 6*–bifacial thinning blades; *7*–unidentifiable core ("completely exhausted"); *10*–bifacially treated fragment of either a core-like piece or a bifacial preform. Items 1, 2, 3, 4, 9, 10 from Level B1; items 5, 6, 7, 8 from Level B.

PARALLEL CORES OF TRIANGULAR SHAPE The parallel core of triangular shape was made on an unidentifiable blank type and has a naturally flat undersurface (Figure 9-4: *4*). It is has three parallel scars on its elongated and narrow flaking surface (4.5 cm long, 2.2 cm wide) that were struck from a crudely faceted striking platform The core's exhaustion is evident from its small size and especially, its minimal thickness of 1.0 cm. On one hand, this core could be an example of a systematic and intentional parallel reduction, but it is more likely that this is another example of a short-term core reduction where the small size and elongate/narrow proportions of the original blank were suitable only for parallel flaking.

PARALLEL CORES OF UNIDENTIFIABLE SHAPE The single example of a parallel core of unidentifiable shape has 5 parallel scars on its flaking surface, all struck from a crudely faceted platform. Oblique fragmentation of the piece makes all but length (4.2 cm) indeterminable.

UNIDENTIFIABLE CORES

Unidentifiable cores are subdivided into 3 that are longitudinally fragmented; 4 that are transversely fragmented, preserving only the upper portion with striking platform; and 3 that are whole but completely exhausted.

Those with longitudinal breaks could be only characterized by striking platform treatment (2 finely faceted and 1 crudely faceted). Their dimensions ranged from 3.6 to 4.5 cm in length and 0.9 to 1.7 cm in thickness. Those broken transversely have only crudely faceted striking platforms. Given the breakage, only width and thickness could be measured (width from 3.2 to 4.2 cm and thickness from 0.8 to 1.4 cm).

EXHAUSTED CORES

Completely exhausted cores (Figure 9-4: *7*) are defined by their small size, the presence of no fewer than two flaking surfaces, three to four striking platforms, and unsystematic and/or a combination of parallel- and centripetally-directed short removal scars on the flaking surfaces. Combined, these indicate maximum reduction with no coordination between different flaking surfaces. Morphologically, these three cores have 11 striking platforms (5 plain, 6 crudely faceted), with one plaquette and two unidentifiable pieces as their blanks. Metrically, they range from 3.3 to 4.0 cm in length, 2.6 to 3.3 cm in width, and 1.0 to 1.3 cm in thickness.

Bifacially Treated Fragments of Either Core-Like Pieces or Bifacial Preforms

Fragments of cores and preforms that have bifacial treatment (Figure 9-4: *10*) are included with the cores and preforms because these broken pieces lack the clear bifacial treatment that would put them unambiguously into one or the other group. Such pieces could be found in any Middle Paleolithic site where both intensive on-site core reduction and bifacial tool treatment took place. Given their broken state, measurements are not useful, but thickness is quite consistent with other categories: from 1.0 to 1.9 cm. Except for two on plaquette, the other blanks were unidentifiable.

Summary of Metric and Morphological Data for Objects of Primary Flaking Processes

If the various items described above are broken down into the three categories of plaquettes/preforms (7), cores (14), or unidentifiable core fragments (7), it becomes clear that while size decreases as reduction continues and breakage increases, the changes are not great.

The dimensions of plaquettes and preforms have the following ranges: length from 3.0 to 5.9 cm (mean = 4.3 cm), width from 1.0 to 5.9 cm (mean = 3.1 cm), and thickness from 1.0 to 2.5 cm (mean = 1.4 cm). Of the seven pieces, six are plaquettes, while one preform is on a flake.

The dimensions of cores have the following ranges: length from 2.0 to 4.9 cm (mean = 3.6 cm), width from 1.0 cm to 4.9 cm (mean = 3.0 cm), and thickness from 1.0 cm to 1.9 cm (mean = 1.2 cm). As expected, the original raw material package of these cores is largely unknowable, although two were from plaquettes and two from flakes.

The dimensions of unidentifiable broken cores have the following ranges: greatest dimension from 3.0 to 4.9 cm (mean = 3.7 cm) and thickness from 1.0 cm to 1.9 cm (mean = 1.1 cm). Their blank types are all unidentifiable.

From these data, it is clear that the dimensions of pieces with only initial reduction are greater than the ones with more intensive reduction. The average differences, however, are not great at all: length = 0.7 cm, width = 0.1 cm, and thickness = 0.2 cm. This suggests that most initial raw material packages (plaquettes and flakes) brought to the site were quite small and as a result, were not and could not have been greatly reduced during blank production. Yet, the metric data could be interpreted that all these pieces were exhausted in terms of reduction potential. That is, the plaquettes and preforms were merely fragmented objects not suitable for any continued reduction. There are some cases of both multiple reductions from probably larger blanks and single reduction of definitely smaller blanks, with more of the latter.

There were also 29 striking platforms for 21 cores. This difference is explained by the presence of 11 platforms on three completely exhausted cores. The striking platforms are plain (20.7%), crudely faceted (69%), and finely faceted (10.3%), suggesting frequent platform preparation for the removal of almost each flake. This is consistent with the overall small sizes and tiny thickness of most of the cores, plaquettes, and flakes used as blanks. The rarity of finely faceted striking platforms is easily understood by the absence of the Levallois method.

The flake scars on the core flaking surfaces indicate centripetal and parallel (non-volumetric in concept) flaking. The accidental character of most of the parallel cores, with mainly overpassed and hinge-fractured flaking surfaces after a single or a last flake removal, shows that there was no systematic or intentional parallel reduction. Radial, atypical discoidal, and completely exhausted cores, most of all, are characterized by hinge-fractured concave flaking surfaces with short removal scars.

In summary, the assemblage's primary flaking was based upon non-Levallois methods with a non-volumetric concept of simple opportunistic parallel and centripetal techniques. These were directed to starting and/or continuing primary reduction on any suitable raw material package, mainly of small size. Of course, the above observations need to be seen in the context of corresponding data from debitage and tools, their analysis and comparisons with primary flaking objects, and their possible numerical and technological interrelations.

DEBITAGE

The debitage of Layer B consists of 395 unretouched flakes (89%) and 49 unretouched blades (11%) (Table 9-1). In spite of the relatively low proportion of blades, they will be reported separately here.

Condition

Of the flakes, about a third (28.1%) is broken: 3.3% are proximal fragments, 2.5% are medial, and 13.2% are distal, while 9.1% have longitudinal breaks. Blades have different breakage patterns: of the 30.6% that are broken, 4.1% are proximal pieces, 12.2% are medial, while 14.3% are distal. The higher percentage of medial blade fragments is expected given the shape of blades. The low occurrence of medial flake fragments relates to the generally small size of the flakes, which lessens the likelihood of their breakage into more than two pieces. Again, the presence of longitudinally fragmented flakes indicates the general lack of flake elongation and hard hammer detachment.

Scar Patterns

Ten different scar patterns were recognized on 280 complete flakes. The most common is unidirectional (48.3%), followed by unidirectional-crossed (14.6%), cortical (9.6%), and bidirectional (6.1%). Four other patterns occur, but are rare: centripetal (5%), converging (5%), 3-directional (4.3%), and crested (4.3%). The final two patterns appear accidental: lateral (2.1%) and dorsal-plain (0.7%).

Blades have eight different scar patterns on 34 complete blades: unidirectional (53%), unidirectional-crossed (11.8%), 3-directional (11.8%), lateral (8.8%), crested (5.9%), bidirectional (2.9%), dorsal-plain (2.9%), and cortical (2.9%).

These flake and blade scar patterns correspond well with one another, as well as to the cores and preforms. It is worth noting that nearly one in ten flakes is cortical, providing evidence for some on-site flaking of initial raw material packages.

Surface Cortex Area and Location

Non-cortical flakes (38.6%) are fewer than ones with some cortex (61.4%). Of those with cortex, only about one in five are wholly cortex covered. Cortex occurs on 64.7% of the blades and only one in twenty-two is wholly cortex covered.

The presence of cortex on both flakes and blades confirms some on-site reduction of initial raw material packages. In addition, 52.4% of all partially cortical flakes have only distal cortex, while other pieces have both distal cortex and otherly positioned cortex. This overall dominance of pieces with distal cortex once again indicates that cores and plaquettes were small. On the other hand, cortex location is different for blades: lateral (32.4%), distal (17.7%), distal and lateral (8.8%), central (2.9%), and distal and central (2.9%). The dominance of blades with lateral cortex is easily explained by their detachment from edges of cores, preforms, and bifacial tools.

Shape and Axis

Of the 284 complete flakes, trapezoidal shapes dominate (58.8%), of which 17.7% are simple trapezoidal, 16.5% are elongated trapezoidal, and 24.3% are expanding trapezoidal. The next most common shape is irregular (24.6%), followed by rectangular (7%), ovoid (5.3%), leaf-shaped (2.1%), crescent (1.4%), and triangular (1.1%). Flakes struck off-axis are predominant (80.3%), compared to those on-axis (19.7%). Again, blades are largely struck off axis (73.5%) and mainly have varieties of trapezoidal forms: elongated trapezoidal (26.5%) and expanding (14.6%). There are, however, significant proportions of rectangular and irregular shapes (26.5% each), with trivial proportions of crescent forms (5.9%). In sum, flakes and blades have similar shape distributions, as well as a strong tendency for off-axis removals. It is worth noting that the variety of blade shapes suggests an absence of clearly consistent removals.

Lateral Profiles

For the 278 flakes that could be examined, profiles are rather evenly divided: incurvate medial (33.1%), incurvate distal (20.1%), twisted (22%), and flat (18%).

Those with convex profiles (due to major hinging) are rare (6.8%), as always. This balanced range of profile types is taken as evidence for the irregular character of core reduction at the site. Blades, on the other hand, show much less variability, with twisted profiles dominating (70.6%) over incurvate medial (26.5%) and flat (2.9%). The dominance of twisted profiles may be taken as evidence that most blades were by-products of bifacial tool shaping and rejuvenation.

Distal Profiles

Of 270 complete flakes, more than half (58.1%) have feathered distal ends, while hinged (27.8%) and blunt (11.5%) terminations occur less frequently. Overpassed flakes are rare (2.6%). The high number of hinged flakes indicates "irregular" and "unsystematic" flaking of short blocks/cores.

Cross-Sections at Midpoint

For 284 complete flakes, midpoint profiles are trapezoidal (36.6%), triangular (27.5%), irregular (16.2%), lateral steep (9.2%), crescent (5.6%), and flat (4.9%). Blades tend to have triangular midpoint shapes (53%), with fewer trapezoidal cross-sections (26.5%), and hardly any irregular (8.8%), lateral steep (5.9%), or crescent (5.9%). Considering trapezoidal midpoint shapes as an indicator for intensive core-like reduction, it is clear that neither flakes nor blades appear to be from such core-like reduction.

Platform Preparation, Lipping, Angle, and Abrasion

Observations on platform characteristics—types, lipping, angle, and abrasion—are based on a flake sample of 297 complete and proximal fragments and a blade sample of 36 complete and proximal fragments. Flake platforms are mainly unprepared (42.3%), including plain (19.5%), punctiform (19.5%), linear (4%), and cortical (3.7%). Prepared platforms include dihedral (8.1%), crudely-faceted (10.8%), and finely-faceted (9.8%). Crushed platforms are common at 29%. Excluding those with crushed platforms, flake faceting indices are IF = 40.3, IFs = 13.7. Blade platforms are fully comparable to those on flakes: plain (8.3%), punctiform (27.8%), linear (2.8%), and cortical (8.3%), while prepared platforms include dihedral (5.6%), crudely-faceted (8.3%), and finely-faceted (11.1%). Crushed platforms are quite common at 27.8%. Blade faceting indices are IF = 34.6, IFs = 15.4. Faceting indices for flakes and blades combined are IF = 39.7, IFs = 13.9.

On 171 flakes, over half (53.2%) exhibit semi-lipped platforms; truly lipped examples are uncommon (18.7%) but unlipped platforms are common (28.1%). Yet, if the percentages for semi-lipped and lipped platforms are combined, the total indicates most flakes were struck with a relatively soft hammer. Only 16 blade platforms could be observed: semi-lipped (50%), lipped (12.5%), and unlipped (37.5%).

Of the 171 flake platforms suitable for angle identification, right angles (about 90°) and semi-obtuse angles (90–110°) account almost two-thirds of all platforms (64.9%). The percentage of obtuse angles (>110°) is quite high (35.1%), however. Of 16 blades, 13 have right and semi-obtuse angles and 3 have obtuse angles.

Among the 224 identifiable flake platforms, abrasion traces are present on 27.2%. Only 2 blades with abrasion traces were found (10.5%).

The above data on lipping, angle, and abrasion show that there are quite a few lipped platforms with acute angles and abrasion: 20–35% among flakes and 10–20% among blades (Figure 9-4: *5, 6*). These items are certainly not connected to any primary flaking, but they are a typical waste by-product of bifacial tool shaping and reshaping.

Dimensions of Debitage

Debitage metrics for flakes and blades are shown in Table 9-2 by grouped data, which clearly demonstrate that flakes are short, wide relative to length, and quite thin. In fact, flakes wider than they are long are in the majority (53.9%). Therefore, the average flake length is less than 3 cm—the metric border for distinguishing chips from flakes. Because so many are wider than they are long, they still fall into the flake class. Blades are, quite expectedly, on average longer than flakes, less wide, and less thick. All 34 complete blades were used for the variety of measurements. The mean flake platform width and height (thickness) are 1.0 cm and 0.3 cm, respectively. The means for blade platform width and height are 0.5 cm and 0.2 cm, respectively.

Taking into account both flake and blade metric data, it is possible to say that, despite their obvious length/width differences, they are quite similar. The great majority of flakes are short and transverse, and blades have an average length : width ratio of only 2.57 : 1. Thus, blades seem to be mostly a result of random reduction.

Some Concluding Data on Debitage

The technological observations presented above provide an understanding of flint reduction processes, which were already displayed in the preforms and cores. The main contribution is that, aside from the obvious non-Levallois flake and blade production from cores, a significant number of both flakes and blades were by-products of bifacial tool production and rejuvenation. Based upon platform characteristics such as lipping, abrasion, and obtuse angles, it is possible to suggest that approximately 20% to 35% of all flakes and about 10% to 20% of all blades were detached during bifacial tool production/rejuvenation. An attempt to arrive at precise proportions of bifacial

Table 9-2
Debitage and unifacial tool dimensions in Layer B of Buran-Kaya III

Length groups (cm)	*N*	*1.0–1.9*	*2.0–2.9*	*3.0–3.9*	*4.0–4.9*	*5.0–5.9*	*6.0–6.9*	*Mean*
Flake debitage	284	1.5	36.0	48.2	4.9	0.4	–	2.81
Blade debitage	34	–	–	73.5	26.5	–	–	3.62
Simple sidescrapers	29	10.3	38.0	31.0	17.3	3.4	–	3.14
Transverse scrapers	26	34.6	38.5	19.2	7.7	–	–	2.47
Convergent scrapers	49	2.0	40.8	51.1	6.1	–	–	3.03
Points	58	5.2	37.9	39.7	13.8	3.4	–	3.16
Retouched pieces	64	7.8	57.8	28.1	1.6	4.7	–	2.80
Width groups (cm)	*N*	*1.0–1.9*	*2.0–2.9*	*3.0–3.9*	*4.0–4.9*	*5.0–5.9*	*6.0–6.9*	*Mean*
Flake debitage	284	13.7	30.3	48.9	6.0	0.7	–	2.89
Blade debitage	34	97.1	2.9	–	–	–	–	1.41
Simple sidescrapers	29	6.9	58.7	27.9	3.4	3.4	–	2.75
Transverse scrapers	26	7.7	26.9	57.7	7.7	–	–	3.07
Convergent scrapers	49	4.1	49.0	28.6	16.3	2.0	–	3.13
Points	58	8.6	46.6	32.8	6.9	3.4	1.7	3.04
Retouched pieces	64	9.4	51.5	34.4	4.7	–	–	2.75
Thickness groups (cm)	*N*	*0.2–0.9*	*1.0–1.5*	*1.6–1.9*	*>2.0*			*Mean*
Flake debitage	284	90.1	8.5	0.7	0.7			0.56
Blade debitage	34	94.1	5.9	–	–			0.49
Simple sidescrapers	29	89.7	6.9	3.4	–			0.62
Transverse scrapers	26	76.9	23.6	–	–			0.65
Convergent scrapers	49	81.7	16.3	2.0	–			0.73
Points	58	91.4	8.6	–	–			0.67
Retouched pieces	64	95.3	3.1	–	1.6			0.55

shaping and thinning flakes and blades versus those unquestionably produced from cores, suggests that 29.3% of flakes and 13.8% of blades resulted from bifacial reduction. Thus, this assemblage represents the results of raw material reduction by both core techniques and bifacial tool production and rejuvenation. This will be discussed further, below. The common debitage characteristics, on the other hand, confirm the already-noted suggestion that the core reduction was based upon non-Levallois methods with a non-volumetric concept of simple ad hoc techniques.

There are no actual morphological differences between flakes and blades in the debitage, beyond that imposed by their definitions. Aside from their differing length/width ratios, their attributes are essentially the same. Therefore, there is no reason to suppose that blades (Ilam = 11%) were purposefully produced: rather, they were simply one end of a single production strategy.

Tools

Aside from chippage, tools constitute the largest category in the assemblage, even more numerous than debitage (Table 9-1). This toolkit of 545 pieces with secondary treatment permits a detailed analysis of both intra- and inter-tool groups to get at the major tendencies of tool manufacture, rejuvenation, and discard.

General Tool Assemblage Structure

Given the large number of tools in this assemblage from Buran-Kaya III Layer B, it is possible to describe the tools not only in terms of whether they are unifacial, bifacial, or have just simple retouch, but also to distinguish, within groups, which tools are complete, as opposed to broken. This is important because this tool assemblage is characterized by an abundance of both unifacial and bifacial tools with multiple retouched edges. When such are broken, during either use or rejuvenation, in most cases the original tool type and shape are not clear. For instance, the proximal or medial parts of seemingly simple—and especially—double scrapers, in reality, could have been convergent scrapers or points. Therefore, when the original state of a broken tool is not clear, it will be listed as an unidentifiable fragment or, when the choice is between a point and a scraper that depends upon a missing distal morphology, the piece will be classified as "point/scraper" (Table 9-3). When, however, a tool is broken at its proximal end or only a small lateral portion of the piece is missing, then it will be classified as if it were complete. Because of the significant occurrence of unifacial and bifacial tools of the same classes (i.e., scrapers and points), the type list has separated them and has placed simple retouched pieces into a third group (Table 9-3).

Thus, the toolkit (545 pieces) is structured in the following way: unifacial tools (64.2%), retouched pieces (22.4%), and bifacial tools (13.4 %) (Table 9-3). Complete tools (52.5%) are only slightly more common than broken tools (47.5%). Of all 73 bifacial tools, 31.5% are complete and 68.5% broken. The ratio of complete to broken tools is surprisingly identical for both unifacial tools and retouched pieces. The bifacial tools are characterized by a reverse order of

TABLE 9-3
Internal structure of the tool assemblage from Layer B

	Level B	*Level B1*	*Total Layer B*
Unifacial tools (complete)	*50*	*132*	*182*
Scrapers:	34	74	108
simple	5	24	29
transverse	11	15	26
double	3	1	4
convergent	15	34	49
Points	14	44	58
Denticulates	1	6	7
Notches	–	3	3
Perforators	1	2	3
Endscrapers	–	1	1
Burins	–	2	2
Unifacial tools (fragments)	*31*	*137*	*168*
Scrapers:	14	42	56
simple	3	18	21
transverse	3	4	7
double	6	6	12
convergent	2	11	13
convergent (tiny tips)	–	3	3
Points	–	13	13
Points (tiny tips)	2	11	13
Denticulates	2	1	3
Notches	–	1	1
Endscrapers	–	1	1
Unidentifiable (heavily fragmented/burnt) pieces	9	31	40
Tiny fragments of retouched edges	4	37	41
Retouched pieces (complete)	*19*	*45*	*64*
Pieces with marginal retouch	8	23	31
Pieces with irregular retouch	11	22	33
Retouched pieces (fragments)	*15*	*43*	*58*
Pieces with marginal retouch	5	24	29
Pieces with irregular retouch	10	19	29
Bifacial tools (complete)	*10*	*13*	*23*
Points	6	5	11
Scrapers	4	5	9
Denticulates	–	2	2
Preforms	–	1	1
Bifacial tools (fragments)	*7*	*43*	*50*
Points (distal parts)	–	5	5
Points (distal tips)	1	11	12
Points/scrapers (proximal parts)	3	6	9
Points/scrapers (proximal ends)	–	9	9
Points/scrapers (lateral edges)	1	7	8
Preforms	2	5	7

complete and broken pieces. This much higher proportional occurrence of broken bifacially retouched tools than unifacially retouched ones may well point to greater degrees of resharpening and rejuvenation of the former than the latter. On the other hand, with the tendency for bifacially retouched tools to have more than one retouched edge, it is not always clear whether the break in any way affected the relevant working edge.

Unifacial Tools

The 350 unifacial tools consist mainly of scrapers (46.8%) and points (24%), with very low percentages of other tool forms: denticulates (2.9%), notches (1.1%), perforators (0.9%), endscrapers (0.6%), and burins (0.6%) (Table 9-3). In addition, there are a good number of tiny fragments of retouched edges (11.7 %) and heavily fragmented and/or burned pieces (11.4 %). These, along with the classified yet broken tools, indicate both the effects of breakage during tool use and the processes of tool edge rejuvenation.

Removing these two unidentifiable tool groups, the definable unifacial tool sample is reduced to 269. In this case, the proportional representation of different unifacial tool groups is: scrapers = 61%, points = 31.3%, denticulates = 3.7%, notches = 1.5%, perforators = 1.1%, endscrapers = 0.7%, and burins = 0.7%. Clearly, most unifacial tools are scrapers and points, while denticulated and notched pieces account together for only 5.2%, and Upper Paleolithic types are rare at just 2.5%. At the same time, the tool group structure of the combined sample of complete and broken unifacial tools coincides with comparable data taken separately for complete and broken tools. The 182 complete unifacial tools consist of scrapers (59.4%), points (31.9%), denticulates (3.9%), notches (1.6%), perforators (1.6%), endscrapers (0.5%), and burins (1.1%). The 87 broken unifacial tools are comprised of scrapers (64.4%), points (29.9%), denticulates (3.5%), notched pieces (1.1%), and endscrapers (1.1%). This is very important for the study of the three facies of the Crimean Micoquian (Ak-Kaya, Starosele, Kiik-Koba), as it is well-known that the Kiik-Koba facies, to which Buran-Kaya III Layer B belongs, is characterized by both a large number of tool fragments and by intensive tool rejuvenation, compared to the other facies.

The blanks used in the production of unifacial tools were predominantly flakes (83.9%), with blades (3.6%), chips (11.6%), and flake-proportioned resharpening pieces (0.9%) occurring rarely. Bifacial shaping and especially, bifacial thinning debitage, including chips, account for 31 items among the tool blanks (Figures 9-5: *4, 10*; 9-6: *1, 8, 12*; 9-7: *10*; 9-8: *6, 8*).

UNIFACIAL SCRAPERS

There are 162 unifacial scrapers, of which 34.1% are broken but still classifiable. Typologically, they are evenly divided between those with one retouched edge (simple and transverse) and those with two retouched edges (double and converging). Within this unifacial scraper group, convergent are most numerous (39.6%), followed by simple (30.5%), transverse (20.1%), and double (9.8%). Complete (108) and broken examples (56) show some differences by subclass. While complete simple scrapers account for 26.8% of the class, they account for 37.5% of the broken examples. The reverse is true for the convergent scrapers: 45.4% of the complete scrapers, but only 28.6% of the broken ones. While this might lead to the conclusion that those with two retouched edges would be strong and thus less likely to break, the complete double scrapers account for only 3.7% of all complete scrapers, but 21.4% of the broken ones. The transverse scrapers follow a pattern similar to that of the convergent ones: 24.1% of the complete scrapers and only 12.5% of the broken ones. It is most likely that the type of scraper has less to do with whether or not it breaks than do its dimensions.

SIMPLE SCRAPERS According to the configuration of the retouched edge and its placement on the blanks, as well as the presence or absence of backing and/or thinning features, all simple scrapers are subdivided into straight, convex, and concave types. There are 33 on flakes, 2 on blades, 6 on chips, and 9 on unidentifiable fragments. Simple scrapers are comprised of:

- straight dorsal – 13 complete and 11 broken (Figure 9-4: *1, 2, 3, 8, 9*)
- straight dorsal, naturally backed – 1 complete
- straight dorsal, thinned base – 1 broken
- straight dorsal, truncated-faceted base – 1 complete
- straight ventral – 1 broken
- convex dorsal – 8 complete and 4 broken (Figure 9-5: *5, 9, 11*)
- convex dorsal, naturally backed – 2 complete and 1 broken (Figure 9-5: *6*)
- convex dorsal, thinned base – 1 broken
- convex ventral – 1 complete
- concave dorsal – 3 complete and 2 broken.

In sum, straight scraper edges are most common (56%), followed by convex (34%). Concave scraping edges are rare (10%). These simple scrapers exhibit very little blank modification beyond the scraping edge, and the presence of those with natural backs reflects blank selection, rather than active modification. Ventral thinning is not very characteristic for either complete (1) or broken (2) simple scrapers. Retouch types vary, from flat sub-parallel to steep stepped with the vast majority scalar (Table 9-4). Metric data are presented in Tables 9-2 and 9-5. As expected, these scrapers are somewhat larger than the unretouched debitage sample in length and thickness and only slightly smaller in width.

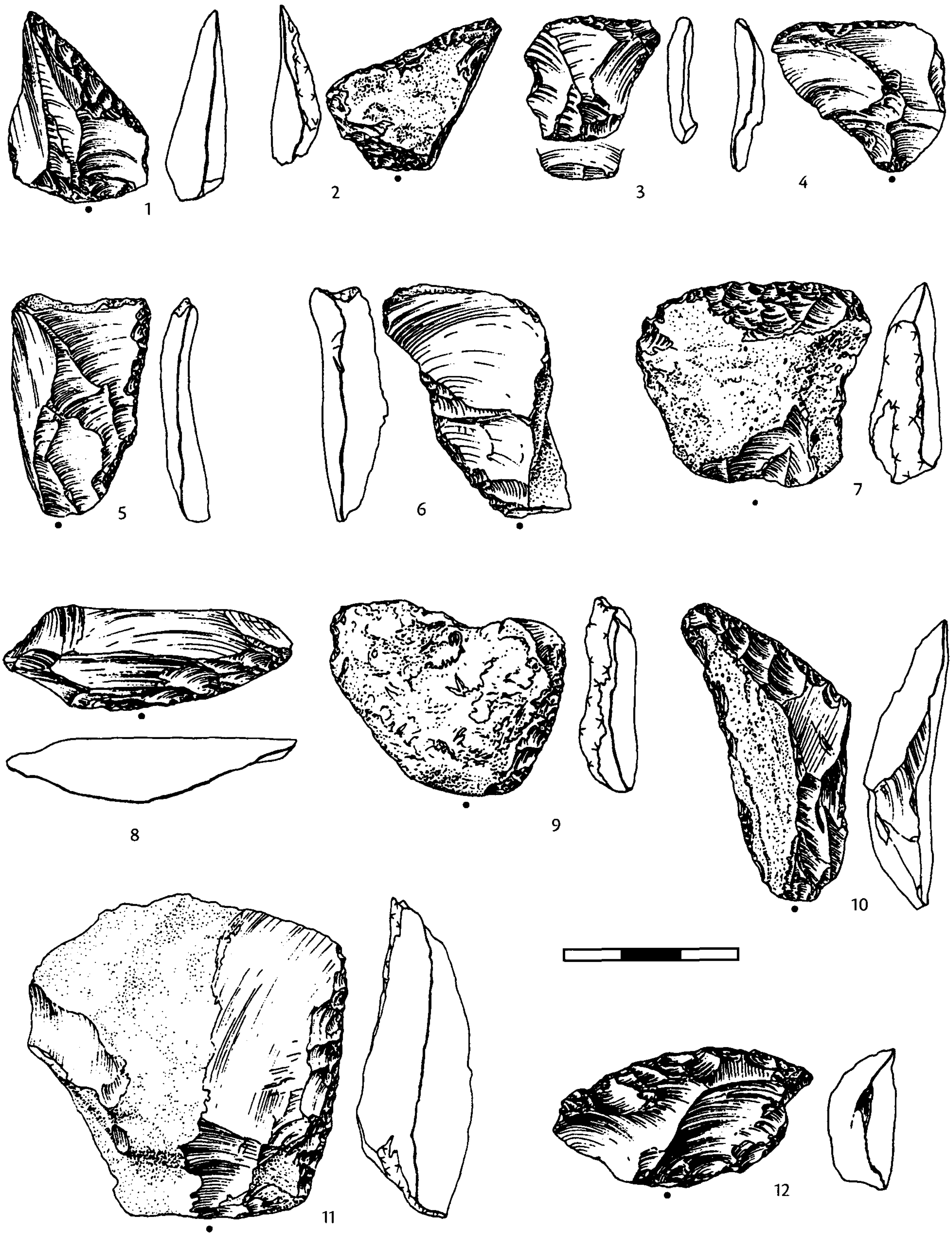


Figure 9-5—Buran-Kaya III Layer B unifacial tools: *1, 2, 3, 4, 7, 8, 10, 12*–transverse scrapers; *5, 6, 9, 11*–simple scrapers. Items 1, 3, 5, 6, 8, 9, 10, 11, 12 from Level B1; items 2, 4, 7 from Level B.

TABLE 9-4
Reduction sequence of unifacial tools reflected by variability of retouch types and angles in Layer B of Buran-Kaya III

	Simple scrapers		*Transverse scrapers*		*Double scrapers*		*Convergent scrapers*		*Points*		*Denticulates*		*Perforators*	
Retouch type	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Scalar	21	72.4	26	78.8	28	87.5	76	64.4	89	61.8	7	46.7	4	50.0
Sub-parallel	4	13.8	4	12.1	1	3.1	10	8.5	13	9.0	–	–	–	–
Stepped	4	13.8	3	9.1	3	9.4	32	27.1	42	29.2	8	53.3	4	50.0
Retouch angle	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Flat	12	41.4	8	24.2	16	50.0	25	21.2	26	18.1	1	6.7	–	–
Semi-steep	12	41.4	16	48.5	9	28.1	61	51.7	99	68.7	4	26.7	2	25.0
Steep	5	17.3	9	27.3	7	21.9	32	27.1	19	13.2	10	66.6	6	75.0

TRANSVERSE SCRAPERS Of the transverse scrapers, 26 are on flakes, 2 on blades, 3 on chips, and 2 on either flakes or chips. They are subdivided as:

- straight dorsal – 9 complete and 3 broken (Figure 9-5: *2, 3, 4*)
- straight dorsal, thinned base – 1 complete
- straight oblique dorsal – 2 complete and 2 broken (Figure 9-5: *1*)
- convex dorsal – 11 complete and 2 broken (Figure 9-5: *7, 8, 12*)
- convex oblique dorsal – 2 complete (Figure 9-5: 10)
- double straight-convex dorsal – 1 complete.

The transverse scraper sample is characterized by: (1) only dorsal retouch, (2) no concave edges and an equal number of straight and convex edges, (3) a fair occurrence of obliquely-oriented scraping edges, (4) an absence of naturally backed blanks and only a single thinned example, and (5) mainly semi-steep scalar retouch (Table 9-4).

Metric data for all 26 complete transverse scrapers are shown in Tables 9-2 and 9-5. Predictably, tool length is shorter than debitage length and, equally predictably, tool width exceeds debitage width. Thickness is also greater than the mean debitage thickness, reflecting the choice of larger, thicker blanks for tool manufacture.

DOUBLE SCRAPERS Of the double scrapers, 5 are on flakes, 1 is on a blade, 1 is on a chip, and 9 have unidentifiable blanks. Twelve of the 16 are broken. They occur in the following types:

- double straight dorsal – 2 complete and 4 broken (Figure 9-6: *4*)
- double straight dorsal, thinned base – 1 broken
- straight-convex dorsal – 1 complete (Figure 9-6: 5)
- straight-convex dorsal, truncated-faceted base – 1 broken
- straight-concave dorsal – 1 broken
- double convex, dorsal – 4 broken
- convex-concave dorsal – 1 broken
- convex-concave alternate – 1 complete.

The retouched edges are straight (53.1%), convex (37.5%), and concave (9.4%). All but one alternate piece have dorsal retouch. Two cases of additional modification (ventral thinning and truncation) are noted for broken tools. Scalar retouch heavily dominates, although retouch is often flat, rather than semi-steep or steep (Table 9-4). In these attributes, they are comparable to the simple scrapers. The four complete examples range in length from 2.2 to 2.9 cm (mean = 2.62 cm), in width from 2.1 to 3.1 cm (mean = 2.52 cm), and in thickness from 0.2 to 0.7 cm (mean = 0.42 cm).

CONVERGENT SCRAPERS Most convergent scrapers are complete: 49 out of 65. Again, most were produced on flakes (51). Minor numbers were made on blades (1), either flakes or blades (3), chips (5), and on unidentifiable fragments (5). The convergent scraper types present are:

Rectangular—2
- semi-rectangular dorsal – 1 complete and 1 broken.

Ovoid—1
- sub-ovoid dorsal, thinned base and truncated-faceted back – 1 complete (Figure 9-6: *11*).

Leaf Shaped—6
- leaf-shaped dorsal – 2 complete and 4 broken.

Crescent—9
- sub-crescent dorsal – 3 complete and 2 broken
- semi-crescent dorsal, thinned base – 2 complete (Figure 9-6: *3*)
- semi-crescent dorsal, thinned back – 1 complete (Figure 9-6: *6*)
- crescent dorsal – 1 complete.

Triangular—9
- sub-triangular dorsal, thinned base – 1 complete
- sub-triangular ventral – 1 complete

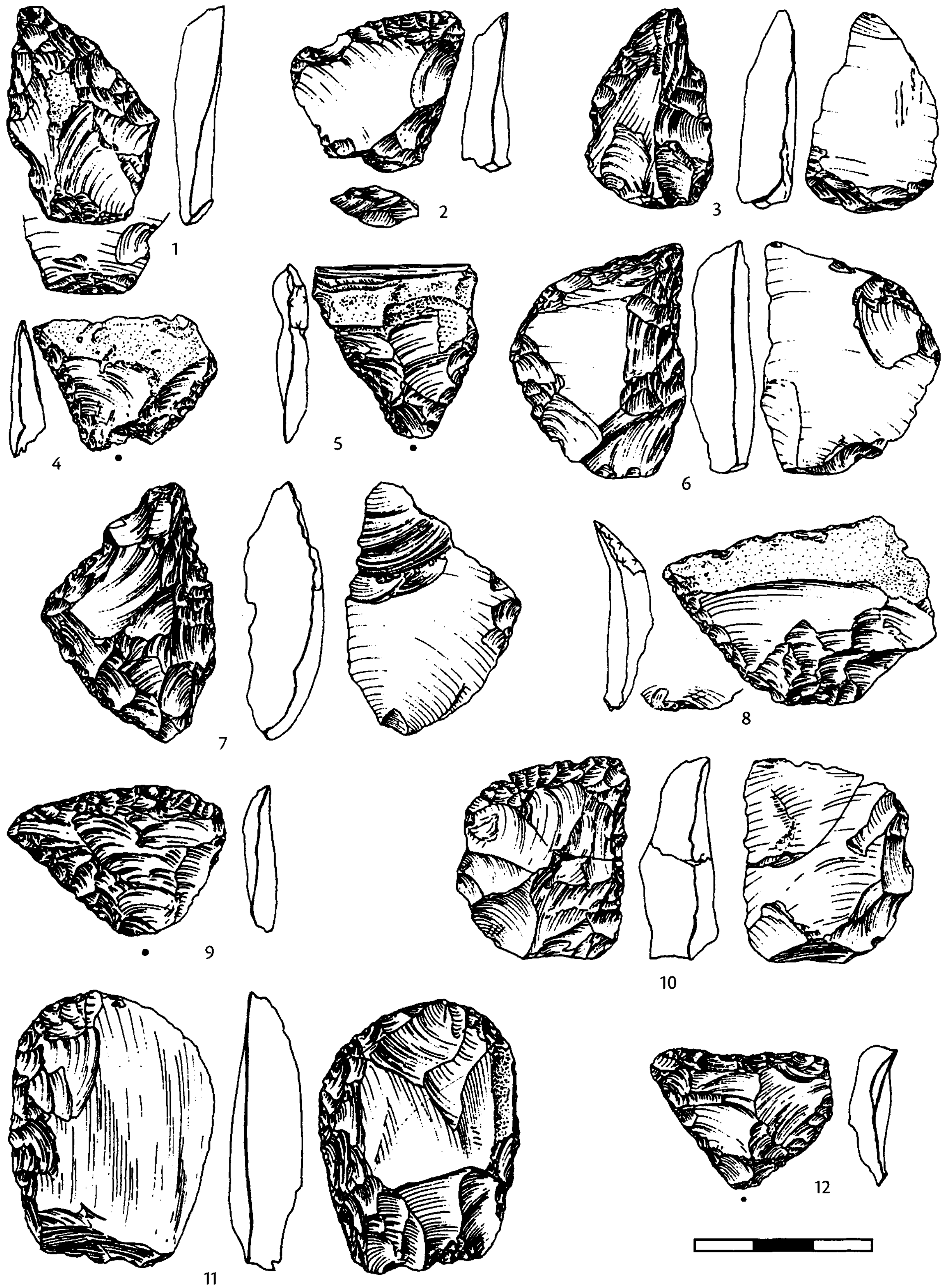


Figure 9-6—Buran-Kaya III Layer B unifacial tools: *1-3, 6-12*–convergent scrapers; *4, 5*–double scrapers. Items 1, 3, 5, 6, 8, 9, 10, 11, 12 from Level B1; items 2, 4, 7 from Level B.

TABLE 9-5
Average dimensions of major unifacial tool groups, retouched pieces, and debitage (in cm) in Layer B of Buran-Kaya III

	N	*Length (cm)*	*Width (cm)*	*Thickness (cm)*	*Transversal items (%)*
Unifacial tools (complete)					
Simple scrapers	29	3.1	2.8	0.6	41.4
Transverse scrapers	26	2.5	3.1	0.7	69.2
Double scrapers	4	2.6	2.5	0.4	25.0
Convergent scrapers	49	3.0	3.1	0.7	53.1
Points	58	3.2	3.0	0.7	50.0
Denticulates	7	2.6	3.2	0.9	85.7
Perforators	3	3.0	2.3	0.9	33.3
Retouched pieces	64	2.8	2.8	0.6	53.1†
Debitage					
Flakes	284	2.8	2.9	0.6	53.9
Blades	34	3.6	1.4	0.5	–

† Does not include the 3 blades.

- triangular dorsal – 6 complete (Figure 9-6: *12*)
- triangular dorsal, thinned terminal end – 1 complete (Figure 9-6: *7*).

Trapezoidal—35
- semi-trapezoidal dorsal – 9 complete and 6 broken (Figure 9-6: *2, 8, 9*)
- semi-trapezoidal elongated dorsal – 8 complete (Figure 9-6: *1*)
- semi-trapezoidal elongated dorsal, thinned back – 1 complete (Figure 9-6: *10*)
- semi-trapezoidal elongated dorsal, thinned base – 2 complete (Figure 9-7: *8*)
- sub-trapezoidal dorsal – 7 complete (Figure 9-7: *5*)
- sub-trapezoidal dorsal, thinned back and terminal end – 1 complete (Figure 9-7: *6*)
- trapezoidal elongated dorsal – 1 complete.

Unidentifiable (Tiny Tips)—3.

There are obvious differences between complete and fragmented convergent scrapers. First, the smaller number of broken convergent unifacial tools (including points) is because most of them are so fragmented that they are typologically unidentifiable. Second, regarding differences in shape, the main discrepancy is that significant quantities of leaf-shaped tools are broken. On the other hand, their identification is quite certain because they are distal parts. Finally, the absence of any ventrally thinned tools among broken convergent scrapers is caused by their fragmentation. Thus, the recognition of convergent scraper shape is only possible through an analysis of complete specimens.

Although there are many recognized shapes, there is a clear dominance of trapezoidal forms, a moderate number of triangular and crescent forms, but few leaf, ovoid, or rectangular examples (Table 9-6). All but one sub-triangular inversely retouched example have obverse retouch, but unlike the other scrapers, a good number of these have some other form of retouched modification. In addition, 20.4% of these scrapers have additional retouched modifications that normally thin the base or back of the tools. Two scrapers actually have two different kinds of thinning. Of the 118 retouched edges on the 49 complete pieces, about two-thirds have scalar retouch, followed by stepped and sub-parallel retouch. Retouch angles are most often semi-steep, followed by steep and flat (Table 9-4). In these observations, the retouched edges of the convergent scrapers are different from those of the simple and double scraper forms. The convergent scrapers have a significantly higher percentage of stepped retouch and, correspondingly, a lower percentage of scalar retouch than simple and double scrapers. As expected with the high percentage of stepped retouch, there are comparatively few flat retouched edges among the convergent scrapers. At the same time, convergent scraper retouch angles are similar to only transverse scrapers, while simple and double scrapers are very different (Table 9-4). Finally, ventral thinning on convergent scrapers (20.4%) is much more common than on other complete scraper types (2–3.4%).

Metrics of all 49 complete convergent scrapers are found in Tables 9-2 and 9-5. Of all measured pieces, 26 (53.1%) have transverse proportions, which is why the mean width is a little larger than the mean length.

UNIFACIAL POINTS

Of 84 points, 58 are complete and 26 broken; about the same proportions (2.2 : 1) as for scrapers (1.9 : 1). Of these, 61 are on flakes, one on a flake or blade, one on a flake or chip, 6 are on chips, two are on resharpening pieces, and the blank form on 13 of the fragments is unidentifiable. Point types are as follows:

Lateral—1
- lateral dorsal, thinned base—1 complete (Figure 9-7: *2*).

Crescent—8
- semi-crescent dorsal – 4 complete and 1 broken
- semi-crescent dorsal, thinned base – 1 complete (Figure 9-7: *1*)
- semi-crescent dorsal, thinned back – 1 complete
- sub-crescent dorsal – 1 complete (Figure 9-7: *7*).

Hook-Like—6
- sub-hook-like dorsal, truncated-faceted base – 2 complete
- sub-hook-like dorsal, thinned base – 1 complete (Figure 9-7: *10*)
- sub-hook-like dorsal, thinned back and base – 1 complete
- sub-hook-like dorsal, thinned base and terminal end – 1 complete
- hook-like dorsal, thinned back and base – 1 complete (Figure 9-7: *9*).

Triangular—12
- sub-triangular dorsal – 3 complete and 3 broken (Figure 9-7: *4*)
- sub-triangular dorsal, thinned base – 1 complete

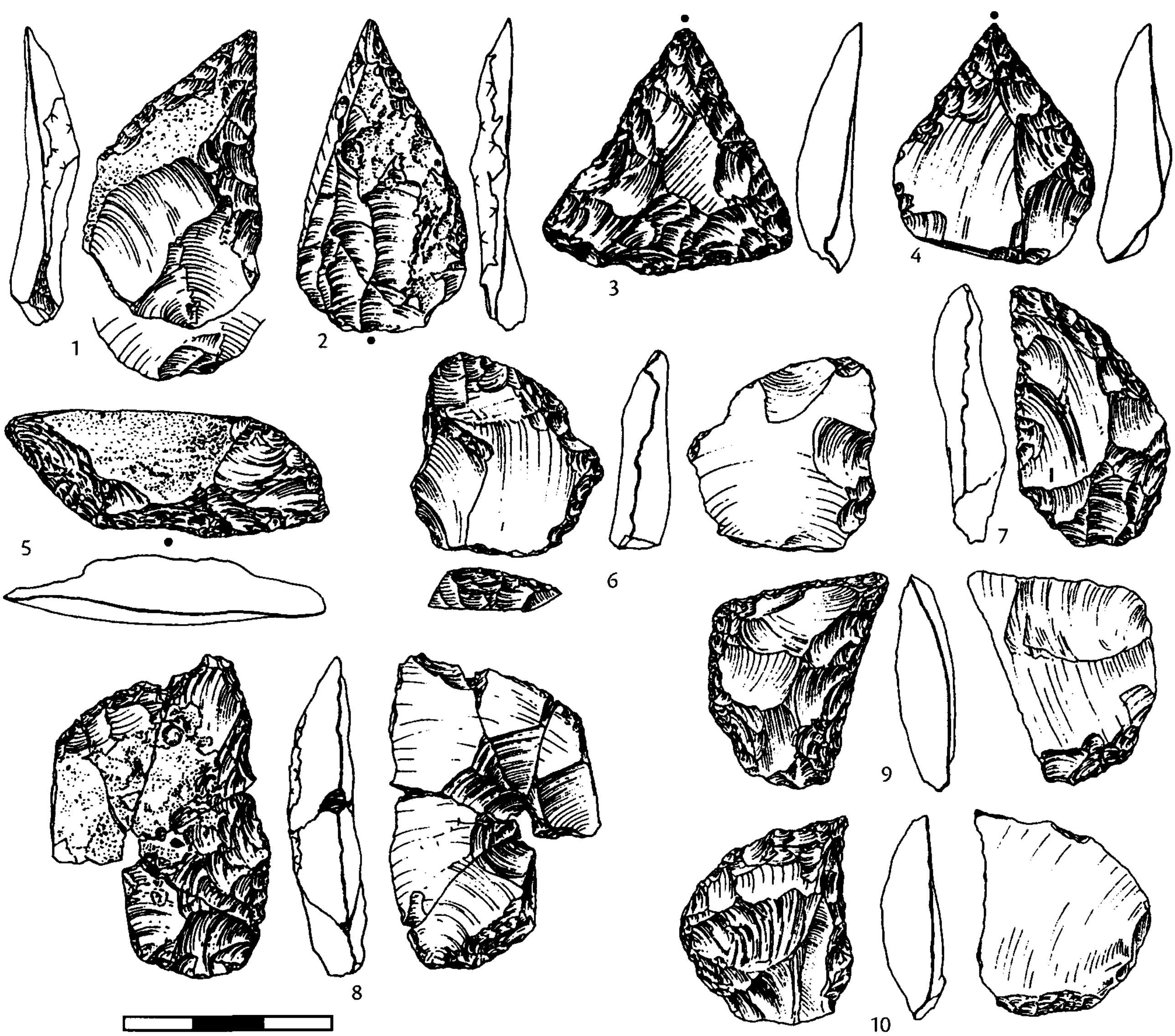


Figure 9-7—Buran-Kaya III Layer B unifacial tools: *1, 2, 3, 4, 7, 9, 10*–points; *5, 6, 8*–convergent scrapers. Items 1, 2, 3, 7, 9, 10 from Level B1; items 4, 5, 6, 8 from Level B.

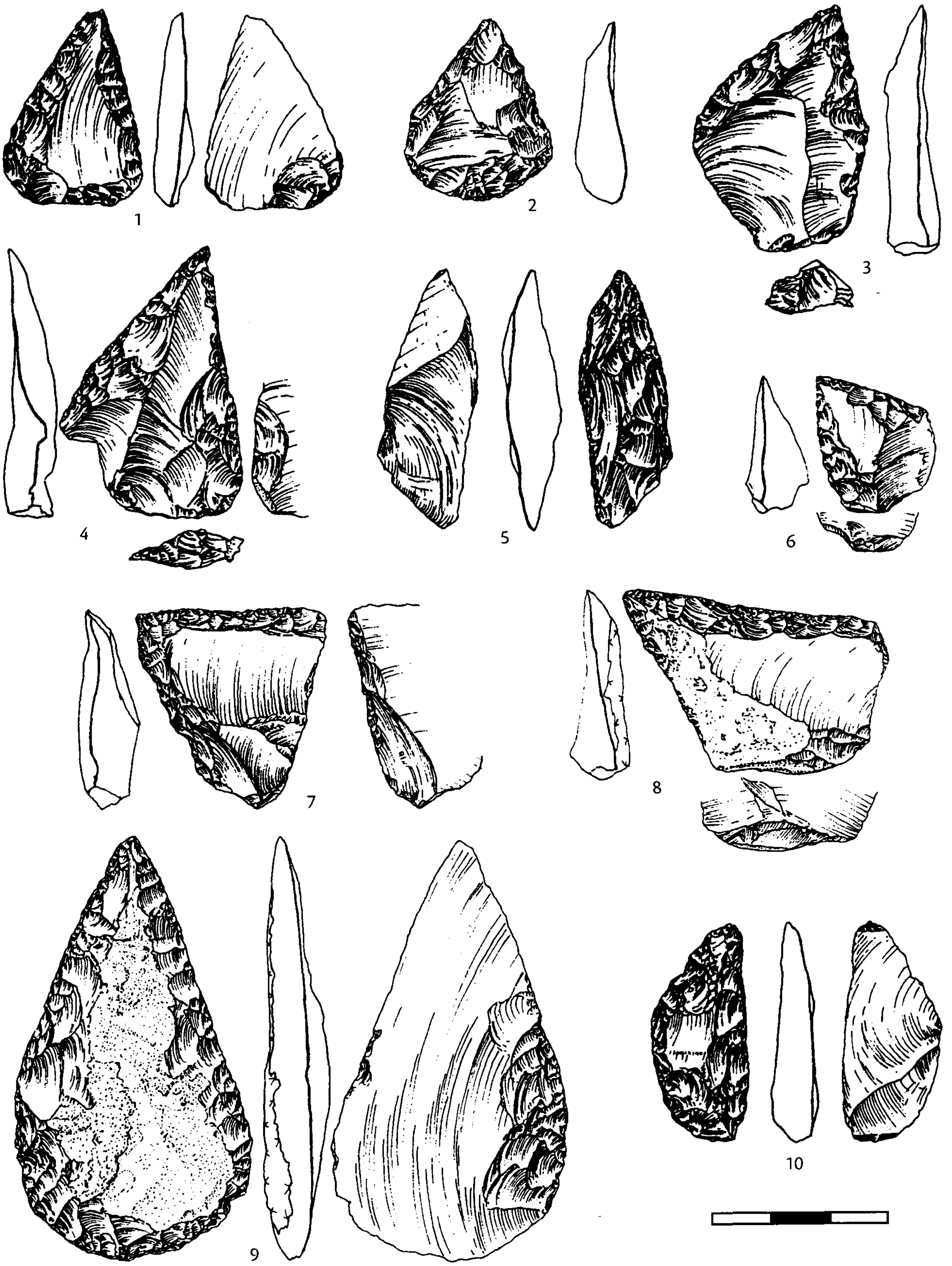


Figure 9-8—Buran-Kaya III Layer B unifacial tools: *1–10*–points. Items 1–6, 8, 10 from Level B1; items 7, 9 from Level B.

- sub-triangular dorsal, thinned back – 1 broken
- triangular dorsal – 2 complete (Figure 9-7: *3*)
- triangular dorsal, thinned base and back – 1 complete (Figure 9-8: *1*)
- triangular alternate, thinned back – 1 complete (Figure 9-8: *7*).

Trapezoidal—27
- semi-trapezoidal dorsal – 7 complete and 7 broken (Figure 9-8: *6, 8*)
- semi-trapezoidal dorsal, thinned base – 1 complete
- semi-trapezoidal dorsal, naturally backed and thinned base – 1 complete
- semi-trapezoidal elongated dorsal – 5 complete (Figure 9-8: *3, 4*)
- sub-trapezoidal dorsal – 1 complete (Figure 9-8: *5*)
- sub-trapezoidal dorsal, thinned base and back – 1 complete
- sub-trapezoidal elongated dorsal – 1 complete
- trapezoidal dorsal – 1 complete (Figure 9-8: *10*)
- trapezoidal elongated dorsal – 1 complete
- trapezoidal elongated dorsal, thinned base – 1 complete.

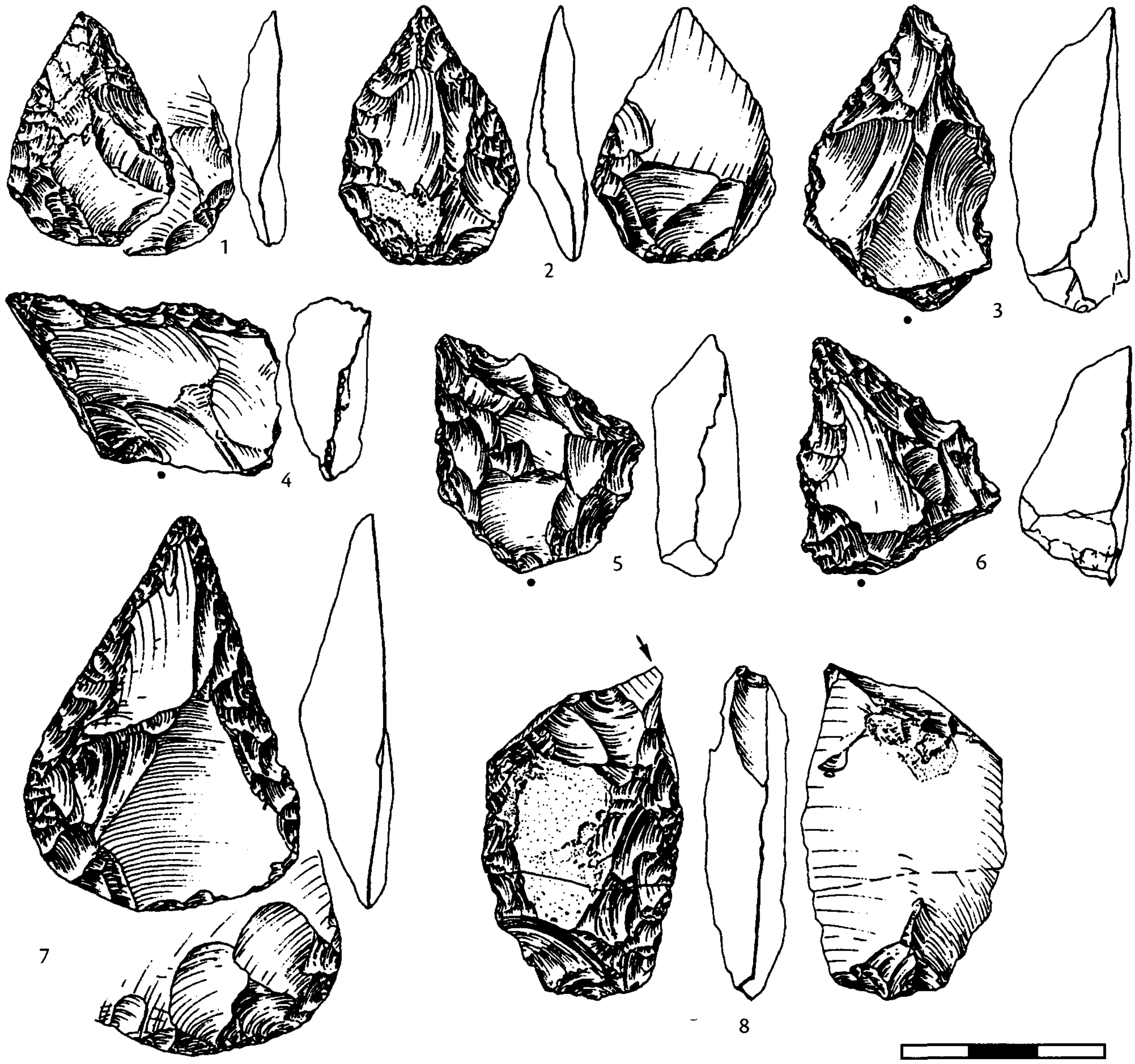


Figure 9-9—Buran-Kaya III Layer B unifacial tools: 1, 2, 7–points; 3, 4, 5, 6,–denticulates; 8–burin. Items 1–3, 5–8 from Level B1; item 4 from Level B.

LEAF SHAPED—17
- sub-leaf dorsal – 1 complete and 1 broken
- leaf shaped dorsal – 8 complete (Figure 9-8: *2*)
- leaf shaped dorsal, thinned back – 1 complete (Figure 9-8: *9*)
- leaf shaped dorsal, thinned base – 2 complete (Figure 9-9: *1*)
- leaf shaped dorsal, thinned base and back – 4 complete (Figure 9-9: *2, 7*).

UNIDENTIFIABLE (TINY TIPS)—13.

The reasons noted above for using only complete pieces for the analysis of convergent scraper morphology are also valid for analysis of points. As with the convergent scrapers, various trapezoidal forms are dominant; but, unlike the scrapers, leaf shapes are common (Table 9-6). Other forms occur only in moderate numbers: triangular, crescent, and hook-like, plus a single lateral example.

As for all the scraper groups, all but one of these have dorsal retouch. The frequency of thinning is high (39.7%) and that is without counting the combinations of two different kinds of thinning on 9 points. Retouch types and angles are dominated by scalar semi-steep retouch (Table 9-4).

These morphological features are significant in comparison with the scrapers. Thinning occurs twice as often on points than it does on convergent scrapers (39.7% versus 20.4%).

Semi-steep retouch occurs more often on points than it does on simple, transverse, and convergent scrapers (Table 9-4). Other attributes do not show such differences, however. Stepped retouch is marginally higher on the points and flat retouch marginally lower. Scalar retouch, again, is only a few percentage points lower than the lowest occurrence among the scrapers (Table 9-4).

Shapes show significant differences, even given the differences imposed by the definitions of scrapers and points (Table 9-6). This also applies to the convergent scrapers, which, intuitively, should be very similar. This is not the case. There are no hook-like scrapers, while such pieces account for 10.3% of all points. The main difference, however, is a radical shift from trapezoidal to leaf shapes. If the trapezoidal and leaf shapes are the most common among the points (34.5 and 27.6%, respectively), the convergent scrapers demonstrate quite different proportions: 59.2% and 4.1%, respectively. Given that other point and convergent scraper shapes are comparable, the differences between the point and scraper shapes directly relates to a decrease in trapezoidal points matched by an increase in leaf-shaped points.

The dimensions of points are found in Tables 9-2 and 9-5 and do not differ much from those of the scrapers.

TABLE 9-6
Shape types of complete unifacial and bifacial convergent scrapers and points (in percentages) in Layer B

	Unifacial convergent scrapers	*Unifacial points*	*Bifacial convergent scrapers*	*Bifacial points*
Lateral	–	1.7%	–	–
Ovoid	2.0%	–	–	–
Rectangular	2.0%	–	–	–
Hook-like	–	10.3%	20.0%	–
Crescent	14.3%	12.1%	20.0%	18.2%
Triangular	18.4%	13.8%	–	–
Leaf-shaped	4.1%	27.6%	20.0%	54.5%
Trapezoidal	59.2%	34.5%	40.0%	27.3%
N	49	58	5	11

UNIFACIAL DENTICULATES

There are 7 complete denticulates and 3 broken. While rare in the assemblage, their secondary treatment is peculiar and important for understanding unifacial tool reduction. Of the 10 examples, 8 are on flakes, 1 is on a blade or flake, and 1 is on a chip:
- straight dorsal – 1 broken
- concave dorsal – 1 broken
- transverse convex – 1 complete (Figure 9-9: *4*)
- double straight dorsal – 1 complete
- semi-trapezoidal dorsal – 3 complete (Figure 9-9: *6*)
- sub-trapezoidal dorsal – 1 complete (Figure 9-9: *5*)
- sub-leaf dorsal – 1 complete (Figure 9-9: *3*)
- semi-rectangular dorsal – 1 broken.

The number of two-edged convergent denticulates is striking. Although the sample is small, it appears that convergent forms are the most common and as for both convergent scrapers and points, there is a dominance of pieces with semi- and sub-trapezoidal shapes. Such shape similarity is also matched by the data on retouch types and retouch angles seen on 15 retouched edges of the 7 complete denticulates (Table 9-4). All denticulates have obverse retouch and none has additional thinning.

The 7 complete denticulates are distinctive in comparison with the scrapers and points, as they have the highest number of transverse pieces (6) and are the thickest (Table 9-5). Length ranges from 2.1 to 3.6 cm, where the longest item (3.6 cm) is the only one exceeding 3 cm. Width ranges from 2.7 to 3.9 cm and there are just two examples less than 3 cm wide: one 2.7 cm and the other 2.8 cm. Thickness ranges from 0.4 to 1.5 cm.

All these observations indicate that the unifacial denticulates exhibit a greater degree of reduction compared to the scrapers and points, and at the same time, have significant similarities to the scrapers and points in their shape and secondary treatment. Therefore, it is reasonable to suggest that most, if not all, denticulates (especially convergent ones) are, in fact, a result of multiple rejuvenations of unifacial scrapers and points. This is a process similar to that described in the production of Quina retouch (Lenoir 1986). Hence, it is assumed that denticulates, as a purposeful tool type, did not exist in the Buran-Kaya III Layer B toolkit.

NOTCHES

Among the notches, 3 are complete and 1 is broken. All are obverse, simple lateral dorsal. The one on a broken blank is on a medial flake fragment with a truncated-faceted edge, suggesting it may have originally been a more complex tool. All are formed by retouch: 1 scalar, 1 sub-parallel, 2 stepped, 1 semi-steep, and 3 steep. No Clactonian notches were noted. Two notches were made on chips, 1 on a blade, and 1 on a blade or flake fragment. The complete specimens have highly variable metrics: 1.8 to 4.8 cm in length, 1.4 to 3.5 in width, and 0.6 to 1.3 cm in thickness.

PERFORATORS

Perforators are rare (3 items) but typologically interesting. In contrast to the usual Middle Paleolithic perforators with small and isolated pointed tips, these have retouch well down each side of the perforating point onto the blank and no difference in retouch quality between the tip and other retouched edges. Thus, these possibly are examples of a last rejuvenation stage for unifacial scrapers and points when the tips of these pieces were resharpened, forming a very pronounced and protruding perforator-like tip. Accordingly, the presence of intentionally manufactured perforators here is doubtful. It is also worth noting that some Middle Paleolithic industries with numerous unifacial convergent scrapers and points are also characterized by perforators, interpreted as rejuvenated points and scrapers. For example, see the perforators of subtypes 34a and 34d for the Zagros Mousterian industry of layer D at Shanidar Cave (Iraq) (Solecki and Solecki 1993:26-127, Fig. 4.8: a-c, h).

Each perforator is different: there is one that is subtriangular with a thinned terminal end (Figure 9-10: *1*), one that is trapezoidal with a truncated-faceted base (Figure 9-10: *3*), and one that is elongated trapezoidal elongated with a natural back (Figure 9-10: *2*). The retouch types and angles for the combined retouched edges are scalar and stepped (50% each), semi-steep (25%), and steep (75%). The perforators are 3.9, 2.7, and 2.3 cm long; 2.0, 2.2, and 2.7 cm wide; and 0.8, 1.2, 0.6 cm thick.

ENDSCRAPERS

One endscraper is complete (Figure 9-10: *5*), the other broken. These are obversely retouched, canted endscrapers on flakes with short, transverse proportions: 2.0 and 2.1 cm long, 3.4 and 3.0 cm wide, and 0.4 and 0.9 cm thick. Each of these has an endscraper-like, rounded, and rather narrow retouched edge situated along one of the lateral edges and, moreover, the edge is directly adjacent to the distal end that is also retouched. Thus, both specimens could have been classified as semi-trapezoidal scrapers. The presence of the endscraper-like convex and narrow retouched edge, nevertheless, permits us to call them atypical endscrapers.

BURINS

There were only 2 burins, both on flake fragments, which had clear burin spall scars. Both are typologically angle burins. These items, most likely, are not genuine burins. One of them (Figure 9-9: *8*), without taking into consideration the single-edged burin-like facet, is a unifacial double convex, bi-truncated-faceted scraper with stepped and semi-steep retouch and a scalar and flat retouch. In this case, the burin facet probably resulted from an unsuccessful removal of one of the truncated-faceting scars struck from the blank's distal end. The other piece has two burin-like facets removed from the flake's distal breakage, but these facets removed no more than one-third of the whole length of the flake's lateral edge and the remaining two-thirds of its edge has stepped and semi-steep retouch. This suggests the possibly of a simple convex scraper with an unsuccessful attempt of additional thinning from the distal end. On the other hand, typologically, both are burins, although probably not purposeful.

In sum, although there are typologically clear Upper Paleolithic tool types (perforators, endscrapers, burins) in this toolkit, they are proportionately rare among the unifacial tools (2.6%). More importantly, there are no serious morphological grounds to suggest the presence of purposefully and repetitively-made Upper Paleolithic tool types here. As discussed above, they resulted most likely from different variations of unifacial scraper and point secondary treatment and rejuvenation.

RETOUCHED PIECES

Retouched pieces account for a significant proportion (24.4%) of all tools (Table 9-3). They are divided between those with regular, continuous, or partial retouch on one or more edges and those where the retouch is irregular and discontinuous. The latter most probably are from usewear, rather than purposeful retouch, although even those with continuous retouch could have been formed by use. Marginally retouched pieces are evenly split between whole blanks (31) and broken blanks (29) and this pattern pertains as well to the irregularly retouched pieces (33 whole and 29 broken). With the exception of three examples, all retouch is obverse, although one piece has alternate retouch and another has a thinned base.

For the marginally retouched pieces, 29 are on flakes, 4 are on blades, and 14 are on chips, while for 13 the blank is either unknown or questionable. For the irregularly retouched pieces 43 are on flakes, 3 are on blades, 9 are on chips, while 7 are on unidentifiable blank fragments. When the complete blank sample is considered, 53.1% are transverse—wider than they are long (Table 9-5). This is certainly related to the high percentage of blanks that came from bifacial shaping and thinning (49.2%).

Using a scraper construct, the majority of marginally and irregularly retouched pieces (61.5%) have only one modified lateral edge, 22.1% have a single modified transverse edge, 8.2% are bilaterally retouched, and 8.2% have bilateral converging retouch.

Retouched Pieces with Marginal Retouch The position and completeness of the retouch for all retouched pieces with marginal retouch are:

- lateral continuous – 30 (Figure 9-10: *6, 7*)
- lateral ventral continuous – 1
- lateral discontinuous – 5
- lateral and distal continuous – 2
- lateral and distal discontinuous – 2
- distal continuous – 8
- distal discontinuous – 4
- distal and lateral ventral discontinuous – 1
- sub-trapezoidal elongated (3 edges) continuous – 1
- bilateral continuous – 2 (1 is denticulated)
- bilateral alternate continuous – 1
- sub-triangular alternate continuous – 1
- bilateral ventral continuous – 1 (denticulated)
- lateral ventral continuous – 1.

Retouched Pieces with Irregular Retouch The completeness and position of the retouch for all retouched pieces with irregular retouch are:

- lateral partial – 35
- distal partial – 7 (1 with thinned base, Figure 9-10: *4*)
- lateral continuous – 1
- proximal partial – 1
- bilateral partial – 5
- bilateral alternate – 1
- distal partial – 1
- distal and lateral partial – 3
- ventral lateral continuous – 2.

Given the number of converging examples and the parallel between scraper forms and the continuously retouched forms, it is possible these represent initial stages of unifacial tool formation.

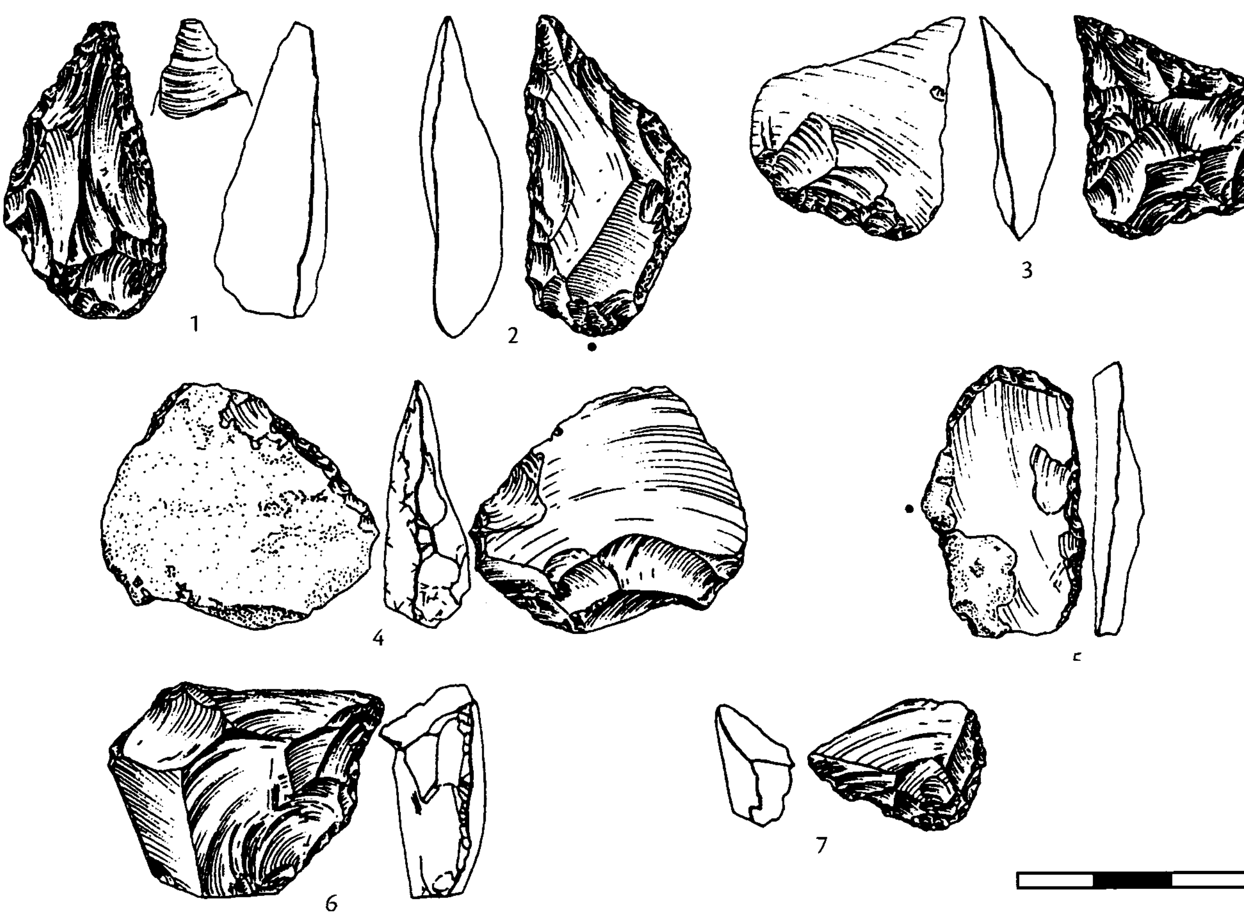


Figure 9-10—Buran-Kaya III Layer B unifacial tools (1, 2, 3, 5) and retouched pieces (4, 6, 7): *1–3*–perforators; *4*–retouched piece with dorsal distal irregular partial retouch and thinned base; *5*–atypical end-scraper; *6–7*–specially transversally fragmented retouched pieces with dorsal lateral marginal retouch. Items 2, 3, 5 from Level B1; items 1, 4, 6, 7 from Level B.

Bifacial Tools

Classification of all 73 bifacial tools according to the different tool groups (preforms, points, scrapers, denticulates) is presented in Table 9-3.

Among the bifacial tools there are 28 points (59.6%), 9 scrapers (19.1%), two denticulates (4.3%), and 8 preforms (17.0%). In addition, there are 26 fragments of bifacial tools that are too small and incomplete to permit classification into recognized types, so they have been classified as point/scrapers (Table 9-3). The bifacial tools differ significantly from the unifacial tools: there are almost twice as many scrapers as points. Another difference is that there is a higher ratio of broken to complete bifacial tools (2.2 : 1) than is the case for unifacial tools (0.9 : 1). A possible explanation for this will be discussed below, after the description of the samples. Of all 23 complete pieces, the original blank form could be recognized on only 4 (2 flakes and 2 plaquettes), because most had surfaces extensively covered by numerous preparation and retouch scars.

BIFACIAL PREFORMS

The one complete example of a bifacial preform (Figure 9-11: *7*), on heavily patinated flint, is 4.4 cm long, 3.5 cm wide, and 1.6 cm thick. It was evidently broken longitudinally but then reutilized by some secondary treatment. Its blank form is unidentifiable. Although it has some primary cortex on one surface, it is uncertain whether it was a plaquette or a primary flake. Its treatment in a probable plano-convex technique permits its classification as a bifacial preform with clear analogies to different Crimean Micoquian facies (e.g., Marks et al. 1996). The 7 fragments include 2 on plaquettes, but most have only rough shaping scars, indicating breakage during early stages of reduction.

BIFACIAL POINTS

The complete bifacial points include 2 on flakes. The other 9 are too completely covered with large shaping and retouch flake scars to distinguish whether they were made on flake or plaquette blanks. All were produced by a plano-convex reduction technique. By shape and secondary treatment, they are:

- leaf-shaped – 1
- leaf-shaped, truncated-faceted base – 1 (Figure 9-11: *3*)
- sub-leaf-shaped – 1 (Figure 9-11: *2*)
- semi-leaf-shaped (reutilized) – 3 (Figure 9-11: 7)
- trapezoidal elongated – 1 (Figure 9-11: *5*)
- trapezoidal elongated, alternate – 1
- sub-trapezoidal elongated (reutilized) – 1
- semi-crescent, thinned and concave (notched) base – 1 (Figure 9-11: *4*)
- semi-crescent, alternate (reutilized) – 1 (Figure 9-11: *6*)
- unidentifiable (distal parts and tips) – 17 (Figure 9-12: *2*, *9*).

Various leaf-shaped points account for just over half of the sample (Table 9-6). These are recognized, when whole, by being symmetrical and almost perfectly leaf-shaped. On the other hand, such points tend to be medially broken and when the broken part is reutilized/rejuvenated with fine retouch, the resulting shape becomes semi-leaf. The only exception is the sub-leaf point, which has no retouched distal end. This relates most likely to the tool's original blank shape and its overall delicacy. All leaf-shaped points are exclusively characterized by bifacial plano-convex technique retouch from initial shaping through final retouching. One of the leaf-shaped points is also notable by a clear truncated-faceted base.

Trapezoidal elongated points are similar to leaf-shaped ones because of their similar reduction. This refers to both complete plano-convex reduced points on flake blanks and to reutilized trapezoidal points. One burned example, however, has a peculiar plano-convex-alternate retouch where each of the two converging edges was treated with the plano-convex technique, but different sides were used for shaping and retouching. Such an uncommon bifacial reduction technique is evidence of the piece's multiple usage and rejuvenation, and should not be considered a special reduction technique.

One of the semi-crescent points with bifacial, plano-convex-alternate reduction and some medial reutilization emphasizes the former suggestion that it represents a long use-life. Another intact semi-crescent point (Figure 9-11: *4*) has considerable thinning and a resulting basal concavity (approaching a notched form) with a flute-like scar coming from it on a convex surface, resembling a North American Paleo-Indian Clovis point. These bifacial points range in length from 3.2 to 5.5 cm, in width from 2.1 to 3.8 cm, and in thickness from 0.6 to 1.3 cm (Table 9-7). They average 4.13 cm long, 3.05 cm wide, and 1.03 cm thick.

Distal fragments of points range from tips no longer than 1.5 cm to one greater than 3.0 cm (Figure 9-12: *2*). While all were formed with a plano-convex technique, two exhibit a plano-convex-alternate technique (Figure 9-12: *9*).

BIFACIAL SCRAPERS

Bifacial scraper blanks include 2 on plaquettes and 7 too heavily reduced to be identifiable. The following types, all produced by a plano-convex technique, are found:

- convex (reutilized) – 2 (Figure 9-12: *8*)
- convex, naturally backed (reutilized) – 1 (Figure 9-12: *1*)
- double convex, thinned base and terminal end/bi-truncated-faceted – 1

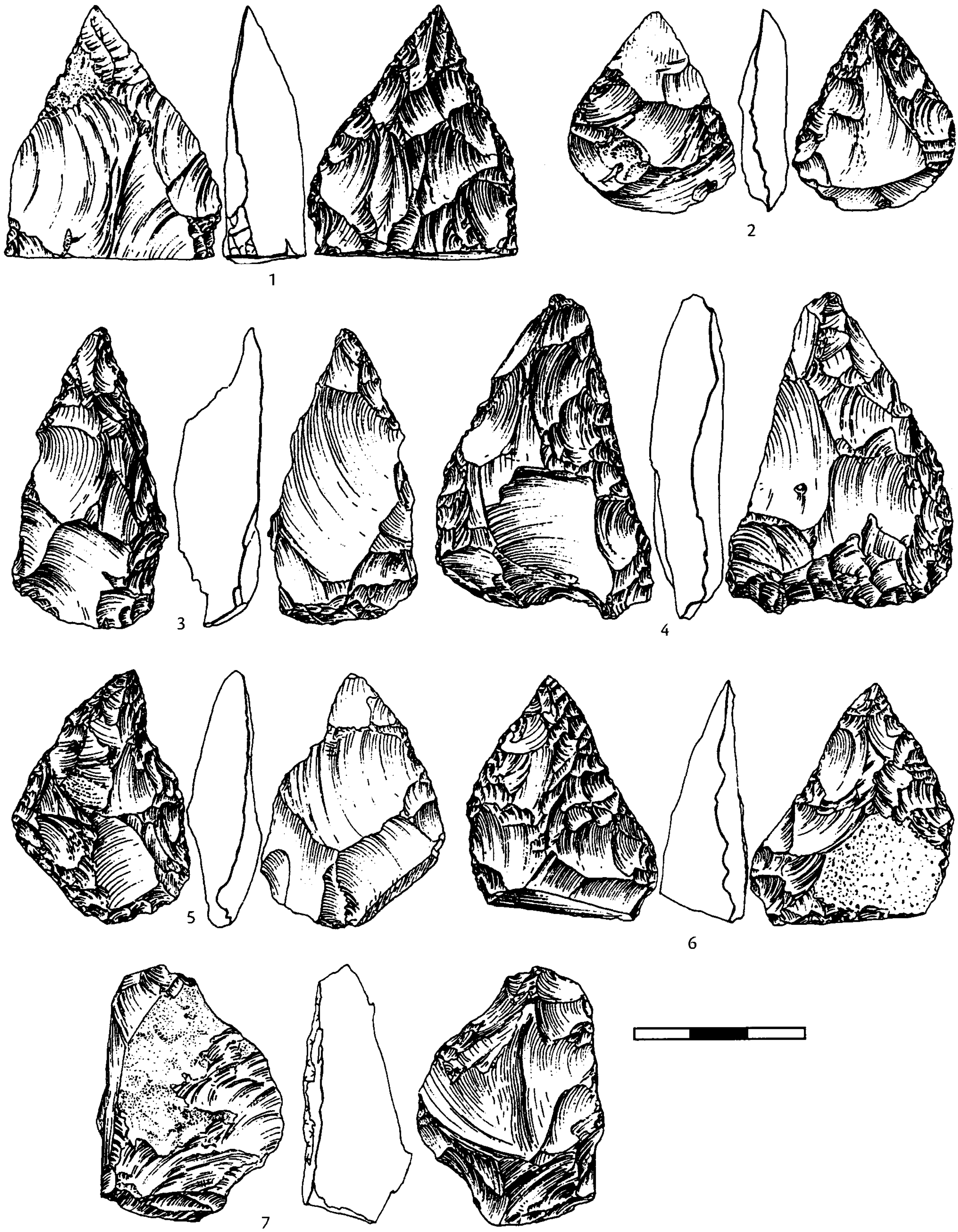


Figure 9-11—Buran-Kaya III Layer B bifacial tools: *1-6*–points; 7–preform. Items 1, 2, 4, 7 from Level B1; items 3, 5, 6 from Level B.

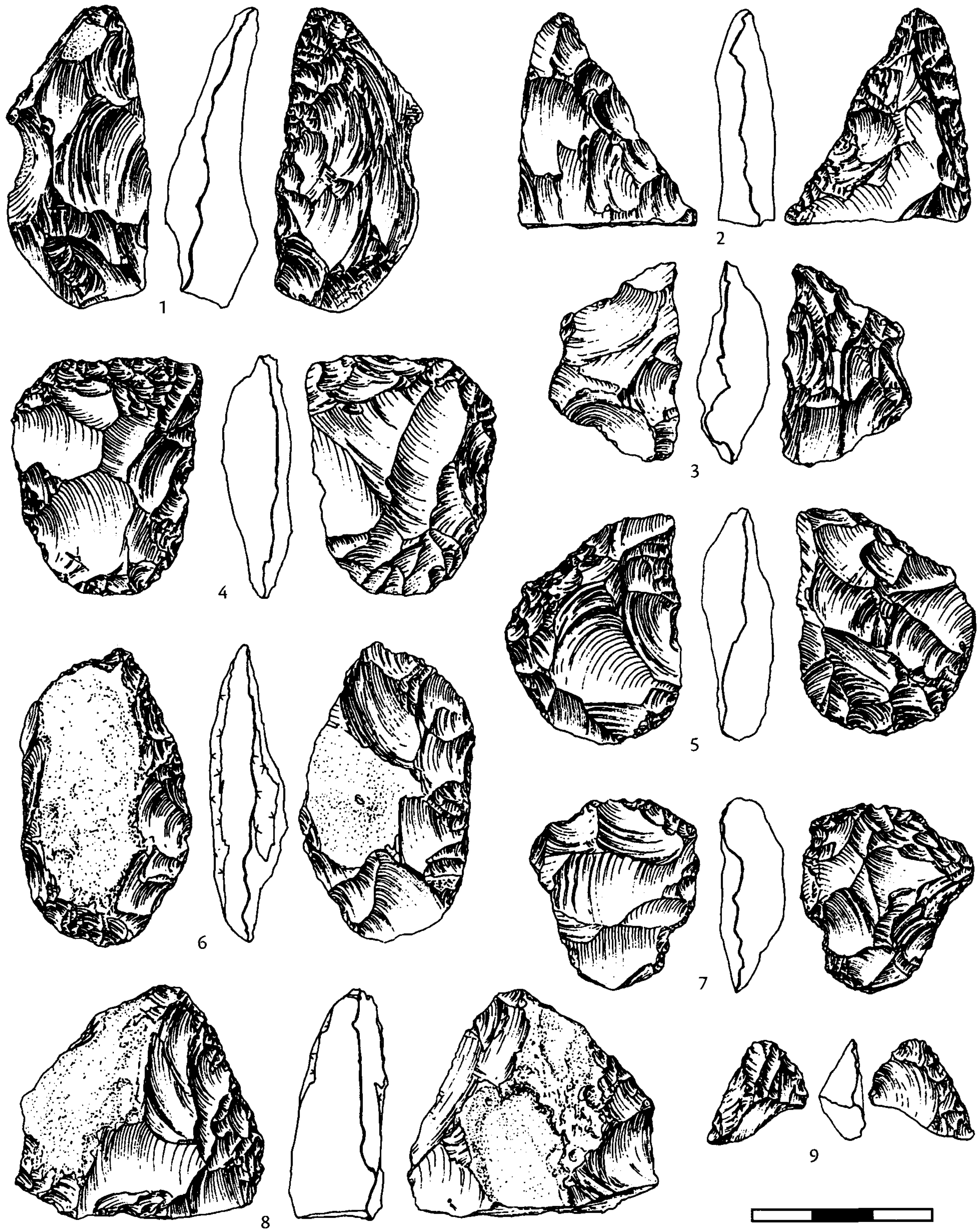


Figure 9-12—Buran-Kaya III Layer B bifacial tools: *1, 4, 5, 6, 8*–scrapers; *3, 7*–denticulates; *2*–point (distal part); *9*–point (distal tip). Items 1–5, 7, 9 from Level B1; items 6, 8 from Level B.

TABLE 9-7
Average metrics (in cm) of bifacial tool groups in Layer B of Buran-Kaya III

	N	*Length*	*Width*	*Thickness*	*Transversal items (%)*
Preform	1	4.4	3.5	1.6	—
Single-edged scrapers	3	4.2	3.1	1.3	33.3
Double-edged scrapers	1	4.2	2.9	0.9	—
Convergent scrapers	5	3.8	2.9	1.1	—
Points	11	4.1	3.1	1.0	9.1
Denticulates	2	2.5	3.0	1.0	50.0

- semi-leaf-shaped, thinned oblique base (reutilized) – 1
- trapezoidal elongated – 2 (Figure 9-12: *4*)
- sub-crescent – 1 (Figure 9-12: *6*)
- hook-like, alternate – 1 (Figure 9-12: *5*).

Simple scrapers and convergent ones occur about equally. The simple scrapers are characterized by either a significant reutilization of a broken lateral and/or medial section for single-edged items or a multiple rejuvenation of the double-edged piece by transforming a sub-trapezoidal scraper into a double one. This permits the suggestion that the simple scrapers are, in fact, initially convergent scrapers, broken pieces of which were subsequently used as blanks for an additional simple scraper edge.

The convergent scrapers (55.6%), aside from a single hook-like plano-convex-alternate form, are comparable in shape to the bifacial points (Table 9-6). Trapezoidal and crescent pieces, however, are regularly and thoroughly retouched by both rough treatment (forming the plano surface) and retouch (the convex surface). On the other hand, leaf-shaped and hook-like scrapers are different. The leaf-shaped specimen was broken and then reutilized, resulting in an accidental semi-leaf shape. The hook-like piece has both good secondary retouch, as well as a rounded base formed by an alternate plano-convex technique. This shift in technique indicates multiple usage and/or rejuvenation.

Thus, it is possible to see the same general characteristics for the bifacial scrapers as for the bifacial points and it is probable that some would have been points had they not been broken and then rejuvenated. Measurements of the bifacial scrapers are as follows: length = 3.3 to 4.9 cm (mean = 3.99 cm); width = 2.3 to 4.0 cm (mean = 2.96 cm); and thickness = 0.9 to 1.5 cm (mean = 1.16 cm). The somewhat smaller length and width values of the scrapers as compared to the points (Table 9-7), again, suggest that some were merely rejuvenation points.

BIFACIAL DENTICULATES

While it is quite unusual to classify bifacial tools as denticulates in Middle Paleolithic assemblages, distinguishing heavily denticulated plano-convex tools in a toolkit will most likely help define some peculiarities of secondary treatment and rejuvenation performed on bifacial tools, at least in this assemblage. These denticulates are trapezoidal plano-convex specimens. They are on unidentifiable blanks (Figure 9-12: *3, 7*), 3.0 and 2.0 cm long, 2.8 and 3.2 cm wide, 0.9 and 1.0 cm thick. The first piece is trapezoidal elongated, although the elongation is more related to our subjective judgment about tool orientation than any knowledge of actual use orientation. These denticulates are interesting in that their lengths and widths are smaller than most of the bifacial points and scrapers. This suggests they under went greater rejuvenation. Accordingly, the denticulated edges are interpreted to be final preparation attempts for further reduction that was not realized and therefore, the denticulation was preserved. The thickness of these pieces is about 1.0 cm, basically corresponding to the usual thickness for all bifacial tools in this assemblage. Metrical parameters are best seen through mean dimensions—3.95 cm long, 3.03 cm wide, 1.09 cm thick—as there are no large differences between the particular tool groups here (Table 9-7).

In summary, the high proportional occurrence of fragmentary bifacial tools, with denticulations, with thinning, etc., all point to intensive bifacial tool production but, more importantly, to extensive and intensive tool reformations and rejuvenation.

SPECIFIC WASTE FROM TOOL REJUVENATION

Aside from the oft noted presence of bifacial shaping and thinning elements as tool blanks, in terms of tool treatment waste, the assemblage is distinctive in its numerous rejuvenation products from the tips of unifacial and bifacial convergent tools (see Table 9-1): 134 examples (0.8% of the whole assemblage). These rejuvenation pieces serve as very clear indications of multiple on-site resharpening of retouched edges from both unifacial and bifacial convergent scrapers and more often, from points. They serve as evidence for the transformation of convergent tool shapes during rejuvenation.

This peculiar tool rejuvenation waste is usually a chip with a maximum width and length less than 3 cm. It is morphologically characterized by an expanding shape, most predominantly transverse, and almost always rhomboidal, where one of two transversal terminations is represented by a retouched pointed tool tip, while the second transverse termination does not bear any retouch. Unifacial tool tips have retouch only on the dorsal surface of one of two triangular transverse terminations (Figure 9-13: *1, 3, 4, 8*), while bifacial rejuvenation pieces have rough scars and retouch scars on both ventral and dorsal surfaces of one of the two triangular terminations (Figure 9-13: *2, 9, 10*). There are virtually twice as many examples from unifacial tools as from bifacial ones. Yet, the extremely small size of some of these makes them difficult to recognize, so this ratio may not be meaningful. It is also important to note that these specific rejuvenation pieces of both unifacial and bifacial convergent tool tips are not chips derived from intentional removal of the tips. Rather, they are real chips from resharpening edges adjacent to tips, resulting from strong blows, instead of a detachment of a tiny portion of a retouched edge.

As a rule, pieces derived from different secondary treatment and/or rejuvenation of unifacial and bifacial tools in European Lower and Middle Paleolithic assemblages, are usually, if at all, published as bifacial shaping and thinning flakes—e.g., the French Acheulian (Bordes 1961: fig. 1, 6 for Cagny); the Mousterian of Acheulian tradition, type A (Bordes 1961: fig. 1, 8; Bordes 1972: fig. 26, 1–4 for Pech de l'Azé I, layer 4); the Central European Micoquian (Wetzel and Bosinski 1969: Tafel 16, 6, 9 for complex IIIa of Bockstein cave; Mania and Toepfer 1973: Tafel 22, 1-13; Tafel 31, 3 for complex A of Königsaue; Richter 1997: Tafel 20, 8-9 for G-complex of Sesselfelsgrotte). On the other hand, specific rejuvenation pieces from bifacial and unifacial convergent tool tips are either not defined at all or very rarely illustrated in publications, e.g., the German Micoquian (Wetzel and Bosinski 1969: Tafel 18, 10-12, 14-15; Tafel 19, 2, 9; Mania and Toepfer 1973: Tafel 29, 4; Richter 1997: Tafel 102, 6), as well as the Zagros-like Mousterian industry of Erevanskaya Cave in Armenia (Eritsyan 1972: Fig. 14, 15, 16). The scarcity of identification of these specific tool resharpening waste products is mainly due to their being either simply included into a common

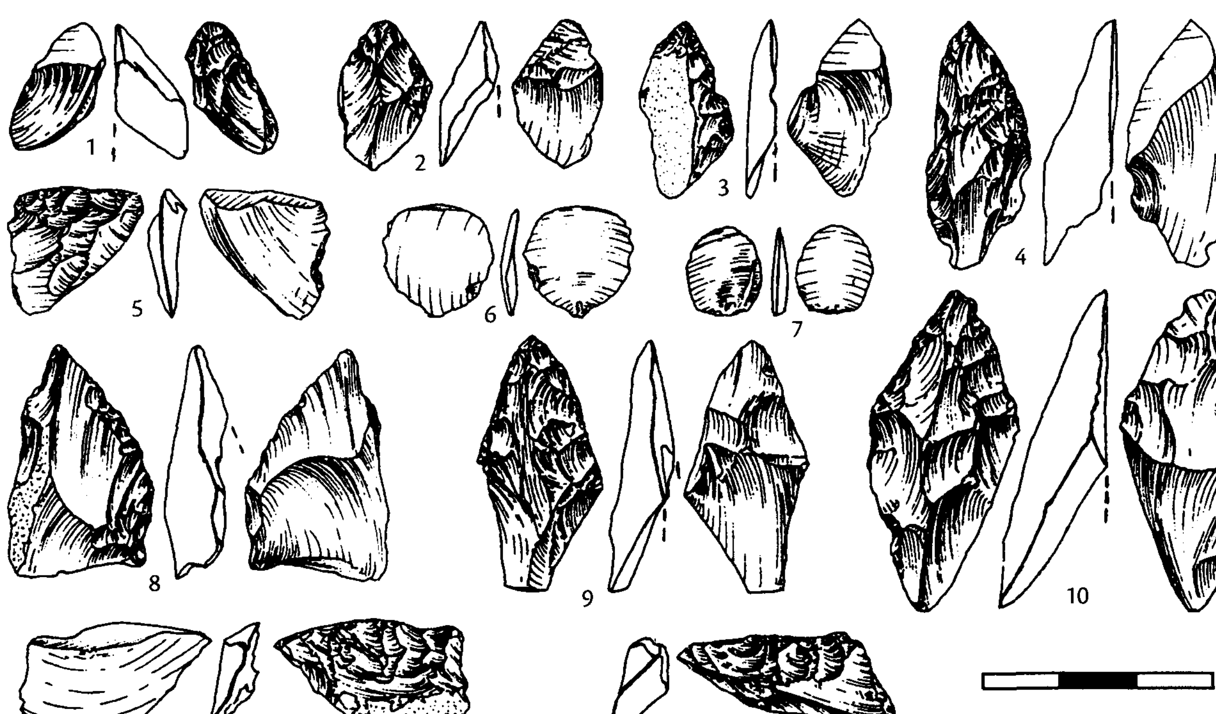


Figure 9-13—Buran-Kaya III Layer B specific waste from the rejuvenation of tools: *1, 3, 4, 8*–rejuvenation pieces of unifacial convergent tools' tips; *2, 9, 10*–rejuvenation pieces of bifacial convergent tools' tips; *5, 12*–peculiar retouch chips on tools' lateral edges fine resharpening; *6, 7*–"Janus/Kombewa" chips on unifacial tools' basal ventral thinnings; *11*–peculiar retouch chips on tool's lateral edges radical resharpening. All items from Level B1.

category of retouched pieces, with no special attention paid to them (e.g., as was done for the level 1 assemblage of Starosele, western Crimea, e.g., Marks and Monigal 1998) or as a surprising classification as "fragments of different tool terminal parts" as was done by V. N. Stepanchuk for the Ak-Kaya and Kiik-Koba facies of the Crimean Micoquian (e. g., Stepanchuk 2002: table XXXIX for Prolom-I rockshelter, eastern Crimea). At the same time, the paucity of these items in many Middle Paleolithic assemblages could be explained by a lack of significant tool rejuvenation on site, so their recognition is important.

Chippage

Taking into consideration the specific waste from tool rejuvenation, the large numbers of chips need to be discussed, bearing in mind their origins: from core reduction, tool shaping, or from rejuvenation/resharpening episodes, both unifacial and bifacial (Figures 9-4: *3*; 9-5: *3, 4, 10*; 9-6: *1, 8, 12*; 9-7: *10*; 9-8: *6, 8*; 9-13: *5, 6, 7, 11, 12*) . At first sight, the subdivision of chippage (all pieces less than 3.0 cm in greatest dimension) into two general categories of normal chips and by-products of bifacial shaping/thinning pieces used for Crimean Middle Paleolithic studies (Chabai and Demidenko 1998:40) seems simple. The main morphological features of the bifacial rejuvenation/resharpening chips, such as lipped platforms with abrasion and acute angles, proximally originating small dorsal scars, generally incurvate and twisted profiles, and thin bodies work quite well for pieces over 3.0 cm in length. On the other hand, for pieces less than 1.5 cm, there are a number of morphological problems. These smallest items are often characterized by an ambiguous condition (complete or broken), poorly definable dorsal scar patterns (as, for example, traces of platform abrasion—a consequence of retouching and resharpening tools) that cannot be distinguished from actual dorsal scars of previously removed pieces, and tiny platforms where the characteristics are unclear. Thus, for these smallest items, one can only define some small rejuvenation by-products of unifacial and bifacial convergent tool tips (Figure 9-13: *1, 2, 3, 4, 8, 9, 10*), and the rare Janus/Kombewa chips from ventral basal thinning of unifacial tools (Figure 9-13: *6, 7*; see also Demidenko 2000: fig. 8: 7).

It was decided, therefore, to subdivide the 15,466 chips into two subgroups by size: under 1.5 cm (68.9%) and 1.5–2.9 cm (31.1%). This considerable numerical difference between the subgroups points to a dominance of intensive tool maintenance. This view is reinforced when the sample of the smallest chips (66.9%) is considered with all other debitage. Both the number of chips and their variety indicate intensive reutilization and rejuvenation of bifacial and unifacial tools. Therefore, the most likely secondary reduction processes were characterized by a transformation of many simple and transverse scrapers into convergent scrapers and points.

Major Technological and Typological Trends and General Patterns of Raw Material Exploitation

Taking into consideration all the above data, it is clear that a primary feature of the Buran-Kaya III Layer B lithic assemblage is the extreme exhaustion of all products of primary and secondary reduction through multiple re-preparations and rejuvenation/resharpening. Such a high degree of reduction was caused by both the considerable distance of the rockshelter from high quality flint sources and a high intensity of occupation. These two factors are responsible for the observed characteristics of each artifact category, as summarized below.

The final stages of primary flaking is, at best, seen on small-sized cores, reflecting opportunistic flaking with the removal of only one or two flakes from very exhausted striking platforms and flaking surfaces. From a purely typological approach, it is also important to note the absence of pre-cores, the use of parallel flattened and transverse cores without supplementary lateral platforms, and the paucity of radial and discoidal cores. Thus, both the primary flaking methods and the overall reduction pattern of cores produced generally small flakes. The complete flakes with no secondary treatment have mean dimensions of less than 3 cm (2.81 cm long, 2.89 cm wide) with only 5.3% being longer than 3.0 cm and 7.1% wider than 3.0 cm. There is a prevalence of transverse flakes (53.9%). The blade index (Ilam) within the debitage is only 11%. Adding blanks for unifacial tools (4.3%) and retouched pieces (5.8%), the assemblage's real blade index is even lower (9.1%). All the morphological and metric data indicate the absence of a separate blade production strategy. Rather, they were struck from the same cores as the flakes were. This is confirmed by their faceting indices, which are fully comparable with the flake faceting indices: IF = 40.3 and 34.6, IFs = 13.7 and 15.4 for flakes and blades, respectively.

At the same time, cores were not the exclusive source of all debitage and blanks in the assemblage. As clearly seen by the morphological features of platforms (lipping, angle, abrasion caused by a soft hammer flaking), it is certain that a large number of blanks/debitage were detached during initial bifacial tool formation and shaping, as well as during rejuvenation. While the actual percentages are not high (29.3% of the flake debitage, 13.8% of the blade debitage, 25.4% of the unifacial tools, and 49.2% of the retouched pieces), the technique of reduction needs to be considered. This technique is traditional for European Micoquian bifaces and results in a plano-convex cross-section (e.g., Bosinski 1967; Boëda 1995). It consists of a series of operational steps on a blank—usually a flake or a plaquette. First, there is a detachment of relatively large flakes and some chips from the blank's ventral surface (technologically, the plano surface) and second, an intensive formation of the convex surface of the blank's dorsal surface by the removal of differently-sized flakes, chips, and perhaps some blades (Chabai and Demidenko 1998:50). As a result, the number of removals struck from the dorsal surface of these bifacial tools is much greater than the number of removals from the ventral plano surface, minimally with a ratio of 4–5 : 1. Thus, the percentage of all debitage derived from the plano surface of bifacial tools does not exceed 20 to 25% of all by-products detached during formation, shaping, and rejuvenation. The by-products from the plano surface lack morphological characteristics associated with bifacial reduction/rejuvenation. In those rare cases where such removals were refitted onto the plano surfaces of bifacial plano-convex tools (Demidenko and Usik 1993: fig. 2.2, 1995: fig. 2.2), they have no characteristic features of bifacial production by-products such as platform lipping, angle, and abrasion, and they are generally flat in profile. They could come from any type of reduction. This means that of all large removals (≥ 3 cm) from bifacial plano-convex tools, it is theoretically possible to define only about 75–80% as originating from the convex surface treatment. Moreover, experimental replication of five British Upper Acheulian handaxes (Bradley and Sampson 1986), using a hard hammer mode and a quartzite hammerstone application, showed that only 23% in this wholly bifacial waste sample could be so classified (!). These data came from a typical Acheulian biconvex reduction technique that, by definition, should permit a greater number of recognizable bifacial flakes than would be the case in plano-convex reduction. Thus, the bifacial thinning flakes in the Buran-Kaya III Layer B debitage are of importance in a quantitative sense. Taking into account the many regular flakes and blades (the waste products of any flint reduction), it may be supposed that the debitage is actually equally divided between products of core reduction and of bifacial tool production.

Almost half of the blanks that would subsequently become retouched pieces were produced during biface tool shaping and reshaping (49.2%), which is very important in this context. Since perhaps no retouched piece was brought into the rockshelter already retouched, all these pieces were used as initial tools, with all subsequent reduction carried out on-site. On the other hand, it is also obvious that some unifacial tools were brought into the rockshelter and therefore, the proportion of bifacial tool reduction blanks among unifacial tools (25.4%) does not reflect their true role within the total debitage sample produced at the site. Thus, it would not be an exaggeration to claim that the by-products of bifacial tool production were dominant, in comparison to blanks produced from cores.

The above suggestions can be elucidated using a series of ratios for different combinations of artifact classes (Table 9-8). The ratio of debitage + unifacial tools + retouched pieces to cores + identifiable bifacial tools (18.7 : 1) seems most realistic, given the small size of all cores and plaquettes, the reduction of which produced many larger chips, not to mention tiny chips. The ratio between these chips and debitage (including unifacial tools and retouched pieces) is 5.3 : 1. It is also worth noting the four other ratios involving these larger chips (1.5– 2.9 cm) shown in Table 9-8, which confirm that there was a great deal of reduction going on at the site. Thus, there are a number of factors pointing to a very significant intensity of flint reduction, seen through both primary reduction of cores/plaquettes and of bifacial pieces. This conclusion is further strengthened by additional information on tool production and rejuvenation.

Considering the importance of chips to the understanding of the assemblage, it cannot be forgotten that the vast majority small-sized chips (≤ 1.5 cm) were recovered during both excavation and double screening of sediments but not from flotation that would have significantly increased the sample of pieces less than 1.0 cm. Of course, while many of these chips were the result of primary flaking, it seems apparent that more than half were the result of tool production and rejuvenation.

The high incidence of broken tools—both bifacial and unifacial—is also important here; these data have been presented in previous sections by tool classes. The significant proportions of broken tools within all classes strongly indicate a high intensity of utilization and rejuvenation.

In addition, an important indicator of very intensive on-site tool rejuvenation and resharpening is the large number of rejuvenation products of unifacial and bifacial convergent tools compared to the actual number of convergent unifacial and bifacial tools (Table 9-8). There are 1.6 unifacial products per unifacial convergent tool and 0.5 products per bifacial convergent tool. We should not confuse this with any change in tool type. Rather, these products testify to the resharpening of already existent convergent tools. The intensive multiple reduction and re-preparation/

TABLE 9-8
Lithic variability in Layer B of Buran-Kaya III

Debitage : objects of primary flaking processes	12.0 : 1
Debitage : core-like pieces	21.1 : 1
Debitage : objects of primary flaking processes + identifiable bifacial tools	6.8 : 1
Debitage : core-like pieces + identifiable bifacial tools	9.1 : 1
Debitage + unifacial tools + retouched pieces : objects of primary flaking processes	24.8 : 1
Debitage + unifacial tools + retouched pieces : core-like pieces	43.6 : 1
Debitage + unifacial tools + retouched pieces : objects of primary flaking processes + identifiable bifacial tools	14.1 : 1
Debitage + unifacial tools + retouched pieces : core-like pieces + identifiable bifacial tools	18.7 : 1
Unifacial tools + retouched pieces : core-like pieces	22.5 : 1
Unifacial tools + retouched pieces : objects of primary flaking processes	12.8 : 1
Unifacial tools + retouched pieces : debitage	1.1 : 1
Unifacial tools : bifacial tools	4.8 : 1
Unifacial + bifacial tools : retouched pieces	3.5 : 1
Unifacial tools : retouched pieces	2.9 : 1
Unifacial tools (complete) : unifacial tools (fragments)	1.1 : 1
Unifacial tools (complete) : unifacial tools (tiny fragments)	1.9 : 1
Retouched pieces (complete) : retouched pieces (fragments)	1.1 : 1
Bifacial tools (complete) : bifacial tools (fragments)	0.5 : 1
Bifacial tools (complete) : bifacial tools (tiny fragments)	0.8 : 1
Unifacial convergent tools : rejuvenation pieces of unifacial convergent tools' tips	1.6 : 1
Bifacial convergent tools : rejuvenation pieces of bifacial convergent tools' tips	0.5 : 1
Chips (≤ 1.5 cm) : chips (> 1.5–2.9 cm)	2.2 : 1
Chips (> 1.5–2.9 cm) : debitage	10.8 : 1
Chips (> 1.5–2.9 cm) + debitage + unifacial tools + retouched pieces : objects of primary flaking processes	154.9 : 1
Chips (> 1.5–2.9 cm) + debitage + unifacial tools + retouched pieces : core-like pieces	273.0 : 1
Chips (> 1.5–2.9 cm) + debitage + unifacial tools + retouched pieces : objects of primary flaking processes + ident. bifacial tools	88.2 : 1
Chips (> 1.5–2.9 cm) + debitage + unifacial tools + retouched pieces : core-like pieces + identifiable bifacial tools	117.0 : 1

resharpening/reutilization of tools is also evident by the high number of all convergent tools (scrapers and points). This has long been recognized as a defining typological characteristic of the Kiik-Koba facies of the Crimean Micoquian (e.g., Gladilin 1971; 1976). Beyond this general observation, the structure of the tool assemblage is also informative.

Considering the three tools groups—simple unifacial tools, convergent unifacial tools, and bifacial tools—proposed by Chabai and Marks (1998) and Chabai et al. (2000) as one way of making comparisons among the facies of the Crimean Micoquian, the true dominance of convergent unifacial tools (51.2%), over simple unifacial tools (38%) and bifacial tools (10.8%) is clear in Buran-Kaya III Layer B. This dominance is even greater, if all broken but possible simple forms are included: rising to 60.5%,.

The internal structure of unifacial scrapers can be viewed by their total numbers of complete and fragments versus only complete scrapers (Table 9-3): simple = 30.5% and 26.8%, transverse = 20.1% and 24.1%, double = 9.8% and 3.7%, and convergent = 39.6% and 45.4%. These percentage indicate that there is a prevalence of simple scraper types (simple, transverse, and double ones) over convergent types, although their interrelations are not great at all: 1.5 : 1 and 1.2 : 1, respectively, for the entire sample and for only complete items.

The proportional dominance among unifacial tools of points over convergent scrapers (56.4% to 43.6%) is as strikingly similar as it is between simple and convergent unifacial scrapers (60.4% to 39.6%). This typological nuance, taken together with the known abundance of rejuvenation products of unifacial convergent tool tips, testifies to multiple and intensive rejuvenation of unifacial tools in general, and at the same time, to the constant resharpening and retouching of various convergently-shaped/reshaped tools. These two convergent unifacial tool types may also be compared on the basis of shape. The convergent unifacial scrapers (Table 9-6) have a prevalence of trapezoidal shapes (59.2%), with a moderate number of triangular (18.4%) and crescent (14.3%) forms, but few leaf-shaped (4.1%), rectangular (2%), or ovoid (2%) forms. Unifacial points (Table 9-6), on the other hand, have quite different shape distributions: trapezoidal (34.5%) and leaf-shaped (27.6%) pieces prevail, while triangular (13.8%), crescent (12.1%), and hook-like (10.3%) shapes occur in moderate numbers, and lateral (1.7%)is quite rare. It is evident that the shift in shapes from scrapers to points was at the expense of the trapezoidal forms of scrapers and their reincarnation as leaf-shaped and hook-like points.

Beyond the mere type-level comparisons, there is a possible relationship between retouch types and angles (Table 9-4). The associations are not always obvious, but they are real: sub-parallel retouch is always rare, sometimes absent, but can be seen as occurring in three clusters: 12.1–13.8% for simple and transverse scrapers, 8.5–9% for convergent scrapers and points, and 3.1% for double scrapers. On the other hand, scalar retouch dominates, although not evenly across each subclass: 72.4–87.5% for simple, transverse, and double scrapers; 64.4–61.8% for convergent scrapers and points, and 46.7–50% for denticulates and perforators. Stepped retouch also has three clusters: 9.1–13.8% for simple, transverse, and double scrapers; 27.1–29.2% for convergent scrapers and points; and 50–53.3% for denticulates and perforators. Thus, the three repetitive numerical clustering for each retouch type across these seven tool groups permits a number of conclusions about the sequence of unifacial tool reduction in the Buran-Kaya III Layer B assemblage. There is an obvious gradual trend through multiple reductions/rejuvenations from simple/transverse/double scrapers to convergent scrapers and points, and subsequently, to denticulates and perforators. Through this reduction stream, scalar retouch continuously decreases, from 87.5% and 46.7%. A similar decrease is seen in sub-parallel retouch, but in a different statistical range: from 13.8% for simple scrapers until its complete absence for denticulates and perforators. On the other hand, there is an increase in stepped retouch from 9.1% to 53.3%. Thus, the shifting percentages of retouch types indicate an increasing level of reduction, beginning with the initial and simple tool forms (simple, transverse, and double scrapers) to convergent tool forms (convergent scrapers and points) to radically and heavily treated tool forms (denticulates and perforators).

This reduction stream is further confirmed by the retouch angle data for unifacial tools (Table 9-4). Flat retouch angle distribution can be observed through three numerical clusters: 41.4 and 50.0% for simple and double scrapers (although transverse scrapers account for only 24.2%, this percentage is higher than the remaining five groups), 18.1 and 21.2% for convergent scrapers and points, with the third and numerically lowest cluster represented by 6.7% for denticulates (this is a single occurrence among all 15 edges and does not include perforators, which displayed no flat retouch. Semi-steep retouch angles also display three clusters: 68.7 and 57.1% for convergent scrapers and points; 48.5 and 41.4% for simple and transverse scrapers; and 28.1–25% for double scrapers, denticulates, and perforators. Steep retouch angles display an exponential increase from the medial cluster of 17.3–27.3% for simple, double, transverse and convergent scrapers to 66.6–75% for denticulates and perforators. The third, lowest cluster among the steep retouch angles is 13.2% for points—since, by definition, points do not have steeply retouched edges.

Summing up the retouch angle data, it is possible to argue that denticulates and perforators in Layer B are at the extreme end of a sequence displaying ever-increasing reduction intensity: about three out of four edges on these tools have steep retouch. Convergent scrapers and points fall into the intermediate cluster, and the simple scrapers/transverse scrapers/retouched pieces have, on average, the flattest retouch. Thus, retouch types and retouch angles indicate a reduction sequence for unifacial tools from simple tool types (simple, transverse, and double scrapers) to convergent types (convergent scrapers, points) that, in some cases, are reduced further into denticulates and perforators.

The metric data also confirm this postulated reduction sequence for the seven unifacial tool groups (Table 9-5). On the most general level, considering only complete items, there are no significant differences between the mean length and width data for all tool groups, retouched pieces, and unretouched flakes. Each of these groups is quite small, with dimensional means under 3.5 cm. The only exception among all subgroups is that which should be elongated—blades—also have a small mean length: only 3.62 cm. The mean length and width for the combined sample of all complete unifacial tools is 2.98 cm and 3.00 cm, respectively. A closer look, however, at mean dimensional parameters for all seven tool groups, retouched pieces, and flakes permits the following observations.

Retouched pieces and flakes have, strikingly, the same average lengths: 2.81 cm and 2.80 cm, respectively. On the other hand, there are obvious length deviations among the tool groups. For simple and convergent scrapers, points, and perforators, the average lengths are larger than for the retouched pieces and unretouched flakes (Table 9-5 plus previous descriptions). The other tool groups (which have smaller sample sizes), are on average shorter: denticulates = 2.6 cm, double scrapers = 2.62 cm, and transverse scrapers = 2.47 cm. No other objective explanations could be used to explain these differences than those related to reduction, and to general tool blank proportions. The smallest average lengths of the transverse scrapers and denticulates may testify to a considerable secondary distal treatment that decreased their overall length, although the prevalence of blanks with transverse proportions among these tools (69.2% and 85.7%, respectively) makes blank selection a more cogent explanation here. Also, by definition, double scraper length does not depend upon any distal retouch, so length may have been primarily determined by blank selection. Convergent scrapers, points, and perforators have the largest average lengths and, as the most reduced tool groups (see above), may reflect a selection of the largest blanks for their continuous and multiple reductions. This, however, did not lead to very significant length diminution, in comparison to other unifacial tool groups. On the other hand, the larger than 3 cm average length for simple scrapers may also point to a minimum length for further unifacial tool reduction.

The mean widths for retouched pieces and flakes are 2.75 cm and 2.89 cm. Not one of the unifacial tool groups has an average width between these parameters. The average widths of transverse and convergent scrapers, points, and denticulates exceed 3 cm (Table 9-5). The other tool groups have smaller average widths. Among the former, there is a notable presence of convergent scrapers and points because these tool groups have the largest average lengths and widths.

Turning to those tool groups with the smallest average widths, they are characterized by low percentages of transverse flakes—from 25% to 41.4% (Table 9-5). Regarding the presence of transverse flakes, it is worth noting that unretouched flakes and retouched pieces have about the same proportion (53.9% and 53.1%, respectively), as do convergent scrapers and points (53.1% and 50%, respectively). This can only mean a very significant reduction of convergent scrapers and points, with multiple rejuvenations of all their retouched edges.

From the average lengths and widths for the unifacial tool groups, retouched pieces, and unretouched flakes, some conclusions may be reached. Convergent scrapers and points are characterized by the largest blanks, which after their formation and rejuvenation were still greater in average length and width than unretouched flakes and retouched pieces. This fact is strong evidence for a basic blank selection for a potentially long "use-life" for unifacial tools. Denticulates and perforators, the most reduced of the unifacial tool groups, partially confirm this conclusion by their own sizable average lengths and widths. On the other hand, simple, transverse, and double scrapers each have different reasons for their varying mean lengths and widths. Simple scrapers, less than half of which are made on transverse blanks, have no distal retouch but do have lateral edge retouch. As a result, their mean lengths exceed their mean widths. Transverse scrapers, with 69.2% on transverse blanks and heavy distal retouch (48.5% semi-steep and 27.3% steep), have greater average widths than average lengths. Double scrapers seem to have been made opportunistically on small blanks.

Because the thickness measurement does not depend upon proportions, blades are included in the present analysis (Table 9-5). First, it is worth noting that the average thickness for all complete unifacial tools is 0.68 cm. Retouched pieces, flakes, and blade debitage all have comparable average thicknesses: 0.55 cm, 0.56 cm, and 0.49 cm, respectively. The other tool groups fall into three cluster for average thickness: simple and transverse scrapers (0.62 cm and 0.65 cm), convergent scrapers and points (0.73 cm and 0.67 cm), and denticulates and perforators (0.91 cm and 0.86 cm). Double scrapers have the lowest average thickness among all the artifact categories (0.42 cm), confirming the suggestion that their blanks were not affected by any sequence of tool reduction. In fact, the increasing order for average thickness of the other tool groups perfectly fits into the proposed unifacial tool reduction sequence: simple types, convergent types, and denticulates and perforators. Indeed, the thickness data show that the most reduced unifacial tools (denticulates and perforators) are characterized by the thickest blanks. Then, by average blank thickness, the next most heavily reduced tools (convergent scrapers and points) occupy an intermediate position for not only thickness but length and width, as well. The simple types (simple and transversal scrapers) are on average the thinnest. Finally, it is worth remembering that the average length and width of retouched pieces are comparable to flakes without retouch. Therefore, it is reasonable to conclude that the retouched pieces are, in reality, merely ad hoc pieces used for short-term tasks and were not the first step in the postulated reduction sequence.

Thus, the thickness data very strongly confirm a selection of large-sized blanks for continuous unifacial tools shaping and reshaping, where the thickest blanks were the most appropriate for multiple tool edge resharpening/rejuvenation.

Bearing in mind the obvious anomalous position of double scrapers in the proposed sequence, it is possible to suggest that double scrapers were not only ad hoc but were actually just double simple scrapers. Accordingly, the transformation of simple unifacial tools into convergent ones did not include an intermediate stage, where simple lateral scrapers were changed into double scrapers and only then, into different convergent forms. Instead, subsequent retouching of a simple lateral or transverse scraper edge resulted in a semi-convergent scraper or point, mainly as a semi-trapezoidal or semi-trapezoidal elongated type. Recognizing this initial semi-convergent unifacial tool type, it is also possible to suppose its further transformation into different varieties of trapezoidal, leaf-shaped, triangular, and crescent scrapers, points, denticulates, and perforators.

Taking into consideration the almost equal representation of normal and transverse blanks among the unifacial tools, as well as all their morphological and retouch characteristics, it is possible to postulate two general unifacial tool reduction models expressed in three different ways.

The first reduction model for normal blanks can follow two different paths. The first path progresses from simple straight and convex scrapers into sub-triangular/semi-crescent scrapers and points and then into triangular/sub-crescent and crescent/leaf-shaped/hook-like scrapers and points. The second path progresses from simple/transverse scrapers into semi-trapezoidal elongated scrapers and points into semi-crescent scrapers and points into sub-crescent and crescent scrapers and points/hook-like points.

The second model is for transverse blanks, where a single path goes from simple/transverse scrapers into semi-trapezoidal scrapers, points, and denticulates into sub-trapezoidal and trapezoidal/leaf-shaped scrapers, points, denticulates, and perforators and/or sub-crescent and crescent/triangular scrapers and points/hook-like points.

These three trajectories sometimes paralleled one another through a considerable size decrease for normal blanks, ending their multiple transformations as transverse flakes and chips. It is also worth noting that the tendency to rejuvenate/resharpen convergent tools resulted, in a few cases, in points being transformed into perforators. Moreover, differential thinning of unifacial tools, with most occurring on convergent forms, provides more evidence that these types were usually heavily reduced—simple scraper types = 2% to 3.4% and denticulates = 0%, on one hand, and convergent scrapers = 20.4%, points = 39.7%, and perforators = 66.7%, on the other hand. A dominance of semi-trapezoidal specimens among convergent denticulates strengthens the already major role of these specimens with pronounced denticulate edges in multiple reshaping processes of unifacial scrapers and points. All in all, of the unifacial tools, 21.0% were differently thinned, while only four pieces had natural backs (all simple scrapers).

The general trends of unifacial tool reduction we have outline for Layer B of Buran-Kaya III agree with the ideas of H.L. Dibble about Middle Paleolithic scraper reduction:

> Larger blanks can be subjected to more reduction...the more reduced types should be thicker on average than the lightly retouched types. Again, all scrapers should be thicker than unretouched flakes....larger blanks are usually chosen for retouch in the first place, and the larger of those are the ones that can be subjected to the most reduction. Thus, it is expected that even the heavily reduced pieces would be, on average, somewhat larger than the unretouched flakes in every dimension, since many unretouched flakes will have been too small for retouching at all. (Dibble 1995:327, 331)

Literally, the only significant difference between the Buran-Kaya III Layer B data and Dibble's construction of scraper reduction (single/double/convergent and single/transverse) is the actual missing link of double scrapers in the Buran-Kaya III operational chains. Yet, the minor role that double scrapers play among the unifacial tools is not a special case in the Layer B assemblage, rather, it is a characteristic common to all facies of the Crimean Micoquian.

The analyzed unifacial tool reduction sequences with the additional data on retouched pieces and debitage are in accordance with those for bifacial tools. It must be recognized, however, that samples sizes are small and conclusions therefore tentative. There is a great emphasis on point shaping and reshaping/reutilization of bifacial tools. Among the complete bifacial points (Table 9-6), most are leaf-shaped (54.5%), followed by trapezoidal (27.3%) and crescent (18.2%). On the other hand, the fewer complete bifacial scrapers (11 versus 9 items) include 4 simple examples (3 single-edged and 1 double-edged) that show no evidence for complex reduction, although they exhibit multiple reshaping from convergent tools. The complete bifacial convergent scrapers do not have any particular shape dominance: 2 trapezoidal, 1 hook-like, 1 crescent, and 1 leaf-shaped. With the addition of their rejuvenation and other modifications, they can be interpreted as having long use-lives. The presence of 2 complete bifacial trapezoidal denticulates and 1 complete and 7 broken bifacial preforms (likely to have been residues of extensively rejuvenated points or scrapers) further confirms multiple reshaping of the bifacial tools.

There are no significant differences among the sizes of the 23 complete bifacial tools (Table 9-7) because all tool groups with retouch (excluding preforms) contain clear reutilized and reshaped examples. Despite their overall exhaustion, there are still two size extremes: one large preform and two small denticulates. At the same time, the average size of bifacial convergent scrapers and points is indicative of their purposeful formation and multiple rejuvenations.

Finally, characteristics such as the prevalence of broken bifacial tools over complete ones (2.2 : 1); the clear dominance of convergent pieces; frequent bifacial tool reutilization; denticulation, thinning, and alternate modifications of the plano-convex reduction technique; and the low ratio of bifacial convergent tools to their rejuvenation pieces (0.5 : 1) (Table 9-8) leave no doubt that there was very intensive on-site production and rejuvenation applied to bifacial tools and that this was greater than that applied to unifacial tools.

The main reason for differences in the high intensity reworking of bifacial and unifacial tools is probably caused by the different nature of their blanks—core derived blanks for unifacial tools and plaquettes, and large, thick flakes for bifacial tools. If the long distance to raw material outcrops is considered, it must be admitted that a significant portion of unifacial and bifacial tools, as well as bifacial preforms, were brought into the rockshelter already formed. Aside from the presence of very high on-site rejuvenation/resharpening levels (Table 9-8), it was necessary to produce a considerable number of new tools on-site from by-products of the imported flint plaquettes and cores. Cores and plaquettes, as well as the reshaping/rejuvenation of the imported bifacial tools supplied blanks for unifacial tools production, while new bifacial tool manufacturing was limited to rare plaquettes and some thick flakes. Therefore, very few bifacial tools were produced on-site, but the on-site reshaping, reutilization, and rejuvenation processes were considerable for bifacial tools and their preforms. Naturally, a high percentage of bifacial tools were broken during the late stages of rejuvenation. Given this, the percentage of convergent tools—unifacial and bifacial—actually recovered probably does not accurately reflect the true number produced. There is a pattern for Crimean Micoquian: the greater the proportion of convergent scrapers and points, the greater is the intensity of tool reshaping and rejuvenation in a toolkit.

In light of the technological, typological, and raw material exploitation seen in Layer B of Buran-Kaya III, it clear that the 17,342 artifacts recovered from just 7 m^2 during the 1966 excavations do not represent just two occupational events, a possibility implied by the two geologically defined sub-levels, B and B1. For the roughly 6.5 m^2 of Level B, with 2,127 artifacts and an average density of 325 pieces per square meter, no more than two to three different occupations are represented, since the average artifact density of artifacts without small chips (< 1.5 cm) and heavily burnt pieces is approximately 125 per m^2. For Level B1, with 15,215 artifacts from almost 7 m^2, the average artifact density is 2,170 per m^2 and without chips, 735 per m^2. Since there were no vertical differences in the densities of artifacts and the highly fragmented animal bones and there was clear evidence of many destroyed fireplaces, it must be supposed there were no fewer than ten short-term human occupations. The proportionately similar artifact class representation for both Levels B and B1 (Table 9-1) also permits the assumption that the same activities were performed at the site during each occupation. These activities were dominated by extensive secondary butchering of animal carcasses using multiply reshaped and rejuvenated flint tools. Accordingly, short, culturally sterile intervals between these recurring and very intensive short-term human occupations at the rockshelter can be assumed, since there are few patinated artifacts.

Buran Kaya-III Layer B and the Kiik-Koba Facies in the Context of the Crimean Micoquian

The Buran-Kaya III Layer B assemblage fits fully within the known variability of the Crimean Micoquian. With the use of a cultural construct to define Crimean Middle Paleolithic industrial variability (Gladilin 1976), several assemblages from Crimean Middle Paleolithic sites have been recognized as belonging to a Kiik-Koba "culture." These include the assemblages from Kiik-Koba upper layer, Prolom-I (Kolosov 1983, 1986; Kolosov et al. 1993; Stepanchuk 2002), Buran-Kaya III Layer B, as well as the Micoquian artifacts from Siuren-I in the lower layer of the 1920s excavations and Units "H" to "G" of the 1990s excavations (Demidenko 2000). While these assemblages are still considered as Kiik-Koba, the Kiik-Koba "culture" is now considered to be a facies within the broader Crimean Micoquian and not a separate culture (e.g. Chabai et al. 2000).

From a techno-typological point of view, locations far from high quality flint outcrops, and the characteristics of the archeological layers, all Kiik-Koba deposits are quite similar. Moreover, these assemblages are very large and constitute a considerable database for analyses of the type presented here. Indeed, the collections (more than 33,000 artifacts) include 4,755 pieces from the upper layer of Kiik-Koba rockshelter, 10,882 from Prolom-I rockshelter, 17,342 from Layer B of Buran-Kaya III rockshelter, and no fewer than 88 artifacts from the 1920s lower layer/1990s Units "H"–"G of Siuren-I rockshelter. Together, these form one of the richest Middle Paleolithic samples of a specific Middle Paleolithic facies, not only in the Crimea but also in the whole of Eastern Europe. Although, as often happens in Paleolithic studies, not all of these assemblages are published in detail, their general typological configurations as well as functional interpretations are available in the literature. With this study, Layer B of Buran-Kaya III is the most completely reported and correlations with the other three assemblages bring to mind a number of thoughts concerning this particular facies and its associated sites.

Based upon recent considerations (Demidenko 2000, 2003), it appears that the following geochronological determinations can be proposed. The upper layer of Kiik-Koba is possibly related to a stadial between the Moershoofd and Hengelo Interstadials (ca. 55–40 000 years BP). The Siuren-I 1920s excavations of the lower layer and the 1990s excavations of Units "H"–"G" and Buran-Kaya III Layer B are connected to Arcy Interstadial (ca. 30,000 years BP). The upper part of the Prolom-I culture-bearing sediments may be dated to ca. 32–30,000 BP. Thus, it is possible to argue a general time range of ca. 55–40,000 BP to ca. 30,000 BP for the presently known Kiik-Koba facies assemblages.

The techno-typological characteristics of the Kiik-Koba facies have been described here for the Buran-Kaya III Layer B assemblage and they do not need to be repeated for the other assemblages because they are all very much alike (Table 9-9). This holds true for the three basic tools groups—simple unifacial tools, convergent unifacial tools, and bifacial tools (Table 9-9). In spite of some proportional variability, they are clearly distinct from the comparable classes in the Ak-Kaya and Starosele facies (Table 9-9). The Starosele facies toolkits show some range within the three tool groups: simple unifacial tools = 41–58%, convergent unifacial tools = 16–43.4%, and identifiable bifacial tools = 9–28.7% (Chabai et al. 2000: table 10). As is evidenced by these data, the Kiik-Koba facies is at one extreme of tool reduction within the three Crimean Micoquian facies (Table 9-9). As was shown by several different reduction sequences for Buran-Kaya III Layer B tool classes, the typological indices cannot be explained by any culturally determined factors; instead, they must be seen as resulting from a complex synthesis of various anthropogenic and natural factors at play within the Crimean Micoquian (Chabai et al. 2000).

Recently, sites with Kiik-Koba and Starosele facies have been called "short-term camps C type" at which the inhabitants mostly carried out full-scale, secondary butchering of hunted animals (Chabai et al. 2000: 88). Because of such activities, the presence of both numerous and mainly heavily fragmented bones of different ungulate species (saiga, horse, and giant deer) and fireplaces and/or solid ashy lenses are understandable. Consequently, the general industrial pattern of the Kiik-Koba facies is also understandable. Intensive

TABLE 9-9

Basic techno-typological characteristics and variability data for all Kiik-Koba assemblages and selected Starosele and Ak-Kaya facies assemblages

	Kiik-Koba				*Starosele*		*Ak-Kaya*
	Buran-Kaya III Layer B	*Siuren I lower layer/H-G*	*Kiik-Koba upper layer*	*Prolom I*	*Starosele Level 1*	*Kabazi V complex C - Levels II/4a, II/7*	*Kabazi II Levels III/1A–III/3*
Ilam	9.1[1]	?	11.6[2]	11.4[2]	18.0[1]	7.9[1]	6.2[1]
IFl	39.7[1]	?	41.9[2]	36.9[3]	45.7[1]	52.6[1]	?
IFs	13.9[1]	?	21.9[2]	26.1[3]		23.8[1]	?
Simple unifacial tools	38.0%	24.1%	28.3%	31.0%	45.8%	42.6%	48.8%
Convergent unifacial tools	51.2%	63.8%	58.5%	55.6%	41.1%	39.4%	17.1%
Bifacial tools	10.8%	12.1%	13.2%	13.4%	13.1%	18.0%	34.1%
Scrapers	61.0%	38.5%	42.0%	49.5%	64.9%	62.5%	75.0%
simple	*30.5%*	*3 items + ?*	*36.2%*	*41.0%*	*30.6%*	*51.5%*	*45.8%*
transverse	*20.1%*	*1 item + ?*	*13.8%*	*12.3%*	*18.1%*	*11.4%*	*12.5%*
double	*9.8%*	*2 items + ?*	*16.8%*	*13.9%*	*19.4%*	*11.4%*	*25.0%*
convergent	*39.6%*	*6 items + ?*	*33.2%*	*32.8%*	*31.9%*	*25.7%*	*16.7%*
Points	31.2%	59.6%	44.1%	43.2%	18.9%	26.8%	9.4%
Denticulates + notches	5.2%	1.9%	11.6%	2.8%	15.3%	10.7%	15.6%
"Upper Paleolithic" types	2.6%	?	2.3%	4.5%	0.9%		
Bifacial preforms	3.6%	?	?	?	42.9%	63.6%	28.6%
Bifacial points	57.1%	1 item + ?	65.6%	66.7%	50.0%	27.3%	21.4%
Bifacial scrapers	32.1%	2 item + ?	34.4%	33.3%	7.1%	9.1%	50.0%
single- and double-edged	*14.2%*	*1 item + ?*	*13.1%*	*15.6%*			*14.3%*
convergent	*17.9%*	*1 item + ?*	*21.3%*	*17.7%*	*7.1%*	*9.1%*	*35.7%*
Denticulates	7.2%	?	?	?			
All bifacial convergent tools	85.7%	2 item + ?	86.9%	84.4%	100.0%	100.0%	80.0%
Identifiable unifacial tools : core-like pieces	12.8 : 1	10.4 : 1	20.3 : 1	10.5 : 1	12.3 : 1	18.7 : 1	16:01
Identifiable unifacial tools : core-like pieces + identifiable bifacial tools	5.5 : 1	4.3 : 1	5.6 : 1	4.2 : 1	4.8 : 1	4.0 : 1	2.0 : 1
Average density per m² of identifiable unifacial and all bifacial tools	48.9	?	14.6	19.3	4.4	5.7	< 1

1 Counts based on all definable debitage pieces (≥ 3 cm) and blanks of unifacial tools and retouched pieces.
2 Counts based on unifacial tools only.
3 Counts based on debitage pieces (≥ 2 cm) only.
Kiik-Koba and Prolom I data recalculated from Stepanchuk 1994, 2002; Starosele data recalculated from Marks and Monigal 1998;
Kabazi V data recalculated from Yevtushenko 1998; Kabazi II data recalculated from Chabai 1999a.

labor during intensive secondary faunal exploitation/utilization required the use of a large number of tools that were not easily available because of large (10–25 km) effective distances to raw material sources. Therefore, the inhabitants had to use the same tools over and over, resulting in extensive resharpening and rejuvenation episodes. The determination of Kiik-Koba facies assemblages as representing "short-term camps" (Chabai 1999a, 1999b) is based upon the aforementioned economic activities that do not correspond to any criteria of ephemeral and/or very specialized sites. On the other hand, the idea that Kiik-Koba facies assemblages represent "base camps" (e.g., Demidenko 1996; Chabai et al. 1995; 1998; Chabai and Marks 1998), is in an obvious contradiction with the following two facts: the impossibility of locating any Middle Paleolithic base camps at a great distance from basic sources of high quality flint as well as structural peculiarities of the archeological layers (low sedimentation rates) that contain the remains of multiple occupational events.

In the framework of "short-term camps C type" for both Starosele and Kiik-Koba facies, because of more occupational intensity and longer durations characteristic of the latter, it has been proposed that Starosele and Kiik-Koba facies should be differentiated with the following terminology: the Starosele facies can be called "short-term camps C1 type," while all the Kiik-Koba facies should be referred to as "short-term camps C2 type" (Chabai et al. 2000:88).

Summing up all the represented general considerations on the Kiik-Koba facies, it is necessary to emphasize the complex analyses of a number of anthropogenic and natural factors involving variability in the Crimean Micoquian, permitting an interpretation of these Middle Paleolithic facies with a tradition of bifacial plano-convex tool production as a single Crimean Micoquian cultural tradition.

10

A Use-Wear Analysis of Some Middle Paleolithic Flint Artifacts from Buran-Kaya III Level B

Evgeny Yu. Giria

This chapter presents the results of a comparative use-wear study of flint tools and their associated rejuvenation pieces from the 2001 excavations of Buran-Kaya III Level B, a Kiik-Koba facies assemblage of the Crimean Micoquian. The principal kinds of activities connected with this assemblage have been reconstructed, since use-wear analysis makes it possible to explain the peculiarities of both tool morphology and rejuvenation pieces. Most of the artifacts with multiple retouched working edges in the assemblage were used for butchering.

Varieties of Traces of Wear on the Surface of Flint Pieces

Use-wear analysis is a procedure studying micro and macro surface features. It studies the traces of various kinds of natural surface changes. The ultimate purpose of the analysis is to find the reasons for these changes. Normally, any artifact from a Paleolithic cultural layer possesses a whole complex of surface traces originating from different causes (Semenov 1957; Anderson 1980; Keeley 1980; Schelinskij 1983, 1994; Moss 1983; Plisson 1985).

Apart from the widely known "traces of wear" (i.e., traces of the contact tool to material worked) and "traces of treatment" (where tool treatment causes technological traces in the form or the quality of the surface relief undergoing changes), a few other kinds of natural relief changes can be defined traceologically.

First, there is a group of traces from post-depositional damages, the origin of which is mostly explained by the impact of natural agents when artifacts are incorporated into a cultural layer. These include:

(1) general "gloss," luster of the surface: polishing due to movement of an artifact in a layer, resulting from contact friction with encompassing rocks and sediments;
(2) spots of polishing, micro "mirrors," "G" type polishing;
(3) linear polishing;
(4) diverse grooves and scratches;
(5) scale-like damage of edges and ridges.

Second, there are changes to the natural surface that occur during the lifetime of the artifact. They are neither connected with artifact use nor with artifact manufacture. Various actions connected with flint handling, hafting, storage, and transporting artifacts with other objects can bring about micro and/or macro surface changes on the artifact. For flints, this surface wear on ridges and/or edges produces the same kinds of wear traces mentioned above. The morphology and, of special importance in this case, the localization of this type of wear on an artifact is very specific. It is this localization and the co-occurrence of different types of traces on facets and/or interfacet ridges that make it possible to distinguish them from traces of a different origin, such as post-depositional damage, manufacture, or use-wear.

When analyzing nearly any flint tool, especially one produced by knapping, it is possible to determine the sequence of various operations applied in the course of its manufacture. Even a non-experienced lithic archeologist can ascertain that manufacture of a flake precedes its retouching, retouch onto the dorsal face can be truncated by a burin spall or become a platform for retouch onto the ventral side, etc. This makes it possible to compare a traceological image of temporally different surfaces on the same item and to match certain kinds of traces to the technological sequence. Traceological analysis can thereby establish a real stratigraphy of traces of wear on different surfaces of an item. (The term "stratigraphy of traces" is borrowed from V. E. Schelinskij, personal communication.)

Post-depositional damage traces often imitate use traces but, in most cases, they differ from other types of wear primarily in their chaotic and unpatterned distribution across the whole surface of the item. They are not associated with any technological sequence that changes the form of the artifact. Such a correlation when made, on the contrary, determines a natural change in the relief of a rejuvenating surface during the artifact's use-life. In other words, if it is determined that newer scars, which shape the artifact, are not reduced and look much "fresher" than the older scars, and if temporally different surfaces of the same artifact traceologically contrast, then all the wear types existing on older surfaces (and not found on the newer surfaces) belong to an earlier period of the item's existence. That is, these traces were made *during the lifetime of the artifact*, before the latest facets were made and, obviously, before the item became a part of a cultural layer. These kinds of traces undoubtedly are connected to human activities and can be called non-functional or non-utilitarian.

As an exception, it is necessary to mention that people of different epochs might use the same artifacts, by recycling them from cultural layers of earlier times. The traceological appearance of such items is always very unusual: post-depositional traces are overlain by the traces of its later use, rather than vice-versa.

The surface of a freshly made artifact can have only technological traces: accidental facets, abrasion, scratches, and/or grinding. Practically all the ventral and dorsal sides of scars are clear, edges of the pieces are micro-denticulated, and ridges are sharp. For instance, in the case of an average quality flint, it is difficult to measure the width of a "fresh" inter-facet ridge apex, even with the help of a microscope.

At the same time, numerous experiments have shown that in spite of the well known hardness of flint, quartzite, or even quartz, when items made of them are carried in a soft (leather) bag for a couple of days, they may show:

(1) grinding and/or polishing, especially on the protruding parts of the surface;
(2) "G" type spots of polishing;
(3) linear traces, such as diverse grooves and scratches;
(4) edge damage.

These traces result from numerous, very light contacts among several items, their slight friction, and their collisions. The traces are uniformly positioned on all edges and surfaces, but more developed on all protruding parts: edges, bulbs, and ridges.

When such an item broke when used, or underwent retouch, each new flaking or rejuvenating facet, of any origin, would have an absolutely clear natural surface and clear, fine linear borders. Thus, an item comes to possess two traceologically different types of surfaces related as a "stratigraphy of traces." It makes the simplest kind of stratigraphy complicated if the item concerned is functionally used. Its surface will acquire traces characteristic for this particular kind of work. These "traces of use" can overlap the two types of surface traces mentioned above. Working parts of tools can be repeatedly retouched and tools can be repeatedly transported in contact with other items. Further transportation traces will be formed on new ridges and put on top of previous transportation traces, making them more pronounced. (i.e., the stratigraphy of traces can be repeatedly changed). The occurrence of very badly worn, less worn, and unworn surfaces, ridges, and edges is quite possible. Traces of use can be destroyed, transformed, or truncated.

The possibility of finding wear traces on an artifact depends upon a number of factors. All types of traces, traces of use included, may be unidentifiable if:

(1) their profile is absent (from buildup to periphery);
(2) they are underdeveloped (no traces of a complete profile);
(3) they are damaged in the course of work, due to edge damage and/or edge exhaustion, by other traces developing, by further treatment, transportation, trampling, post-occupational effects, excavation damage, etc.

Establishing different stages of non-utilitarian wear traces on an item facilitates the reconstruction of its manufacture and/or modification sequence. In addition, it takes a much longer time for these kinds of traces to be established than it does for other types of wear traces. That is why the presence on an item of even the simplest stratigraphy of traces (of two traceologically contrasted areas, at least) documents that the item concerned was not created so from the very start; it was used for a long time and was later modified. Thus, each area with a specific non-utilitarian wear shows a comparatively long period of "intermission."

Summing up all the above, one can conclude that by analyzing non-utilitarian wear traces, it is fundamentally possible to single out the kinds of items used by humans without being modified. This holds true for singling out most stable elements of tools. The information concerning these tools and/or their elements can substantially complement our knowledge of prehistoric behavior and can serve as a basis for the definition of cultural norms.

Technical Means and Methods of Material Processing

During the course of the 2001 excavations of Level B, headed by K. Monigal, all lithic artifacts were placed, with sediments, in sterile plastic bags and left unprocessed. At the end of excavations, a sample of 57 artifacts destined for use-wear analysis was chosen out of the complete (unwashed) assemblage by Yu. E. Demidenko. In the laboratory, each artifact was treated with a 7% solution of acetic acid for 5–10 minutes to remove carbonate crust spots, then was washed with a warm solution of washing powder and rinsed with clear water without using brushes. In the course of this work, acetone and ethyl alcohol on cotton wool swabs were used to remove finger prints.

A reflected light small magnification microscope, MБC 10 and MCПЭ-1 (magnification up to 100×), was used for the primary analysis of surface micro-relief. Detailed analysis was carried out by a metallographic microscope Polam P-312 (magnification up to 1600×) and an Olympus BH2 (magnification 50–400×) with incident light. Photomicrography was carried out with an Olympus SC 35 Type-12. Macro photography of artifacts was carried out with a ULARUS photographical set, with the help of an Olympus E-10 with an MCON-35, a macro supplemental unit.

The composition of the assemblage, based on the typological classification of the flint artifacts by Yu. E. Demidenko, is shown in Table 10-1.

TABLE 10-1
Typological summary of the traceology sample

Tool type	*N*	%
Bifacial tools	4	7.02
Retouch chips	11	19.30
Rejuvenations of bifacial convergent tool tip	4	7.02
Rejuvenations of unifacial convergent tool tip	7	12.28
Unifacial denticulated convergent tools	1	1.75
Unifacial points	10	17.54
Unifacial convergent scrapers	11	19.30
Unifacial double scrapers	1	1.75
Unifacial transverse scrapers	4	7.02
Unifacial simple scrapers	4	7.02
Total	57	100.00

Results of the Analysis

All of the selected artifacts were studied under a microscope to find non-utilitarian wear traces and use-wear. A summary of the salient results is presented in Table 10-2, ordered by their inventory item number, which matches those of the photographs presented at the end of this chapter. [There is no tool no. 36. *Eds.*]

Traces Due to Post-Occupational Burial

Overall, the 57 artifacts (tools and retouch/rejuvenation pieces) from Buran-Kaya III Level B offered for use-wear analysis can be regarded as well preserved and quite suitable for all of our studies.

The general polishing, like a transparent film, that covers all of the surfaces of the artifacts in the sample is caused by burial in the cultural layer. As a very light film of general polishing, it does not crucially change the micro-relief. On flat areas, the film imitates meat polishing when observed under low magnification, although it neither has the characteristic profile nor creates roundedness of edge tips. It is even weaker than averagely-developed polishing from cutting meat. The edge tips formed by ancient retouch are sharp, saw-like (Photo 30d). (In the following discussion and in Photos 10-1–10-58, tools and other pieces are numbered according to the typological classification list of Demidenko.)

Linear traces and micro mirrors of "G" type polishing (Photo 10-10d) are referred to the same group. They make large, mostly less than 1 mm spots of complete polishing. They are sporadically positioned, sometimes have well pronounced orientation showing areas of linear polishing, accompanied by grooves and scratches of different sizes and depth.

Damage Facets Due to Trampling

There are no precise criteria for recognizing this kind of damage for the Buran-Kaya III flint assemblage. However, most of the artifacts possess separate areas of small spontaneous bifacial "saw-like" retouch, which removed traces of use and, at the same time, were overlain by general polishing from burial in the cul-

TABLE 10-2
Sample inventory and summary of results

No.	*Typology*	*Non-utilitarian wear*	*Use-wear*	*Contact material*	*Kinematics*	*Abrasion*
1	Unifacial simple concave scraper	none	–			+
2	Unifacial simple wavy scraper	none	–			+
3	Unifacial simple concave scraper	none	+	meat	cutting	+
4	Unifacial simple concave scraper	2	+	hide	scraping	–
5	Unifacial double straight-convex scraper	none	–			–
6	Unifacial transverse convex scraper	none	–			–
7	Unifacial transverse convex scraper	none	–			+
8	Unifacial transverse-convex oblique scraper	2	–			+
9	Unifacial transverse convex scraper	2	–			–
10	Unifacial convergent scraper (elong. trap. w/thinned base & end)	none	+	bone	scraping	+
11	Unifacial convergent scraper (semi-crescent)	2	+	meat	cutting	+
12	Unifacial convergent scraper (leaf-shaped w/thinned base and back)	2	–			+
13	Unifacial convergent scraper (semi-trapezoidal)	2	–			–
14	Unifacial convergent scraper (elong. trapezoidal w/thinned base)	none	+	hide	cutting/scraping	+
15	Unifacial convergent scraper (elong. semi-trapezoidal)	3	–			+
16	Unifacial convergent scraper (elong. semi-trap., naturally backed)	none	–			–
17	Unifacial convergent scraper (trapezoidal)	none	–			+
18	Unifacial convergent scraper (sub-trapezoidal)	3	–			+
19	Unifacial convergent scraper (sub-trapezoidal w/thinned base)	2	–			+
20	Unifacial convergent scraper (semi-crescent)	3	+	meat	cutting	+
21	Unifacial denticulated convergent tool (semi-trapezoidal)	none	–			–
22	Unifacial point (sub-triangular)	2	–			–
23	Unifacial point (elong. sub-trapezoidal, naturally backed)	2	–			+
24	Unifacial point (leaf shaped w/thinned base)	2	–			+
25	Unifacial point (leaf shaped)	2	+			–
26	Unifacial point (sub-trapezoidal)	none	–			+
27	Unifacial point (leaf shaped w/thinned base)	3	+	meat/hide	cutting/scraping	–
28	Unifacial point (elongated sub-trapezoidal)	2	+	meat	cutting	+
29	Unifacial point (semi-trapezoidal)	2	+	meat	cutting	+
30	Unifacial point (trapezoidal)	3	+	meat/hide	cutting/scraping	+
31	Unifacial point (sub-triangular)	2	–			–
32	Bifacial tool (sub-trapezoidal point)	3	+	meat	cutting	+
33	Bifacial tool (elongated semi-trapezoidal scraper)	3	–			+
34	Bifacial tool (single-edged straight scraper)	none	–			–
35	Bifacial tool (trapezoidal point)	2	+	meat	cutting	–
37	Rejuvenation piece of unifacial convergent tool's tip	2	+	meat	cutting	–
38	Rejuvenation piece of unifacial convergent tool's tip	none	+	meat	cutting	–
39	Rejuvenation piece of unifacial convergent tool's tip	none	+	meat	cutting	–
40	Rejuvenation piece of unifacial convergent tool's tip	none	+	meat	cutting	–
41	Rejuvenation piece of unifacial convergent tool's tip	none	–			+
42	Rejuvenation piece of unifacial convergent tool's tip	none	+	meat	cutting	–
43	Rejuvenation piece of unifacial convergent tool's tip	none	+	meat	cutting	–
44	Rejuvenation piece of bifacial convergent tool's tip	none	+	meat	cutting	–
45	Rejuvenation piece of bifacial convergent tool's tip	none	+	meat	cutting	–
46	Rejuvenation piece of bifacial convergent tool's tip	none	+	meat	cutting	–
47	Rejuvenation piece of bifacial convergent tool's tip	none	+	meat	cutting	–
48	Bifacial thinning chip	none	–			+
49	Bifacial thinning chip	none	–			–
50	Bifacial thinning chip	none	–			+
51	Simple retouch chip	none	–			+
52	Retouch piece from tool's lateral edge, fine resharpening	none	–			–
53	Simple retouch chip	none	–			–
54	Simple retouch chip	none	–			–
55	Retouch piece from tool's lateral edge, radical resharpening	none	–			–
56	Retouch piece from tool's lateral edge, fine resharpening	none	+	meat	cutting	–
57	Retouch piece from tool's lateral edge radical resharpening	none	–			–
58	Simple retouch chip	none	–			+

tural layer. The presence of these facets is particularly obvious on unifacial tools.

Traces Connected with Knapping Technology

Judging from the dimensions and morphology of the lithics from the Level B assemblage, the overwhelming majority was flaked with a hard hammer technique. Use-wear analysis further confirms this. Thus, many platforms and dorsal sides of tool blanks have groups of closed annular cracks of small diameter: this is how conical cracks, resulting from the impact of a hard object against a small contact area, manifest themselves (Photo 10-30). These micro and macro conical cracks are failed fracture planes; the results of failed flaking attempts. When soft stone, bone, or antler hammers are used, mostly widely open conical cracks form on the surface of the flaking area.

Based on the morphology of the retouch facets on the tools and the shape of chips, retouch was quite often made by a soft (bone?) hammer. However, it is clear that a hard hammer was also used for some retouching. For instance, traces of stone hammer use to produce retouch were found on tool 35 (Photo 10-35).

In some cases, traces of abrasion were observed on the core impact area edge (see e.g., Photos 10-15, 10-20). Unlike normal (e.g., for Upper Paleolithic) abrasion, this was present on the core platform rather than the flaking surface. Judging from the roundedness and crushing of the margins and the coarseness and intensity of linear traces (rather deep grooves of different widths), abrasion was carried out with a hard, coarse abrasive. Most likely, the abrasion resulted from light, slipping blows by the working part of the hammer, produced in the course of difficult (when the flake would not work out) retouch of the core platform. It should be underlined, again, that such an orientation of abrasion (from the dorsal side onto the platform) occurs with exceptional rarity on post-Middle Paleolithic flakes and blades. Normally, such abrasive wear can be found only on core tablets or other pieces from the platform rejuvenation of prismatic cores.

Abrasion also occurs on the tips of tool edges. Of the 35 tools in this sample, 22 (63%) have such traces (Figure 10-1). In most cases, areas with abrasive wear are very small. They are not continuous and are only recorded in between retouch facets. Since this type of wear occurs on the retouched edges of all artifact types, often on two retouched edges, there is no reason to assume that it is a deliberate blunting of the tool's butt. A purely technical explanation for this treatment is much more acceptable. It was produced before the edge was retouched, creating and strengthening a platform for retouch removals. A blunted, thin edge is not so susceptible to edge damage during retouching as one that has not been blunted. The blunting also helps to increase the edge angle. However, this explanation does not seem complete. It might also be possible that haphazard areas of abrasion resulted from a failed attempt at edge retouching, brought about by numerous "slips" of a hammer (just like the case of core platform rejuvenation).

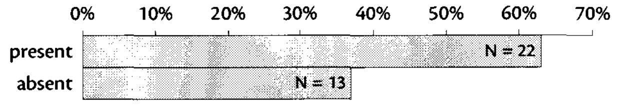


Figure 10-1—Presence/absence of traces of abrasion on thirty-five artifacts (not including chips or debitage).

Artifacts 2 and 10 are worth special attention. Although, on the whole, their edge blunting is of a different character, in both cases the abrasion is present as an uninterrupted belt (Photos 10-2, 10-10). The left side of artifact 2 has a pronounced roundness, grinding, and polishing (Photo 10-2a, b). It is clear that these traces, as well as the fine irregular marginal retouch onto the dorsal side, are the result of abrasion. The blunted left side of the artifact is opposite its sharpened right side, and may well be interpreted as a butt adapted as a finger rest.

Artifact 10 has a blunted left side. However, the treatment of its edge is strikingly different. In profile it is less rounded and in a number of places the roundness is interrupted by facets of sharpening retouch. The morphology of polishing that accompanies the rounding testifies to bone or antler contact; there is practically no full profile polishing anywhere. The edge is sharp and looks like a broken curve in plan view (Photo 10-10a, b); only separate, very short areas of this side look like a scraper working edge for bone/antler (Photo 10-10c). Judging from the orientation of the polishing, the presence of cracks and badly distinguished scratches, it was caused by spontaneous and aggressive scraping, since there are too many chip facets of edge damage. This suggests that bone was scraped with the artifact: not to treat the bone, but only to blunt the artifact's butt (i.e., using a bone hammer instead of a hammerstone).

If the purpose of abrading the core flaking areas is more or less clear, the purpose of the same treatment on flakes is not clear. Thus, at this stage of research, the meaning of flake and tool edge abrasion is unresolved. There are equally compelling reasons to consider its use both to create elements adapted for use and for technological needs.

Traces Due to Non-Utilitarian Wear

Morphologically, and being on the surface, traces of non-utilitarian wear found on Buran-Kaya III artifacts correspond to those obtained during an experiment where flint pieces piled together in a leather bag were transported for a long period of time (compare Photos 10-0a, b and Photos 10-35a, b). On the whole, they are practically identical kinds of wear. On an experimental piece, the surface of a worn area looks looser than that on an archeological item, since the former was not subject to deposition in the sediments of a cultural layer.

Surface wear on non-utilitarian artifacts is represented by the following kinds of traces:

(1) grinding and polishing of protruding areas;
(2) rounded tips of edges and ridges;
(3) linear traces in the form of differently oriented scratches and grooves (Photos 10-3c; 10-30e; 10-33a, b).

"G" type spots of polishing, the origins of which can be connected reliably with non-utilitarian wear, were not found.

At least two clearly distinctive, contrasting areas carrying non-utilitarian wear of different stages were found on 63% of whole artifacts (22 out of 35). On 20% of pieces with wear trace stratigraphy, there are grounds to distinguish not two, but three contrasting areas (Figure 10-2).

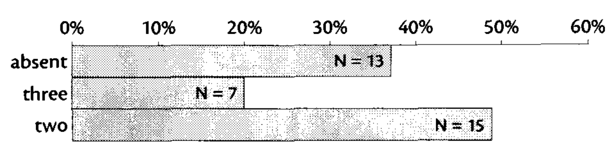


Figure 10-2—Non-utilitarian wear traces: presence or absence of two or three contrasting kinds of micro-relief surfaces.

When tools are formed by retouch, it is quite natural that their lateral edges were the most unstable, often needing rejuvenation. In most cases, retouch did not extend onto the entire ventral and dorsal surfaces: "old," worn-out surfaces remained on proximal areas of tools. It is quite possible that during a flake's use, its working edge was retouched and the item was modified into a scraper, which, upon further retouching (depending on the symmetry of the flake blank), was turned into either a point, or a convergent scraper. Non-utilitarian wear traces on flake surfaces may well be present on the surfaces of tools with retouch (both ventral and dorsal).

Non-utilitarian wear on a core is seen only on the dorsal surfaces of flakes struck from that core. It is contrasted with a "fresh" ventral surface appearance for these flakes. It is therefore not possible to precisely define what stage of artifact life produces non-utilitarian wear. Its origin on a tool can be stated only in relation to the reduction of secondarily treated surfaces. In the remaining cases, when the surface of a tool includes remains of ventral/dorsal surfaces, non-utilitarian wear initiated on a core or a flake can either remain as such on the tool, or be strengthened, due to accumulation throughout its use-life.

It is of interest that not only tools were used over a relatively long time in the Buran-Kaya III Level B assemblage. Quite a number of observations indicate that cores (Photos 10-13, 10-15, 10-18, 10-20) and some flakes (Photo 10-22) were also used for a relatively long time. It should be noted that the assemblage provided for the use-wear analysis lacked flakes and cores. It is quite likely that their inclusion in this study would have made it possible to obtain even more convincing results. Comparing wear stages on flake/blank ventral and dorsal surfaces can identify which process prevailed at the site: manufacture of tools or only their reshaping. In other words, whether flakes were only imported or if cores were used to produce flakes on-site.

For convergent forms, on their pointed tip areas, where shaping scar removals came together and overlaid one another, virtually none of the tools have traces of non-utilitarian wear. They were removed by edge rejuvenation facets. The presence of a miraculously preserved area of non-utilitarian wear on one of the rejuvenation pieces of a bifacial convergent tool tip should be considered as a special success and very significant (Photo 10-37). Generally, these traces are completely destroyed by retouch on the dorsal surfaces of tools with intense dorsal treatment, while they clearly remain on the ventral sides.

In cases where artifacts have been ventrally thinned, edges and ridges of these facets always have a more expressive non-utilitarian wear than do the ridges of dorsal removals of secondary treatment (Photos 10-33, 10-27). This finding is significant and supports commonly held ideas about the sequence of manufacture of Eastern Micoquian tool forms (dorsal removals are always secondary, which is clear from the truncation of thinning scars). They unambiguously signify that the shaping of tool edges by facet removals onto the dorsal surface was carried out repeatedly. Furthermore, there are grounds to assume that the thinning of ventral surfaces could also have been repeated. For instance, by establishing a stratigraphy of scarcely definable wear, it became possible to ascertain two generations of ventral thinning removals on tool 34 (Photo 10-34).

The distribution (presence/absence) of non-utilitarian wear present on the tools in this study is shown in Table 10-3. In spite of the rather small number of analyzed tools, it is worth noting that there is a very high percentage of artifacts with non-utilitarian wear among the bifacial tools and the unifacial convergent forms (points and scrapers).

The only bifacial tool without distinctive non-utilitarian wear attributes is the badly worked plano-convex

TABLE 10-3
Presence/absence of non-utilitarian wear traces

Tool type	*Present*	*Absent*
Bifacial tools	3 (75%)	1 (25%)
Unifacial points	9 (90%)	1 (10%)
Unifacial convergent scrapers	7 (63%)	4 (36%)
Unifacial double scrapers	–	1 (100%)
Unifacial transverse scrapers	2 (50%)	2 (50%)
Unifacial simple scrapers	1 (25%)	3 (75%)
Unifacial denticulated convergent tools	–	1 (100%)

TABLE 10-4
Association of abrasion and non-utilitarian wear traces

	Abrasion	*No abrasion*
Non-utilitarian wear	14 (40%)	8 (23%)
No non-utilitarian wear	8 (23%)	5 (14%)

tool 34, the plano surface of which was retouched two times (Photo 10-34). Surfaces and inter-facet removal ridges in the center of the plano surface from the first generation of retouch retain traces that look like non-utilitarian wear. In spite of their poor recognizability, due to weak development, it is possible to observe their "cutting" by scars of secondary removals (Photo 10-34). This artifact retains some traces that look like the type of wear we are interested in, but they are not sufficiently preserved for reliable conclusions.

The prevalence of non-utilitarian wear on bifacial tools and unifacial points looks even more convincing when compared to all unifacial scrapers and denticulated tools combined (Figure 10-3). The majority of

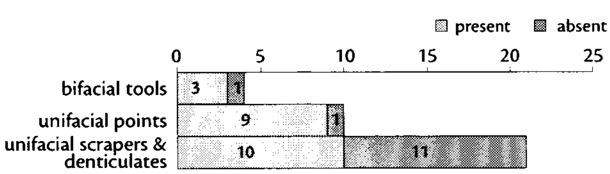


Figure 10-3—Presence of non-utilitarian wear traces on bifacial and unifacial tools from Level B.

unifacial scrapers and denticulates do not have non-utilitarian wear, while a majority of bifacial tools and unifacial points do have it. These tools, compared to the total number of all unifacial scrapers plus the denticulated tools, underwent non-utilitarian wear without a substantial change in form. If our study had included more scrapers, their convergent forms are likely to have added to the group of bifacial tools and unifacial points, although even now the tendency is evident. Such an analytic result is surprising and even paradoxical. It would be quite logical to presume much more non-utilitarian wear in the group of unifacial simple scrapers, since compared to bifacial tools and unifacial points, these items underwent less intensive secondary treatment. Therefore, they should have retained more traces of "old" dorsal surfaces of the blank-flake or even the core. Dorsal surfaces of unifacial points, to say nothing of the surfaces of bifaces (due to the very fact that they are convergent), theoretically, should have fewer chances to accumulate non-utilitarian wear. If it does not always hold true for the Level B assemblage, the question arises, why?

At the present research stage, it is not possible to carry out a complete analysis of this phenomenon, based on the results of such a small group of artifacts. Some judgments and assumptions are quite appropriate, however. First, the reason for the phenomenon discussed lies in the intensity of wear. It is possible that people constantly carried these tools with them, to use during hunting, for instance, while simpler tools (flakes and scrapers) mostly "stayed at home." Second, it is possible that this phenomenon is explained by the duration of tool use. In other words, these items could have had longer lives because they did not fundamentally change form, being a more stable type of tool as compared to flakes and scrapers. Third, it is possible that during their long life, they underwent more intense wear than did flakes and scrapers. The coincidence of the number of items with non-utilitarian wear and those with abrasion (63% each) is more likely to be accidental. Rather, a large part of abrasively treated items among those with non-utilitarian wear is worth noting (Table 10-4). Both kinds of traces are recorded on 40% of the tools. It may serve as additional evidence for these items having been used for a long time, and more attention paid to them. A list of these tools is presented in Table 10-5.

Tools 8, 11, 12, 19, and 28 were heavily exhausted and were subsequently retouched (Photos 10-8, 10-11, 10-12, 10-19, 10-28). The position of non-utilitarian wear traces on the other tools is different: they were both heavily exhausted and retouched repeatedly.

Traces of non-utilitarian origin do not come along just once and rapidly. Since every "layer" of such traces means a certain period of stability—an interval in the process of shaping an item—we can pose the question, What were these items in the intervals between retouching/rejuvenating processes? Since there is no evidence that the morphology of the tools was stable throughout their lifetime, if the tools were repeatedly modified, we must ascertain (1) if these complex tool forms were the result of multiple rejuvenations by simple flaking (scalar) retouch or (2) if there existed a transition from one kind of tool into another.

TABLE 10-5
Characteristics of tools with both non-utilitarian wear traces and abrasion

No.	Tool type	On the surface of a core and/or dorsal surface of a flake	On ventral surface	On the surface of secondary treatment removals (dorsal side)	On the surface of secondary treatment removals (ventral side)
8	Unifacial transverse scraper	+	+	–	–
11	Unifacial convergent scraper	+	+	–	–
12	Unifacial convergent scraper	+	+	–	–
19	Unifacial convergent scraper	+	+	–	–
28	Unifacial point	+	+	–	–
18	Unifacial convergent scraper	+	+	+	–
29	Unifacial point	+	+	+	–
30	Unifacial point	+	+	+	–
24	Unifacial point	+	+	+	+
23	Unifacial point	+	+	+	+
15	Unifacial convergent scraper	+	+	+	+
32	Bifacial tool	+	+	+	+
33	Bifacial tool	+	+	+	+

Traces of Use

Thanks to the good preservation of the flint material from Buran-Kaya III Level B, traces of use were found on 23 artifacts, or 40.4% of sample provided for use-wear analysis. Table 10-6 summarizes the results based on particular categories and character of the traces of use.

In spite of a rather limited number of artifacts, it is obvious that well pronounced traces of use occur most often on bifacial and unifacial convergent tool tip rejuvenation pieces. The surfaces of these rejuvenation pieces, not strictly related to their ventral surfaces, are both fragments of the pointed areas of the tools' working edges and pointed tips of convergent tools themselves. Altogether, such pieces with use traces account for 90.9% of the rejuvenation pieces studied. Such a high percentage is not accidental, and, if we study more pieces of this kind, it is unlikely to substantially change. Undoubtedly, these rejuvenation pieces in the Level B assemblage practically always have use-wear traces on their working edges. For now, we know only of one function for the artifacts from which these fragments come: meat/raw hide cutting.

This observation further confirms an assumption by Demidenko (Chapter 9) about the origin of these rejuvenation pieces. They result from the retouching/resharpening of dulled working edges of convergent tools, since the formation of well pronounced traces of meat/hide cutting is always connected with rounding of the edge. This edge rounding is the main reason that cutting tools became dulled.

The morphological stability and the considerable number of such rejuvenation pieces in this Middle Paleolithic assemblage seem to demonstrate their special, deliberate manufacture. Indeed, they are identical and quite numerous here. Formally, their origin should be recognized as purposeful. In this case, however, the question of what kind of mental template produced them is not clear. Can it have been a special way of shaping/reshaping pointed/convergent tools? Points and convergent tools are well represented in some Middle Paleolithic industries, but rejuvenation pieces of this kind hardly occur in all in them. A number of observations indicate that the objective was not for these pieces themselves, but rather the standardized process of edge retouching/rejuvenation. That is, convergent tools were retouched and rejuvenated in a special way in Buran-Kaya III Level B. In addition, edge rejuvenation retouch was carried out almost exclusively onto the dorsal face (there are no pieces with a different orientation). Edges of numerous items are retouched in one direction, starting from the base onto the distal part. In the case of convergent tools, they are retouched from the base or one-third of the worked length to the terminal end (pointed tip). Owing to stratified traces, some tools show that resharpening retouch of a dulled edge stopped at the very point, where an expressive wear area remains (e.g., Photos 10-22, 10-29). As the area of application of force shifted towards the pointed tip, the probability of its non-deliberate breakage strongly increased. That is why this area was retouched with special care. Thus, the regularity and recurrence of the morphology of the analyzed rejuvenation pieces is a result of a definite, ordered sequence of retouching tools with edges that converge at an acute angle, and this is reflected in the products of the resharpening process. So, it is not a special way of shaping convergent tools. The recurrent morphology of the rejuvenation pieces should be regarded as very similar to the recurrent morphology of blades/flakes with plunging distal ends. Both these

TABLE 10-6
Summary of use traces by tool type

Tool type	*Traces of use (total)*	*% of pieces with traces of use within the group*	*% of the total number of pieces with traces of use*	*Kinematics*	*Contact material*
Bifacial tools	2 (of 4)	50.0	8.7	cutting	meat
Rejuvenations of bifacial convergent tool tips	4 (of 4)	100.0	17.4	cutting	meat
Rejuvenations of unifacial convergent tool tips	6 (of 7)	85.7	26.1	cutting	meat
Unifacial points	4 (of 10)	40.0	17.4	2 cutting, 2 scraping-cutting	2 meat, 2 hide-meat
Unifacial convergent scrapers	4 (of 11)	36.4	17.4	2 cutting, 2 scraping-cutting	2 meat, 1 hide, 1 bone
Unifacial simple scrapers	2 (of 4)	50.0	8.7	1 cutting, 1 scraping	1 meat, 1 hide
Unifacial denticulated convergent tools	0 (of 1)	–	–	–	–
Unifacial double scrapers	0 (of 1)	–	–	–	–
Unifacial transverse scrapers	0 (of 4)	–	–	–	–
All retouch chips	1 (of 11)	9.1	4.4	cutting	meat
Total	23		100.0	18 cutting, 1 scraping, 4 scraping-cutting	18 meat, hide, 2 hide-meat, 1 bone

kinds of pieces were not made accidentally, but at the same time, they were not made deliberately.

In Table 10-6, judging from the number of items with use-wear traces, unifacial points and convergent scrapers follow the group of rejuvenation pieces of tips of bifacial and unifacial convergent tools. Working areas (lateral edges and the pointed area) in most cases underwent retouch: they almost always possess "fresh" retouch. Both edges of the points were made by sharpening retouch and it is not possible to distinguish any backed areas. One of the convergent scrapers, however, probably shows some backing. Use-wear traces (or their remains) cover the tool from the tip to two-thirds of the length of the edge. Traces of cutting meat and cutting/scraping meat/raw hide occur on points. Traces of cutting meat and cutting/scraping meat/raw hide occur on convergent scrapers and, as mentioned above, there are traces of scraping bone, the reason for which is not quite clear (see Photo 10-10).

Only traces of meat cutting occur on bifacial tools. Their position and distribution is similar to that found on unifacial points and convergent scrapers.

Unifacial simple scrapers complete the set of tools carrying traces of use-wear. In the two cases, preservation of traces is quite unsatisfactory. On one scraper, they represent remains of the working edge, which was probably used for scraping hide. The main area carrying traces of use-wear was removed by subsequent retouch (Photo 10-4). On the second scraper, there is exceptionally badly developed meat cutting wear damaged by crushing (Photo 10-3). A distal part of the piece had a working area.

Finally, it is worth noting that only a single item among the eleven retouched chips had use-wear traces. A retouched piece on an unifacial/bifacial lateral edge with fine resharpening, piece 56 had a cutting meat/raw hide function (Photo 10-56). The absence of any use-wear traces on the other ten retouched chips is probably connected to their very tiny and thin butts where detection of wear is very difficult, if not impossible.

Meat and/or raw hide work wear is found on the majority of tools with unquestionable wear; it also dominates all the groups, apart from unifacial simple scrapers (Figure 10-4).

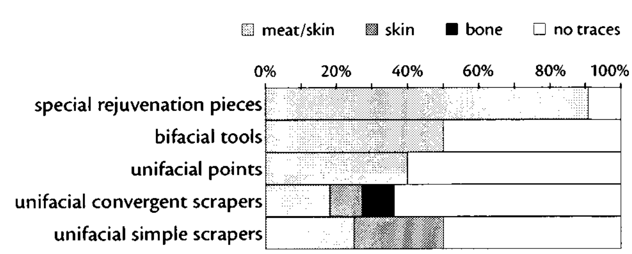


Figure 10-4—Use wear distribution according to the kinds of contact materials.

Buran-Kaya III tools are made of good quality Crimean flint and have a very high degree of preservation. This is probably the reason why meat/raw hide use-wear traces resemble textbook examples (Photos 10-3, 10-11, 10-30, 10-43, 10-45, 10-56). First, they have two-sided, fluid polishing that softly envelopes the micro-reliefs. Well-developed, it concentrates at the very edge and, as it moves away from that edge, it gradually disappears in peripheral areas. The working edge's flange is softened in plan and slightly rounded in profile (Photo 10-43a, b). Only the smallest protrusions are smoothed (Photo 10-56b). No sufficient or clear linear traces were found on the tools carrying meat cutting traces. Grooves and scratches that are very expressive occur only on the tools where hide wear traces predominate over meat cutting ones (Photos 10-30a–c). The predominance of hide treatment wear traces is expressed by intensive (as compared to meat cutting) rounding and smoothing of the working edge's flange in plan and profile. In some cases, the surface of areas with traces of meat/hide wear shows separate spots of different, more compact polishing, probably resulting from repeated contacts with bone (e.g., Photo 10-11d shows a spot of complete polishing on the right side of the edge).

Two scrapers, no. 14 and no. 4, show traces of contact with hide (Photos 10-4 and 10-14). Scraper 14 shows the most pronounced wear (Photo 10-14a–i). It is expressed as two-sided polishing, relatively pronounced, softly, but intensely smoothing micro-relief penetrating practically into all the depressions of the edge-area of the tool, except the smallest ones. In spite of a rather high degree of relief abrasion, the surfaces of the intensely worked areas is loose. The edge is strongly dulled, smoothed in plan, and rounded in profile. The surface carries a large number of linear traces (Photos 10-14b–d, h–i). They are, in part, directed diagonally towards the working edge, which corresponds to the cutting function, and in part directed perpendicularly, which shows scraping. It is significant that both pieces (Photo 10-4 and 10-14) carry traces of wear that were damaged by the subsequent retouch rejuvenation and that tool no. 14 was also used after such rejuvenation.

Cutting use predominates among the tools with defined wear, as well as among most of the groups, apart from simple scrapers (Figure 10-5). Only two tools—no. 4, a simple scraper, and no. 10, a convergent scraper—exhibit scraping traces in more or less

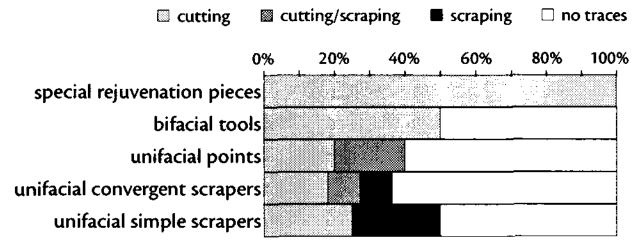


Figure 10-5—Traces of the distribution of use according to kinematics.

pure form (Photos 10-4 and 10-10). However, both pieces have problematic traces. It has already been mentioned that it is not possible to interpret unambiguously scraping traces for tool 10. Tool 4 retains only a small portion of the working edge. That is why, based on these observations, it is practically impossible to get a complete idea about the character of the working edges of tools meant for scraping. Nevertheless, it is enough just to establish the fact of scraping as a kind of reconstructible behavior.

Tables 10-2 and 10-6 show that the simpler the morphology of Level B tools, the more diverse are the use-wear traces as to the kinds of contact materials and kinematics. At the same time, the set of reconstructible functions is not wide. All of the tools show traces of meat and/or hide cutting. Thus, it is possible to argue that an overwhelming number of items with use-wear were connected with butchering animal carcasses (Figure 10-6).

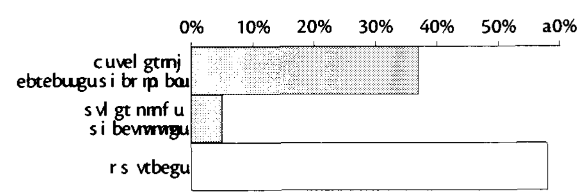


Figure 10-6—Distribution of reconstructed kinds of activities in Level B.

Signs of activities connected with bone and hide treatment are minimal. There is no evidence indicating wood treatment.

Conclusions

Thanks to the relatively young age of this Middle Paleolithic assemblage and the favorable depositional conditions, artifacts from Buran-Kaya III Level B are rather well preserved for wear analyses. They show the entire range of traces needed for traceological research. There is no significant post-depositional damage to the artifacts. The presence of some small crushing facets on the edges of the artifacts is due to trampling.

Wear traces connected with knapping technology are represented by an abrasive treatment on the flake edges and on the flanges of core platforms in the area where the blow was applied. The purpose of such abrasive treatment to these edges is not clear. Equally, its use to create adaptation elements of tools for application and/or technological needs can be assumed.

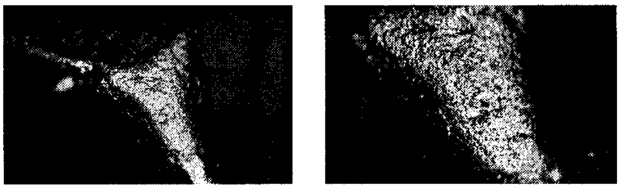
Traces of "non utilitarian" wear occur more often, and in a more developed way, on complex tool forms: bifacial tools, unifacial points, and convergent scrapers, which quite definitely indicate longer and/or more intense use of these particular tool types.

Of interest is the thermal treatment of a flake used as a blank for a unifacial convergent scraper (Photo 10-12). Even given that this thermal treatment could hardly have been deliberate, it is a unique example among the materials of a Middle Paleolithic industry.

Practically all rejuvenation pieces of bifacial and unifacial convergent tool tips have pronounced wear resulting from meat cutting. They are non-deliberate, specific retouch spalls of reduced tool working edges.

On the whole, both use and wear traces occur more often on morphologically complex tools. In all likelihood, they are "exhausted" tools abandoned at the final stage of their shaping/reshaping and usage. To explain this phenomenon, it is necessary to compare the traceological appearance of separate groups with morphologies of different complexity. That is why, to continue the research, it is necessary to get a more complete idea about the traceology of simple scrapers and flakes without retouch.

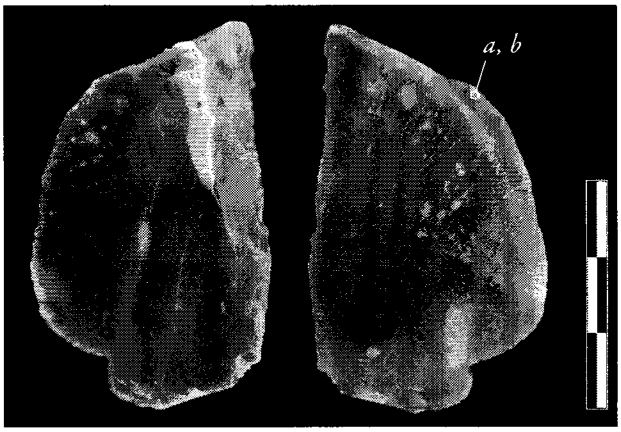
The predominant functions of tools in the Buran-Kaya III Level B assemblage were butchering carcasses of animals and probably initial hide treatment. No significant traces indicating any other kinds of activities were found

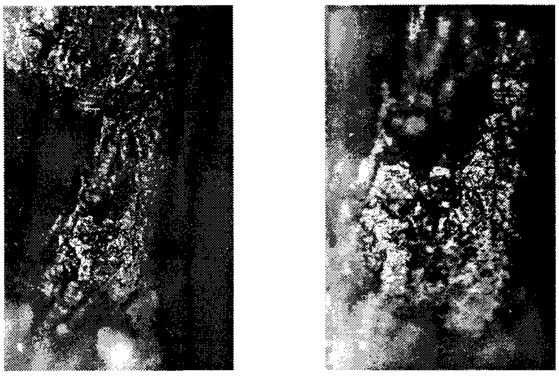


a *b*

Photo 10-0—Experimental tool: non-utilitarian wear traces on the tool's ridge were caused by transportation in a leather bag, *a*–100×, incident light; *b*–200×, incident light.

Photo 10-1—Unifacial simple concave scraper. No significant traces of use were found. Weak traces of abrasion occur on the lowest area of the right edge. Convincing traces of non-utilitarian wear are absent. The surfaces of the dorsal side and the flake's butt look more reduced than the ventral side. Preservation: excellent.





a *b*

Photo 10-2—Unifacial simple wavy scraper. No significant traces of use were found. Traces of abrasion occur along the whole length of the left edge: *a*–100×, incident light; *b*–200×, incident light. The treatment is very intense, turning into grinding, rounding the edge in profile. It is unclear whether this is preparation of a knapping area before application of sharpening retouch or is an adaptation of the butt of the tool. There are no traces of non-utilitarian wear. All surfaces, edges, and ridges are almost equal and are almost non-reduced. Preservation: excellent.

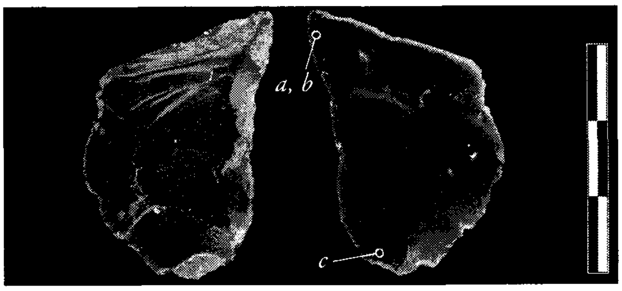
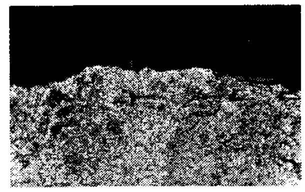
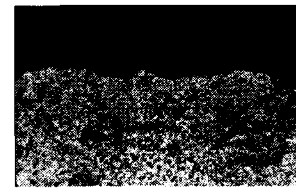


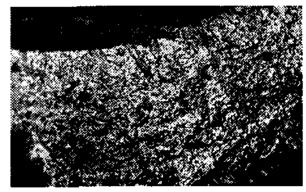
Photo 10-3—Unifacial simple concave scraper. There are very weak "meat polishing" traces on the right edge at the distal end of the tool. There are no sufficiently long, full profile traces. Small, badly pronounced fragments of abrasion occur on both edges. There are no convincing traces of non-utilitarian wear. Surfaces of the dorsal and ventral sides and butt have the same wear as the interfacet ridges of the secondary retouch treatment. Preservation: excellent. *a*–poorly pronounced meat cutting traces, 100x, incident light; *b*–poorly pronounced meet cutting traces, 200x, incident light; *c*–Non-utilitarian wear traces, 100x, incident light.



a



b



c

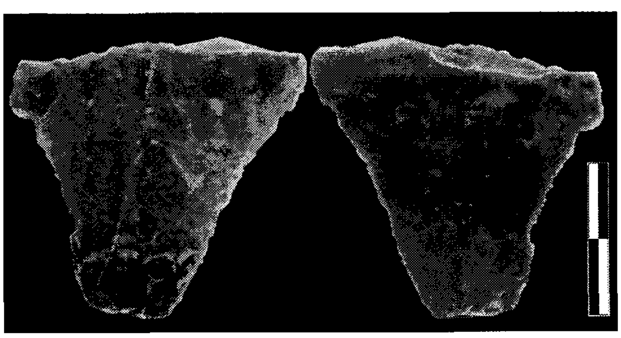


Photo 10-4—Unifacial simple concave scraper. Remains of a scraping edge with slightly pronounced roundedness of the edge, meat grinding, and "hide" polishing occur in the upper left area of the tool. The remaining parts of use-wear traces were destroyed by the subsequent retouch and edge damage. Slight degree of ridge erasure on ventral and dorsal surfaces and edges. The retouch on both edges retouch has a fresher appearance. Right edge retouch is reminiscent of trampling edge damage. The item, when in the flake stage without any particular retouch, was used for a short time (hide scraping, but there are too few traces for a reliable conclusion), then slightly retouched and abandoned. There are grounds to distinguish at least two stages of use-life for the tool: before and during formation of traces on the left edge, and a succeeding retouch. Preservation: satisfactory.

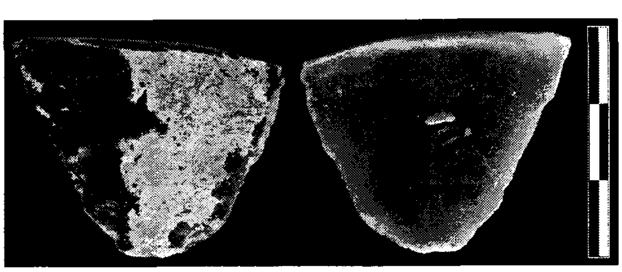


Photo 10-5—Unifacial double straight-convex scraper. Traces of use were not found. Signs of non-utilitarian wear are absent. Preservation: satisfactory.

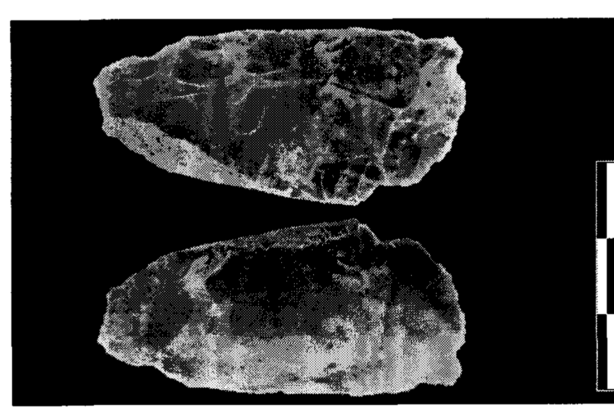


Photo 10-6—Unifacial transverse convex scraper. Traces of use were not found. Signs of non-utilitarian wear were not found. Preservation: satisfactory.

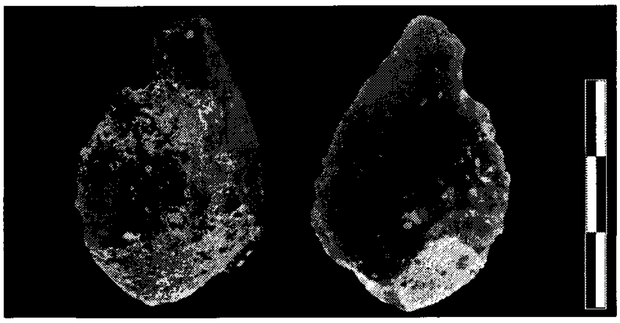


Photo 10-7—Unifacial transverse convex scraper. No pronounced traces of use were found. Areas with a slight roundedness of the edge and very slight, non-developed polishing are broken by later damage on both edges. Remains of small fragments of abrasion on the edge. No traces of non-utilitarian wear. The microrelief on the dorsal and ventral surfaces is practically identical. Preservation: excellent.

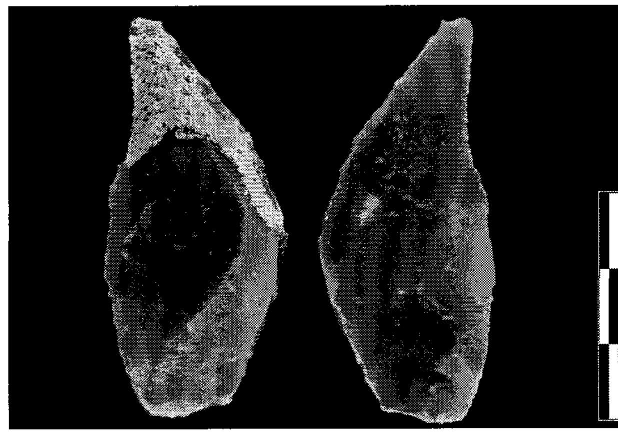


Photo 10-8—Unifacial transverse-convex oblique scraper. No pronounced traces of use were found. There are remnants of edge abrasion on the right side. Traces of non-utilitarian wear were found on both the dorsal and ventral sides. Separate areas of the retouched edge rounded by this kind of wear remain at the base and on the right side. Thus, there are grounds to distinguish (1) the removal of the flake and its primary retouching and (2) secondary retouching. Preservation: excellent.

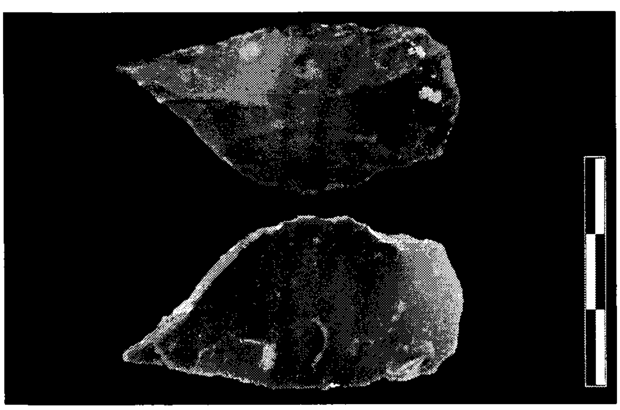
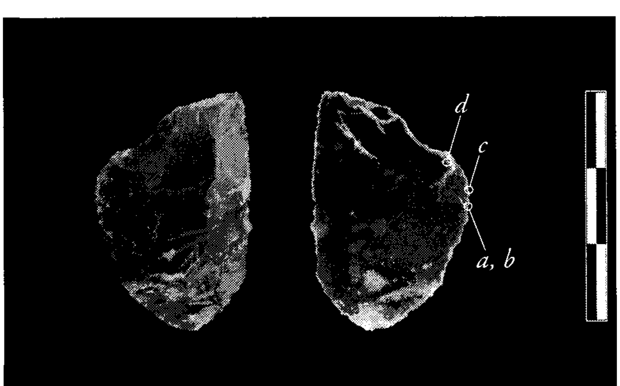
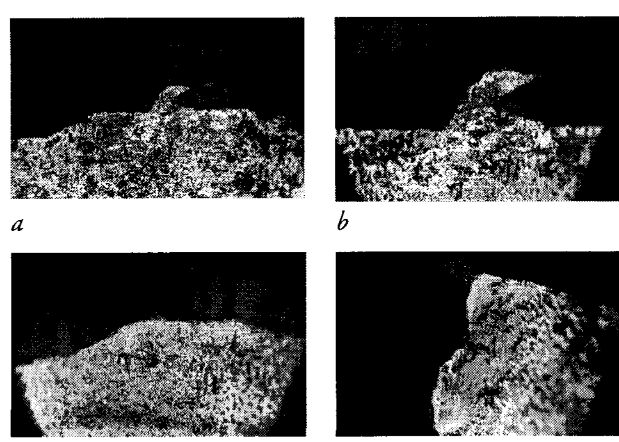


Photo 10-9—Unifacial transverse convex scraper. Not clear polishing was found along the right ventral side. Traces of non-utilitarian wear were found on the dorsal sides. Intensely worn ridges on the dorsal side are removed by secondary treatment retouch facets. Preservation: satisfactory.





c *d*

Photo 10-10—Unifacial convergent scraper (elongated trapezoidal with thinned base and distal end). There is bone/antler polishing on the left edge (backing?). Judging from badly defined scratches, and the disposition and directions of cracks, it had a scraping function, but somewhat irregular. It may well be the result of blunting the backing against bone, not scraping bone to shape it. Slightly pronounced non-utilitarian wear was found on the ventral side and ridges between retouch facets on the dorsal side. All areas of the old surfaces were removed by the tool's retouch facets. Preservation: good. *a*–bone scraping traces, 100×, incident light; *b*–bone scraping traces, 200×, incident light; *c*–bone scraping traces, 200×, incident light; *d*–micro mirrors of "G" type polishing, post occupational burial traces, 100×, incident light.

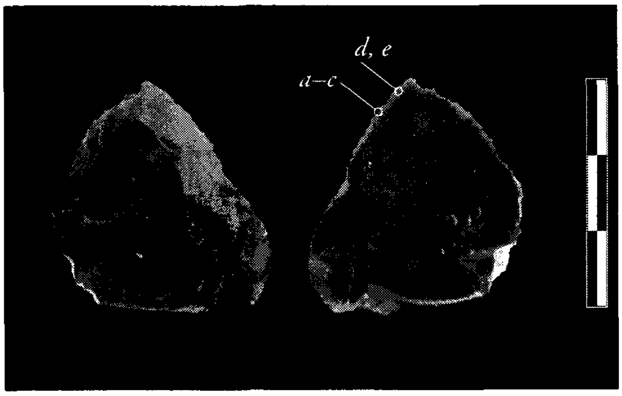
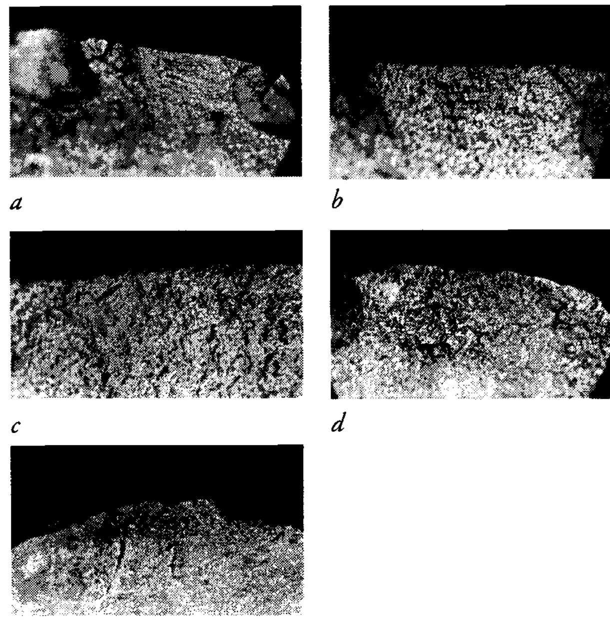


Photo 10-11—Unifacial convergent scraper (semi-crescent). There are remains of well pronounced meat cutting wear on the right edge. There are remains of abrasion on the left edge, situated on the surviving areas of the edge after the last retouch facets were made. Non-utilitarian wear on the dorsal and ventral sides was removed by retouch facets. Thus (1) manufacture of tool and its use, (2) abrasion of the right edge (probably simultaneously with the preceding process), and (3) rejuvenation retouch are distinguished. On the very tip of the dorsal side, there are facets of small lengthwise spalls, reminiscent of spin-off wear or a Kostenki-type knife, since they are removed from a prepared platform by retouch onto the ventral side. Preservation: good.



a–c–meat cutting traces: *a*–100×, incident light; *b*–200×, incident light; *c*–400×, incident light; *d, e*–meat cutting traces: *d*–200×, incident light; *e*–100×, incident light.

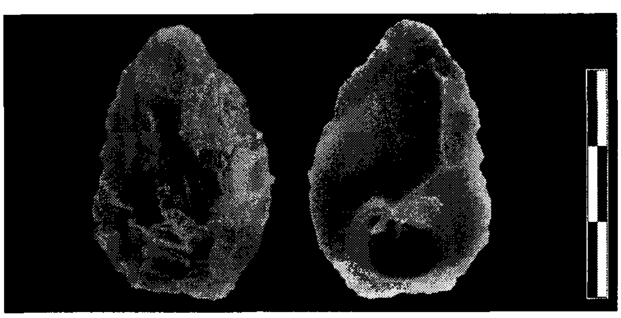


Photo 10-12—Unifacial convergent scraper (leaf-shaped with thinned base and back). No pronounced traces of use were found. Areas of edge abrasion remain on the lower part of the right edge. There is well pronounced roundedness of dorsal ridges, particularly on the ventral side. Interfacet ridges and facet surfaces of rejuvenation retouch of the edges have a practically fresh appearance. Thus, it is possible to distinguish two stages of life: before the resharpening of the working edge and after. This tool is made on a thermally treated flake. Nearly all of the ventral surface has a matte "pre-surface" (texture of the surface prior to thermal treatment), the rest of the facets are made after the treatment. They have a smoother texture and a characteristic oily gloss. The morphology of a chip negative detached from the lower ventral part also testifies to a thermal treatment. Most likely, it occurred accidentally. The tool in its present form was made from a thermally treated flake or retouched after thermal treatment. All retouch facets on the dorsal and ventral sides relate to a post-thermal stage. Preservation: good.

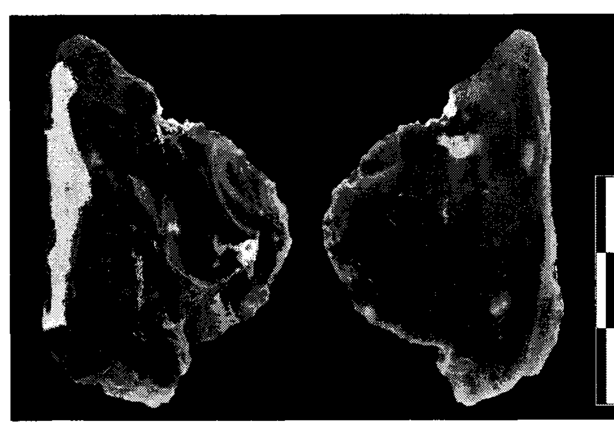
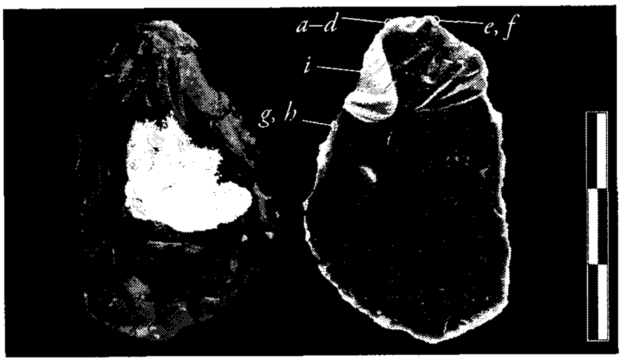


Photo 10-13—Unifacial convergent scraper (semi-trapezoidal). Pronounced traces of use were not found. Well pronounced wear of dorsal interfacet ridges, particularly well developed is the grinding of the ridges existing on the core. New interfacet ridges, as well as ventral ridges, are much less reduced. There are grounds to distinguish only two life stages: (1) non-utilitarian wear of the surface of a core and (2) the flake's removal, retouching, and possible use. Preservation: excellent.



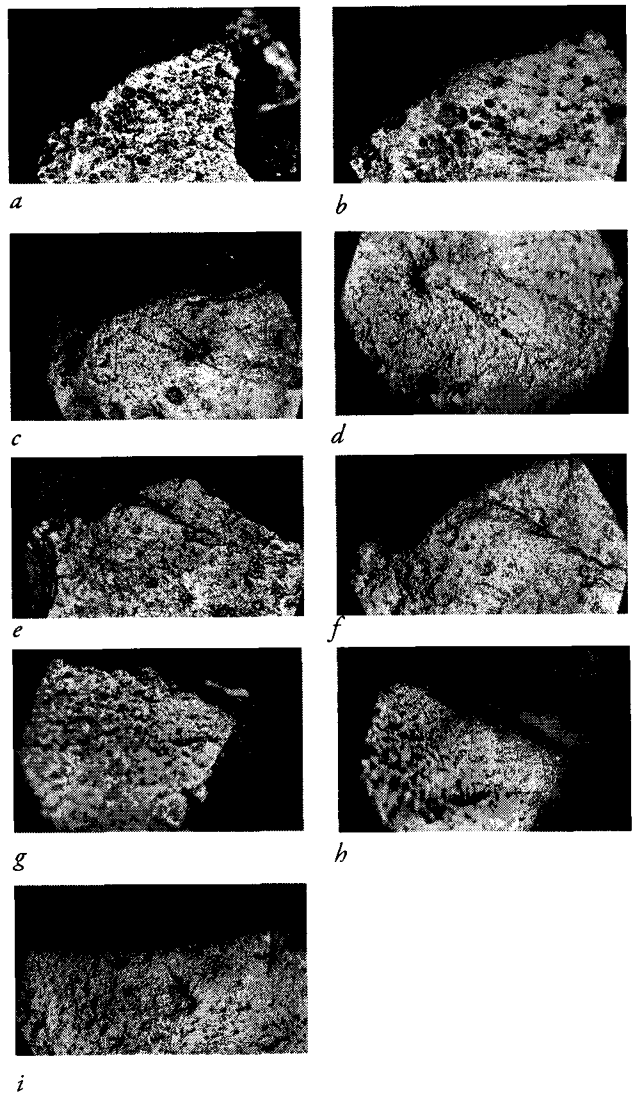


Photo 10-14—Unifacial convergent scraper (elongated trapezoidal with thinned base). Very expressive raw hide cutting/scraping traces were found on the upper part of the tool and on the right edge in the area between the tip and the middle part of the edge. On the very tip and along the edge this wear is partly damaged by later edge damage (trampling?). The intensity of polishing and degree of roundness of the edge's flange are not homogeneous. In the area where trimming retouch removed a part of the edge, this wear is less developed. The tool was likely used for the same function before and after trimming. Traces of abrasion were found on the left side. Most likely, it is not an adaptation of the tool's back, but preparation of a platform for dorsal retouch. Areas with abrasion are retained only in between facets. Traces of non-utilitarian wear were not found. Preservation: excellent. *a-d*–raw hide scraping-cutting traces: *a*–50×, incident light; *b*–100×, incident light; *c*–200×, incident light; *d*–400×, incident light; *e-f*–raw hide scraping-cutting traces: *e*–100×, incident light; *f*–200×, incident light; *g-h*: raw hide scraping-cutting traces, *g*–100×, incident light; *h*–200×, incident light; *i*–raw hide scraping-cutting traces, 200×, incident light.

Photo 10-15—Unifacial convergent scraper (elongated semi-trapezoidal). Pronounced traces of use were not found. Areas with abrasion of the edge occur on the right and left sides. On the back, in the proximal part of the tool, there are areas of abrasion, remains of polishing of the contact area on the nucleus. Distinct from normal (e.g., for Upper Paleolithic) abrasion, this was carried out in the direction from the flaking surface onto the platform. Well pronounced roundedness and polishing of ridges on the fragments of the flake removal surface occur on the back of the flake. Badly pronounced non-utilitarian wear is on the ventral side. Interfacet ridges and retouch facet surfaces of the left edge have a practically fresh appearance. The first row of dorsal facets on the right edge has traces of reduction of ridges. The ventral ridges of facets are also reduced. Thus, the item had three life stages taking place at different times: (1) a core with developed non-utilitarian wear (transportation?), (2) manufacture of the tool and its use (?), and (3) application of new retouch—rejuvenation. Preservation: satisfactory.

Photo 10-16—Unifacial convergent scraper (elongated semi-trapezoidal, naturally backed). No pronounced traces of use. No non-utilitarian wear. Microreliefs of the ventral and dorsal surfaces are practically identical. Preservation: satisfactory.

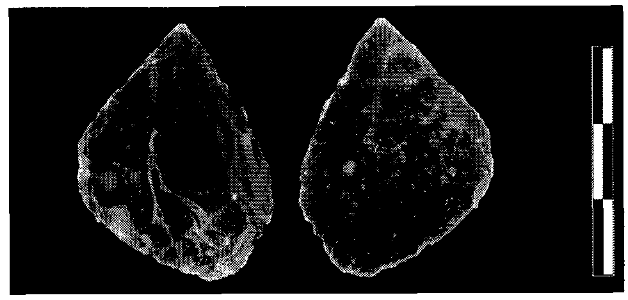


Photo 10-17—Unifacial convergent scraper (trapezoidal). No pronounced traces of use. The left side retains small areas of abrasion of the edge. No traces of non-utilitarian wear. The microreliefs of ventral and dorsal surfaces are practically identical. Preservation: excellent.

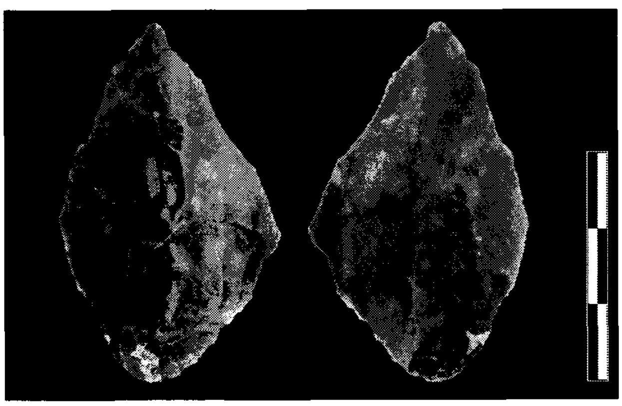


Photo 10-18—Unifacial convergent scraper (sub-trapezoidal). No pronounced traces of use. Separate fragments of "meat" polishing are in the upper part of the left edge. There are abrasion areas in the lower part of the left edge. The same, but in a very small area, occurs on the left edge where abrasion is mostly removed by retouch. Well pronounced roundedness of ridges on the flake removal surface occur on the back. Badly pronounced non-utilitarian wear is on the ventral side and interfacet ridges and retouch facets on the dorsal side. Surfaces created at different times are distinguished: (1) core, (2) tool with a succeeding or simultaneous edge abrasion, and (3) secondary retouch. There is a platform on the very tip of the ventral side similar to Kostenki-type knives. No removals from it are seen. Preservation: good.

Photo 10-19—Unifacial convergent scraper (sub-trapezoidal with thinned base). Pronounced traces of use were not found. Abrasion areas are present in the central part of the right edge. On the back, in the proximal part of the tool, there are areas of abrasion, remains of polishing of the contact area on a core. Distinct from normal (e.g., for Upper Paleolithic) abrasion, this was carried out in the direction from the flaking surface onto the platform. Very badly pronounced roundedness of ridges on ventral and dorsal sides. A practically fresh appearance of interfacet ridges and facet surfaces of rejuvenation retouch of the edges was noted. Thus, the item concerned may possess two life stages, which can be stated with a very low probability. Preservation: good.

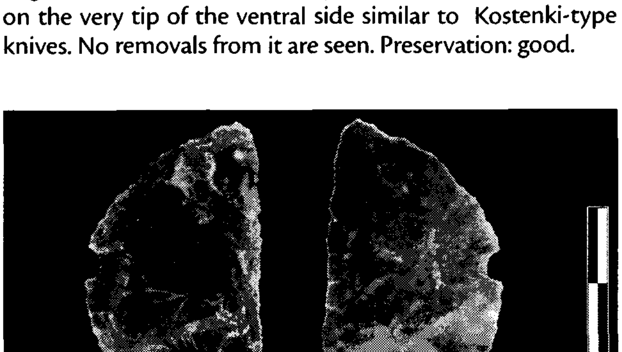


Photo 10-20—Unifacial convergent scraper (semi-crescent). Pronounced traces of use were not found. The presence of separate fragments of "meat" polishing on the right edge (at the distal end) were distinguished. On the back, in the proximal part of the tool, there are areas of abrasion: the polishing remnants of a contact area on a core. Distinct from normal (e.g., for Upper Paleolithic) abrasion, this was carried out in the direction from the flaking surface onto the platform. There is very well pronounced roundedness of ridges on the fragments of the flake removal surface on the back of the flake. There is badly pronounced non-utilitarian wear on the ventral side. Interfacet ridges and retouch facet surfaces on the working edges have an almost fresh appearance. The item may therefore possess three life stages: (1) a core with extremely strong wear (transportation?), (2) tool manufacture and its use, and (3) rejuvenation retouch. On the very tip of the dorsal side there are facets of small lengthwise spalls, like spin-off wear or a Kostenki-type knife, since they are removed by retouch from a prepared platform onto the dorsal and ventral sides. Preservation: satisfactory.

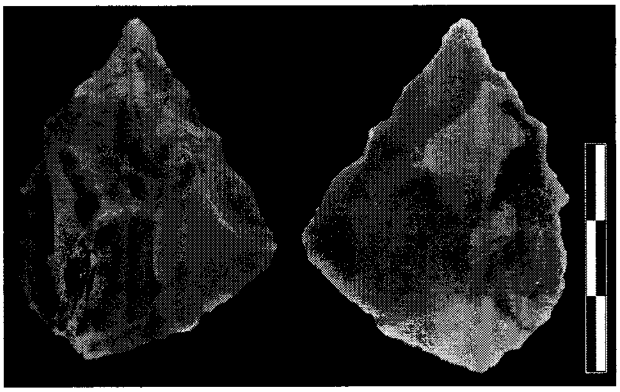


Photo 10-21—Unifacial denticulated convergent tool (semi-trapezoidal). Pronounced traces of use were not found. Traces of non-utilitarian wear were not found. Preservation: good.

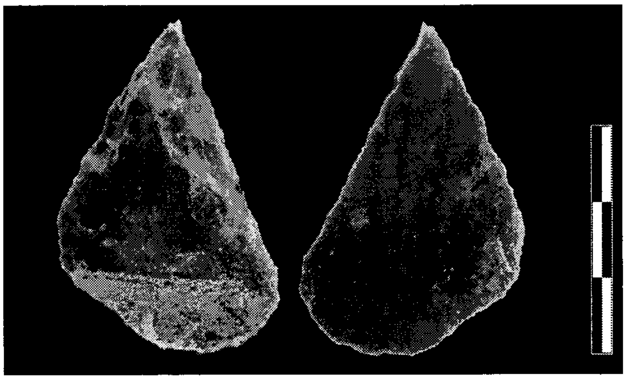


Photo 10-22—Unifacial point (sub-triangular). Pronounced traces of use were not found. There are traces of roundedness of the edge and unclear polishing along the edge of the protruding part of the base. It is very likely non-utilitarian wear of the flake. Left edge retouching was the final act of the tool retouch, and was carried out from the base onto the tip. Preservation: satisfactory.

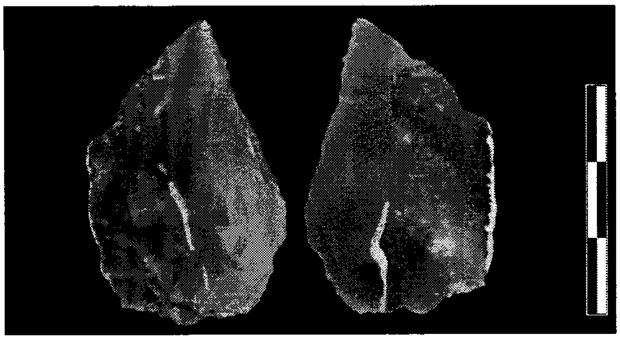


Photo 10-23—Unifacial point (elongated sub-trapezoidal, naturally backed). Pronounced traces of use were not found. In the lower part of the right edge, there are areas of abrasion. According to the degree of wear, it is possible to distinguish at least two generations of retouch on the ventral part and, to a lesser extent, on the back. Preservation: satisfactory.

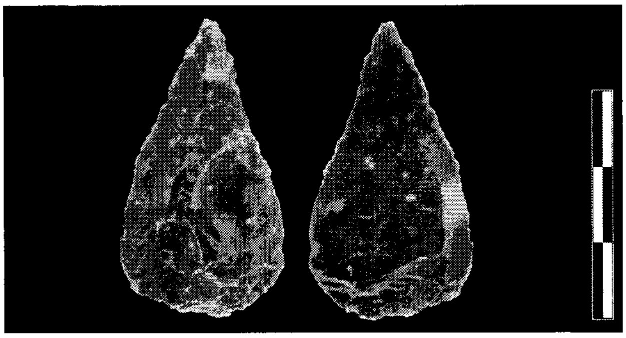


Photo 10-24—Unifacial point (leaf shaped with thinned base). Pronounced traces of use were not found. There are areas of abrasion in the lower part of the right edge. Ridges and protruding areas erasure (exhaustion) is observed at the base on the ventral part. Ridges of thinning removals are reduced. Dorsal ridges of removals are fresher. Thus, at least two phases in the tool's lifetime are distinguished. Thinning of the ventral side precedes the treatment negatives for the dorsal side. Preservation: satisfactory.

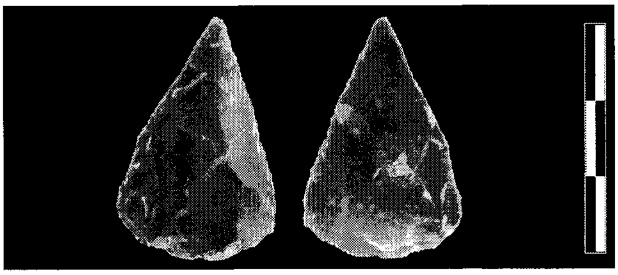


Photo 10-25—Unifacial point (leaf-shaped). There is badly pronounced meat cutting wear on the right edge (less) and left (more). According to the degree of wear, it is possible to distinguish at least two generations of retouch on the ventral part and, to a lesser extent, on the dorsal surface. Preservation: good.

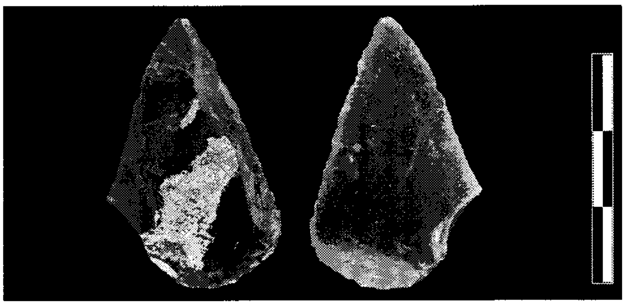


Photo 10-26—Unifacial point (sub-trapezoidal). Neither working edge has sufficiently pronounced use wear, only hinting at weak meat processing use wear. There are areas of abrasion on the lower part of the base on the right side. Weakly pronounced traces of erasure occur on the ventral side. Preservation: satisfactory.

Photo 10-27—Unifacial point (leaf-shaped with thinned base). Well pronounced cutting/scraping hide/meat traces were on part of the left edge. At the very tip, this wear was removed by edge damage like a micro burin spall, and from the side of the base by a later rejuvenation. Erasure (exhaustion) was observed on some ventral and dorsal ridges (very poor preservation) and on protruding lateral areas. This erasure was removed by shaping removals of the right and left lateral edges, as well as thinning removals made from the base onto the ventral part. Thinning removal negative ridges also have non-utilitarian wear, less developed than the "old" part of ventral and dorsal surfaces, but much more pronounced than the last retouch removals of the edges. The thinning was probably repeated. Spall dorsal ridges are fresher. Thus, three phases in the lifetime of the tool are distinguished: (1) an item to the last ventral thinning, (2) thinning, (3) an item with dorsal resharpening retouch. There is an impression that the left edge was more often retouched in order to sharpen it. Preservation: good.

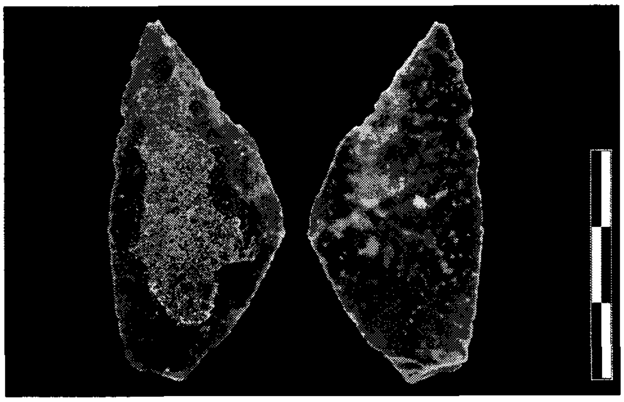


Photo 10-28—Unifacial point (elongated sub-trapezoidal). Well pronounced cutting meat/hide traces were on the right and, particularly, on the left edge, where rejuvenation retouch is more shallow. An abrasion area is in the middle of the right edge. On the ventral and dorsal sides (very poor preservation), erasure (exhaustion) of ridges and protruding areas was observed. This erasure was removed by shaping removals of the right and left edges. Thus, at least two phases in the lifetime of the tool are noted. Preservation: good.

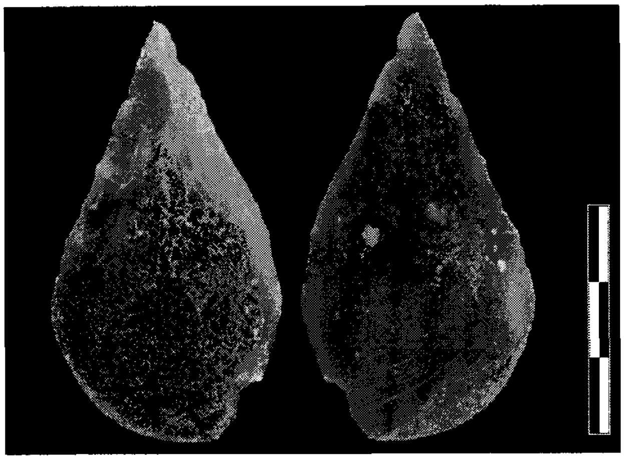
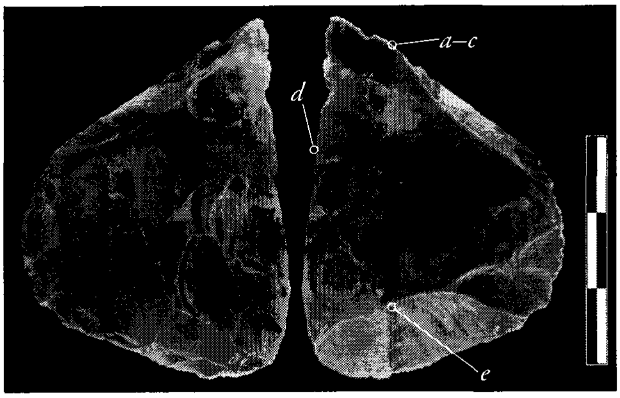


Photo 10-29—Unifacial point (semi-trapezoidal). Use-wear traces were seen on the very tip and separate areas of the left edge. The wear is poor, with fine edge roundedness and meat polishing. Remnants of abrasion areas were on the lower left edge. Non-utilitarian wear is not pronounced, so it is not possible to assume stages of treatment took place at different times. However, an area with cutting traces at the tip of the tool makes it possible to assume that the final act of tool rejuvenation was the retouch of the left edge, carried out from the base towards the point. Preservation: good.



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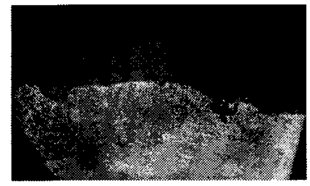

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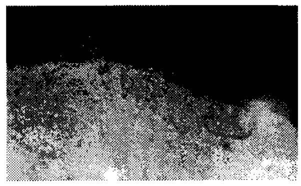

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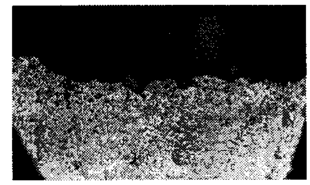

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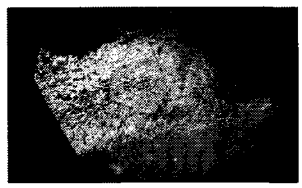


e

Photo 10-30—Unifacial point (trapezoidal). Traces on the left edge are morphologically similar to scraping/cutting raw hide. Areas of edge abrasion remain. Erasure (exhaustion) was observed on the ventral and dorsal sides at the basal ridges and protruding areas. This erasure was removed by shaping removals of the right and left edges. Thus, at least two, or possibly three, phases in the lifetime of the tool are distinguished. Numerous circular cracks, which are traces of hammerstone treatment, are situated on the dorsal surface of the blank-flake and its butt. Preservation: satisfactory. *a*–raw hide scraping-cutting traces, 50×, incident light; *b*–raw hide scraping-cutting traces, 100×, incident light; *c*–raw hide scraping-cutting traces, 200×, incident light; *d*–ancient "freshly" resharpened edge, 100×, incident light; *e*–Non-utilitarian wear traces, 100×, incident light.

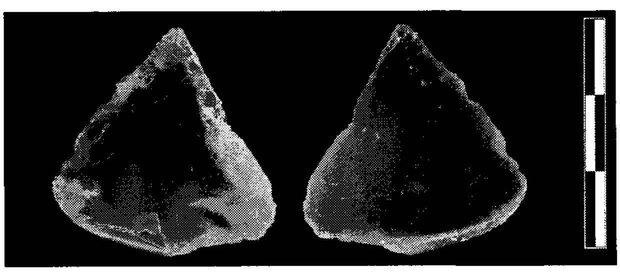


Photo 10-31—Unifacial point (sub-triangular). Neither edge has sufficiently pronounced traces of wear. No abrasion traces were recognized on the edges. Traces of soft erasure and roundedness of the edge were on separate retouched areas along the base of the tool; they were removed by the second row of retouch. Dorsal and ventral erasure traces are poorly pronounced. Thus, at least two phases in the lifetime of the tool are established: (1) old retouch, non-utilitarian wear, (2) new retouch. Preservation: good.

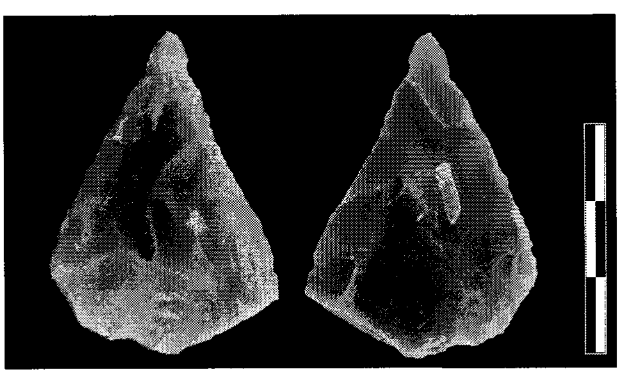
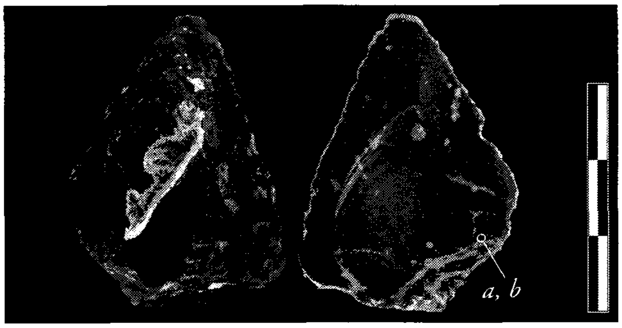
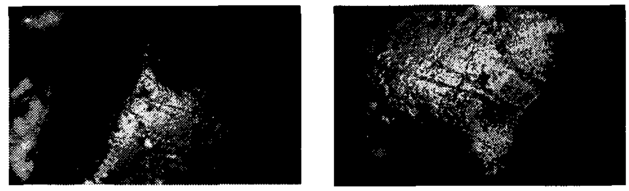


Photo 10-32—Bifacial plano-convex tool (sub-trapezoidal point). No pronounced use traces were found, although separate areas of poorly developed meat polishing on the left edge were noted. The left edge retains small areas of very badly developed abrasion. Both sides of the item display erasure (wear) on ridges and protruding areas. Areas of this kind remain at the very tip on the plano side. This erasure was removed by the retouch of the right and left edges from the plano side onto the convex side. Retouch goes along edges, and is obviously of the second row. The left edge, considering the plano side as the ventral one, was retouched for the second time almost along the whole length. The right edge was retouched only at the tip, with the new facets covering only ⅓ of the length. Thus two, possibly three, phases in the lifetime of the tool are apparent. The oldest surface is the plano side of the biface, it underwent rejuvenation last. There is only a small lengthwise removal from the tip, four very small facets from the left edge at the base forming an angle upwards, and two negatives of flat thinning at the base. The oldest surfaces of the convex side remain in the central part (lengthwise). It is not possible to compare the time of emergence of the oldest areas of the plano and convex sides. Judging from the degree of wear on their ridges, they are almost identical. Later rejuvenation as a multi-row marginal retouch was mostly carried out onto the convex side. At the very tip, there is edge damage reminiscent of spin-off; its length does not exceed 4 mm and it is highly likely that it is retouch and not darting wear. Preservation: satisfactory.





a *b*

Photo 10-33—Bifacial plano-convex tool (elongated semi-trapezoidal scraper). No pronounced use-wear traces were found. The right and left edges (from the middle to the base of the item) retain areas of abrasion. Protruding parts and ridges are very badly worn on the plano side (the ventral side of a flake) and the massive butt (a wide plane, fracture). On the convex side, the surface with similarly bad wear remains only on a very small area at the base of the item. It is possible to state two retouch stages, both from the plano side onto the convex one, but the older retouch is present only at the basal part; it was the first to be removed and shaped the major part of the convex side, especially from the center towards the tip. Since it is difficult to prove non-simultaneity of the first retouching and the oldest areas both on the plano and convex sides, two, and only hypothetically, three, attempts of rejuvenation of both surfaces at different times can be asserted. There are facets of small lengthwise spalls similar to spin-off or Kostenki-type knife treatment on the very tip of the back, since they are removed from a prepared platform by retouch onto the plano side; their length does not exceed 3 mm. Preservation: satisfactory. *a*–non-utilitarian wear traces, 100×, incident light; *b*–non-utilitarian wear traces, 200×, incident light.

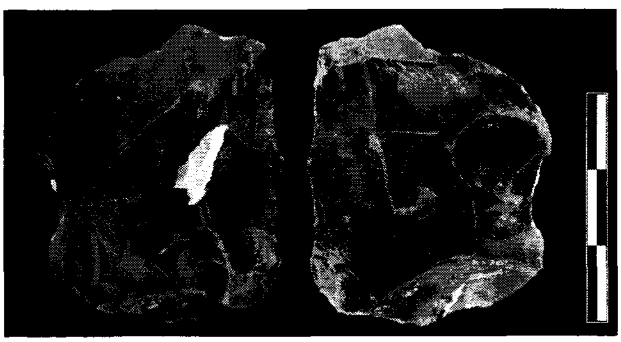
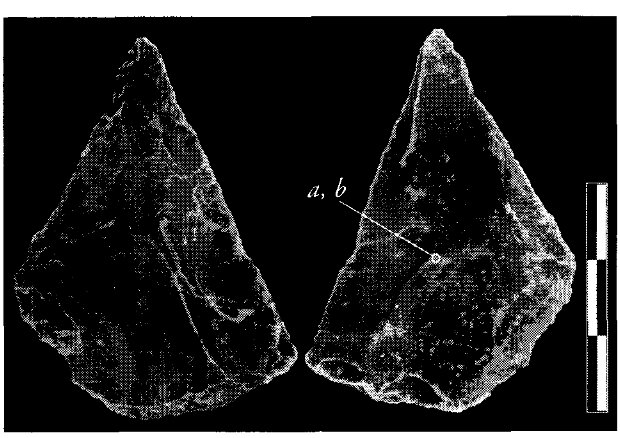
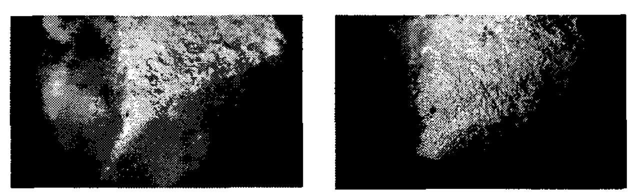


Photo 10-34—Bifacial plano-convex tool (single-edged straight scraper). No pronounced use traces were found. There are no good reasons to distinguish stages of treatment taking place at different times. Both sides of the item have practically identical, very weak wear, possibly due to embedding in the cultural layer. The item is an intensely worked plano-convex tool. The latest rejuvenation removals were made onto the convex side. The plano side was modified twice, but despite this, there are no truncated large removal negatives on its surface. There is very badly pronounced additional wear that is absent on negatives from the later thinning of this side in the central part of the plano side, on the surface of negatives, and interfacet ridges thinning of the first generation. These wear areas are relatively flat, the traces are not very pronounced, and are very likely to be remains of non-utilitarian wear. Preservation: satisfactory.





a *b*

Photo 10-35—Bifacial plano-convex tool (trapezoidal point). Pronounced use-wear was not found. Separate areas retain wear on the right and left edges beneath the center. Wear is probably meat cutting. Protruding parts and ridges on the plano side and convex side are worn. Retouch of later rejuvenation is present on both plano and convex sides at the base (very little). The latest facets are removed from both edges from the center towards the tip of the tool. It is possible to distinguish two stages of treatment for both edges of the tool. Circular cracks on the plano side are evidence of hammerstone usage. There are facets of micro spin-off at the very tip of the convex side. Preservation: satisfactory. *a*–non-utilitarian wear traces, 100×, incident light; *b*–non-utilitarian wear traces, 200×, incident light.

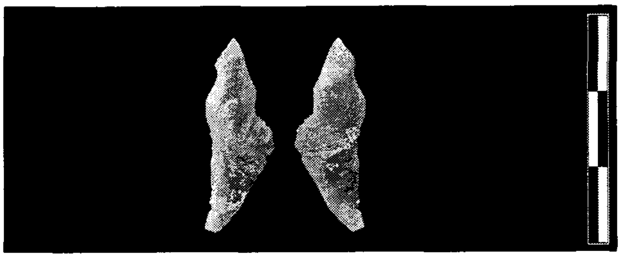


Photo 10-37—Rejuvenation piece of a unifacial convergent tool's tip. Badly pronounced but definable meat cutting polishing traces were found on the edge of the right side. Badly developed non-utilitarian traces were on the back, 1 cm away from the tip. It is quite obvious that these traces are present on this removal only because it is the longest of all. Compared to other similar pieces, it "seized" the biggest part of the dorsal relief, lying under the point of flaking (closer to the base). The very tip of the tool is normally shaped by facets of the latest (freshest) retouch. Preservation: good.

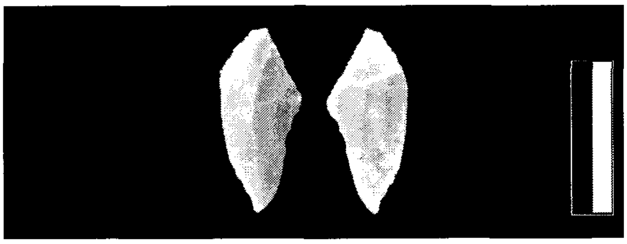


Photo 10-38—Rejuvenation piece of a unifacial convergent tool's tip (2× natural size). Well pronounced meat cutting traces were found along the edge of the side at the very tip. Preservation: good.

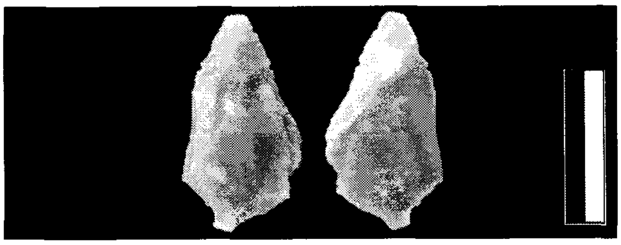
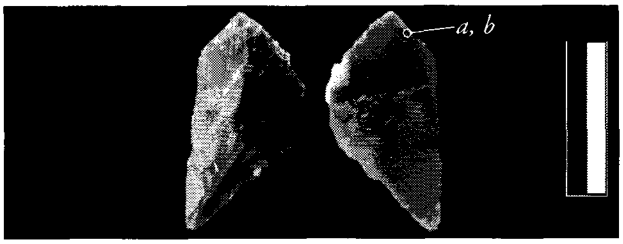


Photo 10-39—Rejuvenation piece of a unifacial convergent tool's tip (2× natural size). Badly pronounced but definable meat cutting polishing traces were found along the edge of the side at the very tip. An area with abrasion remains at the lower part of the right edge. Non-utilitarian traces were not found. Preservation: good.

Photo 10-40—Rejuvenation piece of a unifacial convergent tool's tip. Rather expressive meat cutting/raw hide polishing traces were found along the edge of the piece, as well as a fragment of the right edge. Similar traces were very likely present on the left edge, but were removed by fresher micro- retouch. Non-utilitarian traces were not found. Preservation: good.

Photo 10-41—Rejuvenation piece of a unifacial convergent tool's tip (2× natural size). Expressive traces of use were not found. Very poorly developed abrasion traces were on part of the left working edge. Non-utilitarian traces were not found. Preservation: good.

Photo 10-42—Rejuvenation piece of a unifacial convergent tool's tip (2× natural size). Rather expressive meat cutting/hide polishing traces were noted along the edge of the piece, as well as a fragment of the right and left edge. Non-utilitarian traces were not found. Preservation: good.



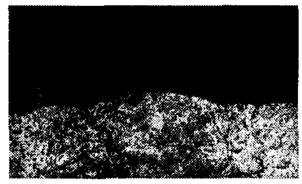

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Photo 10-43—Rejuvenation piece of a unifacial convergent tool's tip (2× natural size). Poorly expressive, but quite definable meat cutting/hide polishing traces were found along the piece's side, at the very tip, on the left edge. Non-utilitarian traces were not found. Preservation: good. *a*–meat cutting traces, 100×, incident light; *b*–meat cutting traces, 200×, incident light.

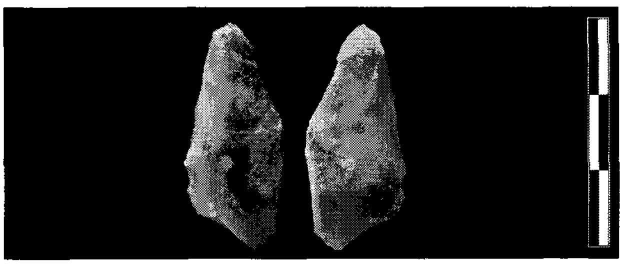
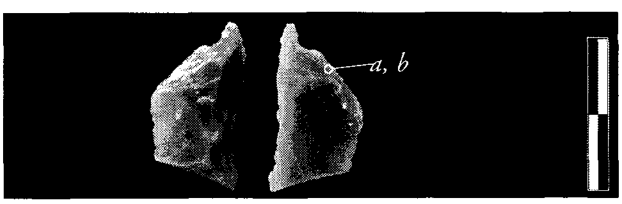
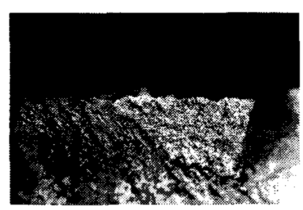


Photo 10-44—Rejuvenation piece of a bifacial convergent tool's tip. Badly pronounced meat cutting polishing traces were found on the edge of a fragment of the left side. Non-utilitarian traces were not found. Preservation: good.

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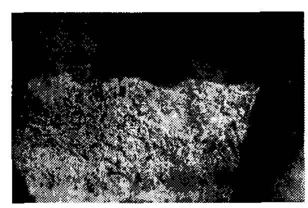
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Photo 10-45—Rejuvenation piece of a bifacial convergent tool's tip. Well pronounced meat cutting polishing traces were found on the edge of a fragment of the left blade, on both sides of the tool. Non-utilitarian traces were not found. Preservation: good. *a*–meat-hide cutting traces, 100×, incident light; *b*–meat-hide cutting traces, 200×, incident light.

Photo 10-46—Rejuvenation piece of a bifacial convergent tool's tip (2× natural size). Badly pronounced meat cutting polishing traces were found on the edge of a fragment of the left blade, on both faces. Non-utilitarian and abrasion traces were not found. Preservation: excellent.

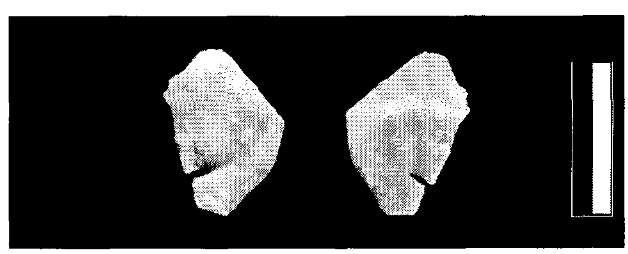


Photo 10-47—Rejuvenation piece of a bifacial convergent tool's tip (2× natural size). Badly pronounced meat cutting polishing traces were found on the edge of a fragment of the right side, on the surface of the plano side, and to a lesser degree, on the convex side. Non-utilitarian traces were not found. Preservation: good.

Photo 10-48—Bifacial thinning chip. There are remains of well pronounced abrasion along the edge of a fragment of the working edge. Non-utilitarian traces were not found. Preservation: good.

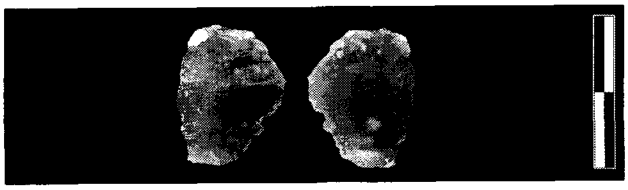


Photo 10-49—Bifacial thinning chip. No definable traces were found. Preservation: excellent.

Photo 10-50—Bifacial thinning chip. There is well pronounced abrasion along the flange of a fragment of the edge. Erasure of interfacet ridges on the dorsal surface is noted. Preservation: excellent.

Photo 10-51—Simple retouch chip. There are light abrasion traces on the edge of the butt, which is a fragment of the tool's edge. Preservation: good.

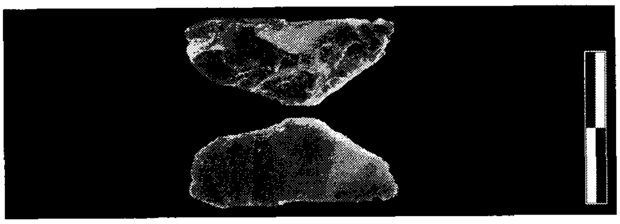


Photo 10-52—Retouch piece on unifacial/bifacial tool's lateral edge fine resharpening. No use-wear traces were found. Preservation: good.

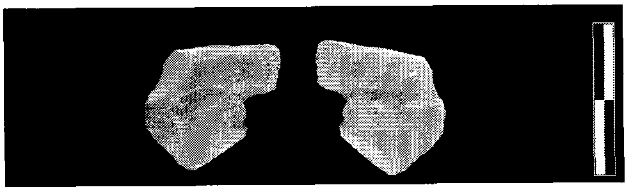


Photo 10-53—Simple retouch spall. No changes of natural surfaces traces were found. Preservation: excellent.

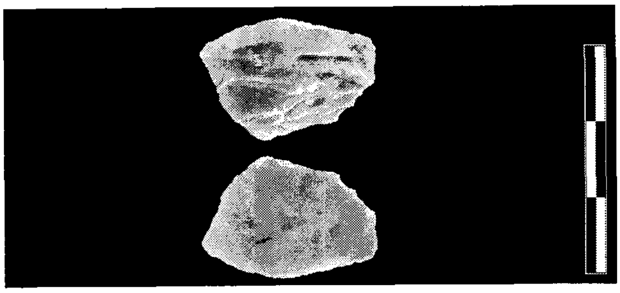


Photo 10-54—Simple retouch spall. No changes of natural surfaces traces were found. Preservation: good.

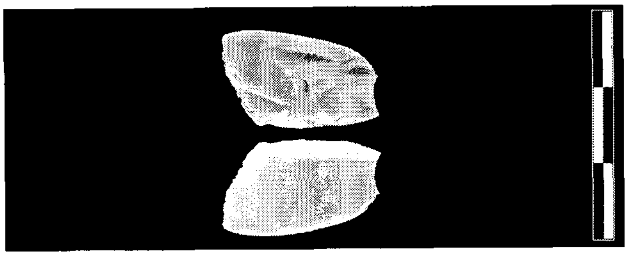


Photo 10-55—Retouch piece on unifacial/bifacial tool's lateral edge radical resharpening. No expressive traces of any kind were found. Preservation: good.

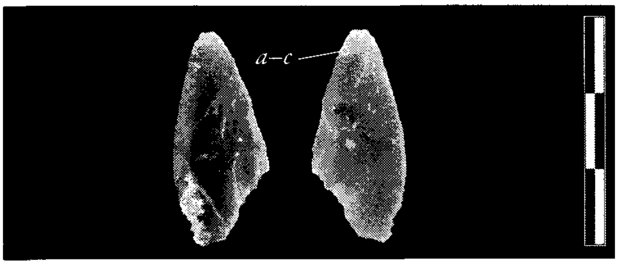
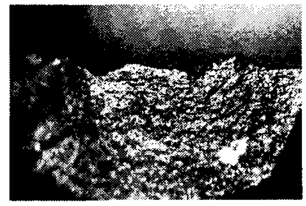


Photo 10-56—Retouch piece on unifacial/bifacial tool's lateral edge fine resharpening. Well pronounced meat cutting wear traces are on the fragment of the left edge and near the point on the right edge. Area of abrasion traces is in the lower part of the piece. Non-utilitarian wear traces are not recognized. Preservation: good. *a*–meat cutting traces, 100×, incident light; *b*–meat cutting traces, 200×, incident light; *c*–meat cutting traces, 400×, incident light.



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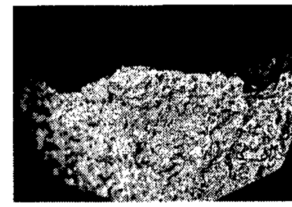

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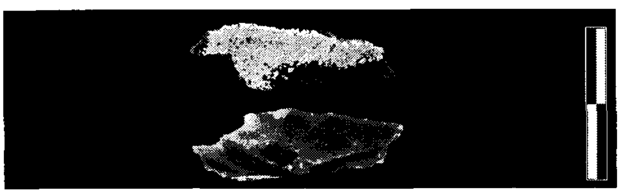

Photo 10-57—Retouch piece on a unifacial/bifacial tool's lateral edge radical resharpening. Possible non-utilitarian traces are along the fragment of the tool's edge—the piece's butt. Preservation: good.

Photo 10-58—Simple retouch spall. There are poorly pronounced abrasion traces along the fragment of the tool's edge—the piece's butt. Preservation: good.

11

Transformation Analysis and the Reconstruction of On-Site and Off-Site Activities: Methodological Remarks

Thorsten Uthmeier

One, if not the main, focus in Middle Paleolithic research is still the question of whether the observed concepts of blank production, as well as the different forms and frequencies of stone tools, derive from functional processes, or if they are better explained as resulting from cultural development. To analyze aspects of this discussion, which has been called the Binford-Bordes-discussion in the German literature (Richter 1997:134), it is necessary to control two other important factors that are, without doubt, responsible for some of the diversity among Middle Paleolithic assemblages: the influence of space and time. Both can be excluded as explanatory variables if contemporaneous assemblages from one region with similar environmental settings are used. It follows that the investigation of functional and/or cultural variability in the Middle Paleolithic should start on a regional scale in a limited chronological time range.

Chronology, however, is a major problem even if regional assemblages should be ordered according to their relative ages only. It seems as if typological comparisons alone, based on the hypothesis of an evolutionary development of stone tools, are not an adequate solution. In addition, analyses based on those type forms that are supposed to have a chronological relevance use only a part of the archeological data related to the production and use of stone tools (Rolland 1988; Sackett 1988). It is for this reason that two of the major complexes of Central European Middle Paleolithic, the Mousterian and the Micoquian, were believed to be units distinct in space and time (Bosinski 1967:84 *Einheiten in Zeit und Raum*) and thus the result of cultural changes over a long period of time. As soon as all artifacts, including debitage, from well-stratified sequences were used, and not just tool types (with a focus on type forms), different hypotheses emerged (Geneste 1985, 1988, 1990; Richter 1997; Soressi 1999; Uthmeier 2000).

The presence of the Levallois concept in both industries, as well as similarities in many other technological and typological variables, led to the hypothesis that the Central European Mousterian and Micoquian assemblages were produced by the same groups of Neandertals. The differences between both industries, which can be reduced, in a much simplified view, to the presence or absence of bifacial tools, seem to originate in different activities, rather than relating to different chronological positions and/or cultural traditions. The same analytic approach that tries to explain all artifacts in an assemblage in terms of typology, technology, raw material procurement, and settlement pattern, led to the hypothesis that assemblages of the so-called Szeletian (Allsworth-Jones 1986) may also represent the remains of special activities of the Mousterian and Micoquian-producing Central and Eastern European Neandertals (Uthmeier 2000).

Apart from the question of whether modified pieces alone bear sufficient data to answer chronological questions, it is common sense that multi-layered sites provide the most adequate data to establish a regional chronology. In this regard, the data from the Late Middle Paleolithic of Crimea is of exceptional quality. After more than twenty years of intensive research, many multi-layered open air sites, rockshelters, and caves from a small region situated along the ridges of the Crimean Mountains are known (Chabai 1998a). Among these, Kabazi II with more than 25 archeological horizons embedded in more than 15 geological layers is one of the major sequences for the Upper Pleistocene in Europe (Chabai 1998b; Chabai et al. in press). Sites like Kabazi V, Starosele, Buran-Kaya III, Karabi Tamchin, and Chokurcha I also have several archeological layers containing different industries and faunal material (Burke 1999a, 1999b, Chapter 16; Patou-Mathis 1999, Chapters 8 and 22). In combination with the analysis of malacofauna (Mikhailesku 1999, Chapter 19), small mammals (Markova 1999, Chapters 3, 17, 23), and pollen-sequences (Gerasimenko 1999, Chapter 2), it is possible to reconstruct different activities within local and regional paleoenvironments (Burke et al. 1999). For chronological comparisons, absolute dates were made with different dating methods to control and correlate the stratigraphical sequences (Rink et al. 1998).

According to Schiffer (1987), however, the distribution of finds within a given excavated unit may not only be the result of human activities, but may also be due to geological processes and other non-human agents. Geological processes that move artifacts after human occupation are supposed to be especially active in multi-layered caves and rockshelters (Richter 1987). Only after isolating processes that might lead to an admixture of artifacts from different archeological levels is it possible to meaningfully analyze and interpret human activity. Apart from other aspects, the following questions are considered to be important: Do all artifacts from an archeological horizon belong to a single episode of human settlement, or were they left in the course of several repeated visits to the same long-exposed living floor? What were the shapes of the artifacts that first entered the site, and from where did they come? Which part of the *chaîne opératoire* took place on-site, and which part happened off-site? What concepts were used for the production of blanks, and for what purpose were the tools made? Finally, what was the function of the site, and how does the site fit into a regional settlement pattern?

To answer these questions, it is necessary to isolate distinct short-term episodes. Afterwards, these distinct episodes can be analyzed in regard to their technology, typology, and the activities they represent, embedded in the use of the regional landscape. We believe that the sorting of stone artifacts into their original nodular context, the subsequent treatment of these nodules as minimal prehistoric units, and the interpretation of these units in terms of on-site and off-site activities are new methods that help to get closer to the recognition of functional processes in Paleolithic assemblages (Figure 11-1).

The Approach: Sorting Artifacts into Nodules

Today, the grouping of artifacts into different classes of raw material is a standard method in analyzing stone tool assemblages. In most studies, these classes represent geological formations and/or distinct raw material sources. It is only since the work of K.-H. Rieder (1981/82, 1990), J. Hahn (1988), and W. Weissmüller (1995) that the attempt to sort artifacts by using macroscopic attributes (Figure 11-2) into even smaller units has become more widely known. Inspired by the diversity of Jurassic and Cretaceous raw materials found in southern German Middle and Upper Paleolithic assemblages, they used carefully recorded attributes like the texture and color of the fracture, the structure and color of the cortex, and the presence or absence of microfossils to define individual nodules even when refits were missing. While the diversity of attributes within a unit thought to be the equivalent of a single nodule should tend towards zero, the differences between these units should be as numerous as possible. Unlike Weissmüller (1995:61), we decided not to sort artifacts under 3 cm if they were classified as simple chips. Chips from bifacial flaking and from retouch or the resharpening of working edges, however, were included in the samples. The attempt to sort artifacts into raw material units results in four different categories:

(1) Single piece: one artifact that shares no raw material attributes with any other artifact from the analyzed assemblage.

(2) Workpiece: two or more artifacts, with refits or without, that belong to a single nodule.

(3) Raw material source (or variant): two or more artifacts that belong to different nodules. The variety of raw material attributes is within the known variability of the raw material source.

(4) Formation: two or more artifacts, the origins of which can only be traced back to their geological genesis.

While in most cases a distinction between different geological formations, as well as between different raw material sources is possible, the identification of individual nodules requires knowledge of the variability of attributes such as color, cortex, and fossils within a given raw material source. The significance

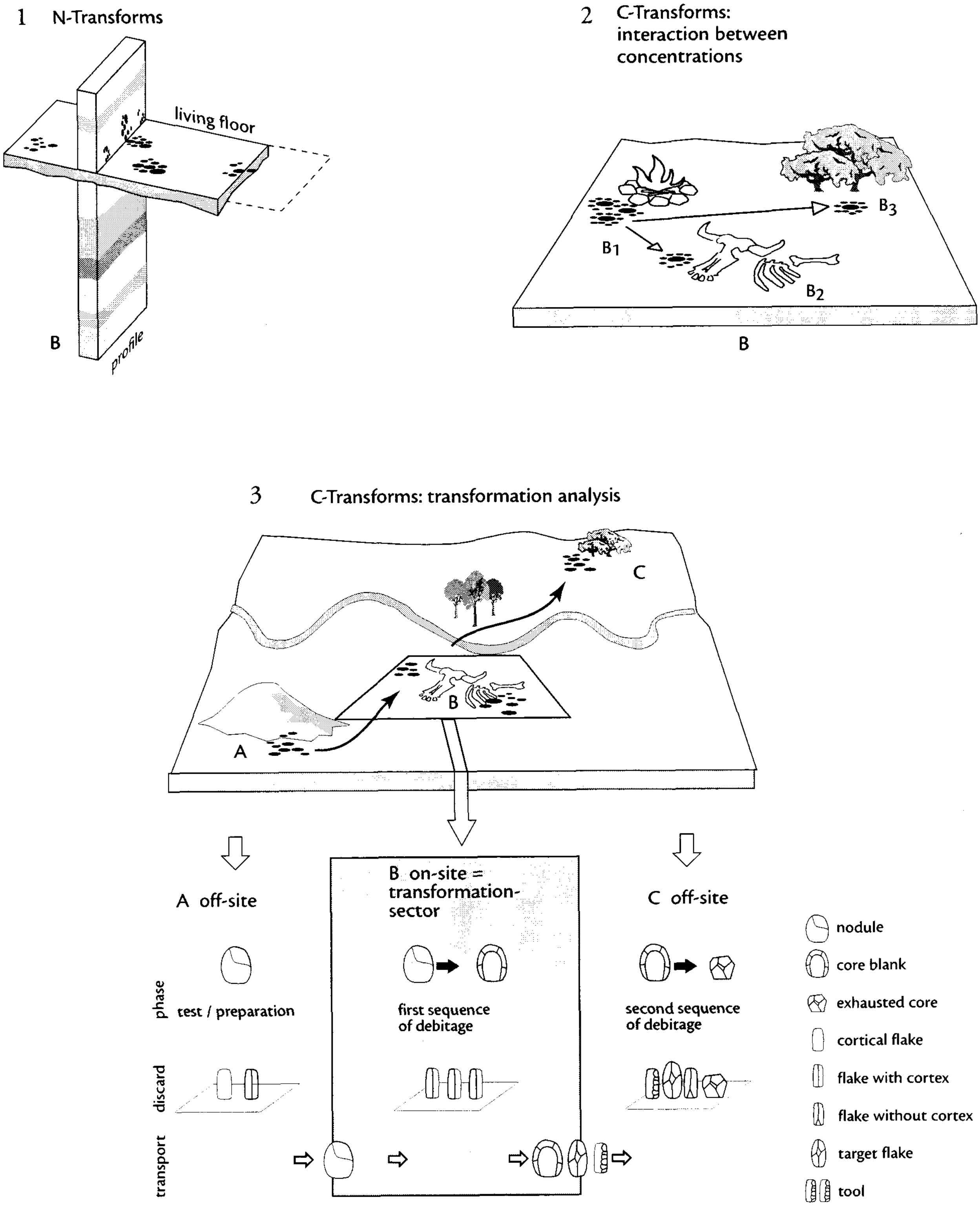

Figure 11-1—Analyzing stone tool assemblages on the basis of workpieces. Because they are considered to be equivalents of refits, workpieces can be used for the analysis of N-transforms and C-transforms: 1–the vertical and horizontal distribution of workpieces helps to identify and solve stratigraphical problems after N-transforms were active; 2–the mapping of artifacts accumulated in workpieces helps to reconstruct the spatial distribution of activity zones on a living floor; 3–single pieces and workpieces help to reconstruct on-site and off-site phases of the *chaîne opératoire* (A–outcrop; B–excavated site; C–ephemeral site).

of the raw material units for functional interpretations varies with the level of resolution reached in the sorting. Because they consist either of single artifacts or contemporaneous pieces, the categories "single pieces" and "workpieces" are regarded as the shortest temporal activities in the Paleolithic that we are able to recognize and explain in a broader context, e.g., *chaîne opératoire*, local activities, and regional settlement patterns (Figures 11-1, 11-2, 11-3). In general, Paleolithic assemblages are seen as an accumulation of such short-term events. Single pieces, for example, were manufactured elsewhere, imported, and—either after being used or not being used at all—discarded. Workpieces, on the other hand, went through either some or all phases of the *chaîne opératoire* at the site. In reality, the other two categories, the raw material sources and the geological formations, are also comprised of a number of single pieces and/or workpieces, but, due to related raw material attributes, it is impossible to separate every single event, e.g., each nodule. Within the framework of the search for nodules, they are defined as the sorting remnant (Weissmüller 1995: 58). If compared with the entire assemblage, it can only be assumed that the procurement of raw material for the production of two or more cores coming from the same raw material outcrop or geological formation took relatively little time.

The attempt to identify nodules must not be looked at as a failure if such a high resolution can only be achieved for part of an assemblage. Theoretically, even the recognition of some single pieces or workpieces allows better hypotheses to be formulated about the intentions of Paleolithic people than if such information is lacking. Yet, how is it possible to check if the macroscopic attributes used to separate nodules were sufficient, especially when refits are missing? The following list gives some features that permit a plausible sorting into workpieces:

(1) The number of artifacts of a workpiece and the estimated sum of their volumes. If present-day raw material sources were sampled, it is possible to estimate the size range of the nodules. Therefore, it is possible to check if the total amount and the maximal length of the artifacts in a workpiece fall into the range of volume and metric attributes known for the sampled nodules.

(2) The shape of a nodule and its geological provenance. If pieces with cortex allow conclusions about the shape of a nodule (plaquette, etc.) and its geological provenance (river terrace, residual, or primary

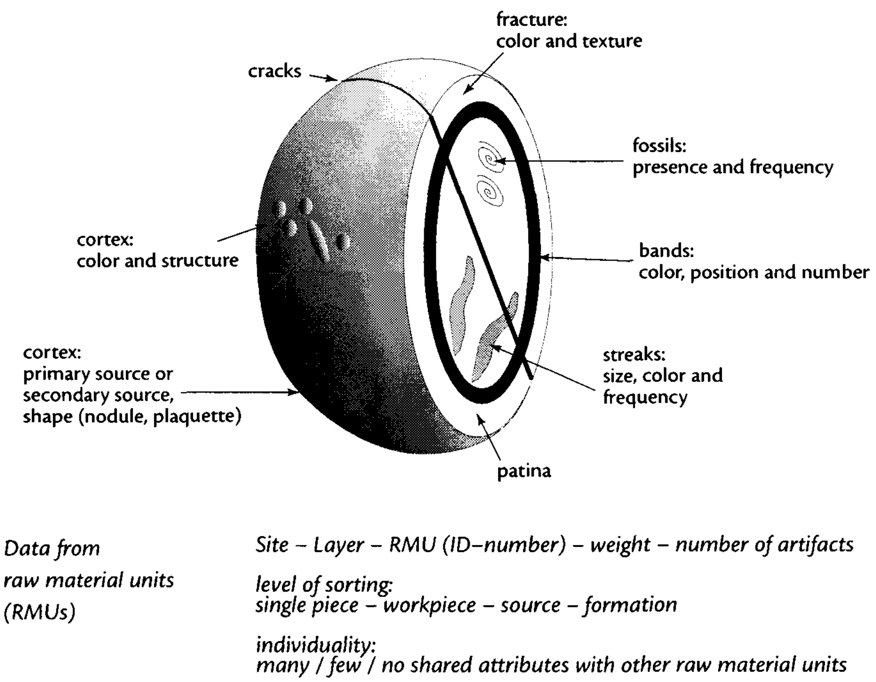

Figure 11-2—Attributes used as defining criteria for the sorting of artifacts into raw material units. Single pieces that share no attributes with any other artifact of the sample are treated as an unquestionable import; small units with an individual combination of attributes (workpieces) are supposed to be an equivalent of refitted debitage on the site.

source), all artifacts with cortex should be classified the same (e.g., plaquette from primary source).

(3) Refits. Refits should exclusively occur within workpieces.

(4) Technology. If the attempt to identify a concept of blank production was successful, all artifacts of a workpiece should fit into the expected variability of blanks for this concept (e.g., if a core is recognized as Levallois, no blank normally expected for the discoidal concept (Böeda 1995) should be present).

(5) Spatial distribution. If the finds are considered to be in situ, the mapping of artifacts from a numerically larger workpiece should show a concentration.

Raw Material Requirements for Successful Sorting into Workpieces

Only unpatinated artifacts allow identification of raw material sources, since the formation of patina destroys the original surface of the fracture (Rottländer 1983:554–558). At the same time, the identification of workpieces and single pieces presupposes different macroscopic attributes between nodules coming from the same raw material source. The origin of Jurassic hornstone and Cretaceous flint as cyclical secretions in parallel layers (Floss 1994:81) formed during the submersion of microorganisms below the seabed favored the genesis of individual nodules that differ in volume, color, and in the presence or absence of streaks and fossil inclusions. In addition, the vulnerability to chemical solution and mechanical abrasion of the outer nodule covering leads to different molding of the cortex. Other raw materials of biogenetic origin, such as radiolarite, however, appear to be more homogeneous. Raw materials developed during processes of metamorphosis, like quartzite and chalcedony, as well as magmatic raw materials developed during volcanic activities, often do not have such a broad spectrum of individual attributes. In general, raw material procurement that uses several outcrops of different geological origins makes the sorting of artifacts into workpieces easier. The Middle Paleolithic assemblages of southern Germany, where the sorting into nodules was first done, are good examples of such procurement strategies. In most cases, the diverse spectra of raw materials are the result of repeated cycles of purposeful surveys for mainly local sources from the mountain ranges of the Swabian and Franconian Alps, where formations of different geological eras found their way onto the Pleistocene surface (Weissmüller 1995:108–111).

This is also true for the southern part of the Crimean Peninsula, where the genesis of the Crimean Mountain ranges (Figure 11-3) led to the exposure of different raw material sources (Ferring 1998). The first range, rising at the southern bank of the Crimean Peninsula, is composed of Jurassic limestone, sandstone, and conglomerate. The second range is built up by Cretaceous sedimentary rock that is, in part, overlain by laccoliths. The third and lowermost range in the north consists of clay, sand, and limestone from the Tertiary period. Many primary raw material sources known today (Figure 11-3) are situated in the eastern part of the second range of the Crimean Mountains, along the valley of the Burulcha River and near the small town of Russakovka (see also Figure 12-1). Because dark colors, ranging from black to dark grey and greyish-brown, dominate most of the samples we took in that area (Table 11-1), it is possible that the outcrops belong to the same layer of Cretaceous flint. At the same time, we observed a great variability in shape, color, and streaks between the nodules. Secondary raw material sources such as outcrops of residual flint and river terraces are even more numerous and mainly located along the Bodrak, Kacha, and Alma river valleys. In some cases, as in the Bodrak Valley, the river has cut into primary raw material sources. As a consequence, nodules with rolled cortex and those with chalky cortex lie near the riverbeds. As far as the sorting into workpieces is concerned, conditions on the Crimean Peninsula are good because the raw material there is characterized by different geological formations within a small area and, at the same time, nodules from the same raw material source show variability in color, structure, and cortex.

When compared with the situation today, it is not easy to calculate the distribution of and the access to raw material outcrops during the Upper Pleistocene. According to Chabai et al. (1999:228), some of the outcrops were exposed only in a late phase of the Upper Pleistocene when the rivers cut their beds deeper into the landscape. Nodules from secondary sources, especially when taken out of river terraces, have been rolled and crushed during their natural transportation and therefore are often of poor quality. Others, which were collected at the bottom of slopes with primary sources, are in comparably bad condition because of weathering. Today, many artificial terraces make it easy to locate and sample the above-mentioned raw material sources. For Neandertals, the acquisition of good quality raw materials must have been much more difficult.

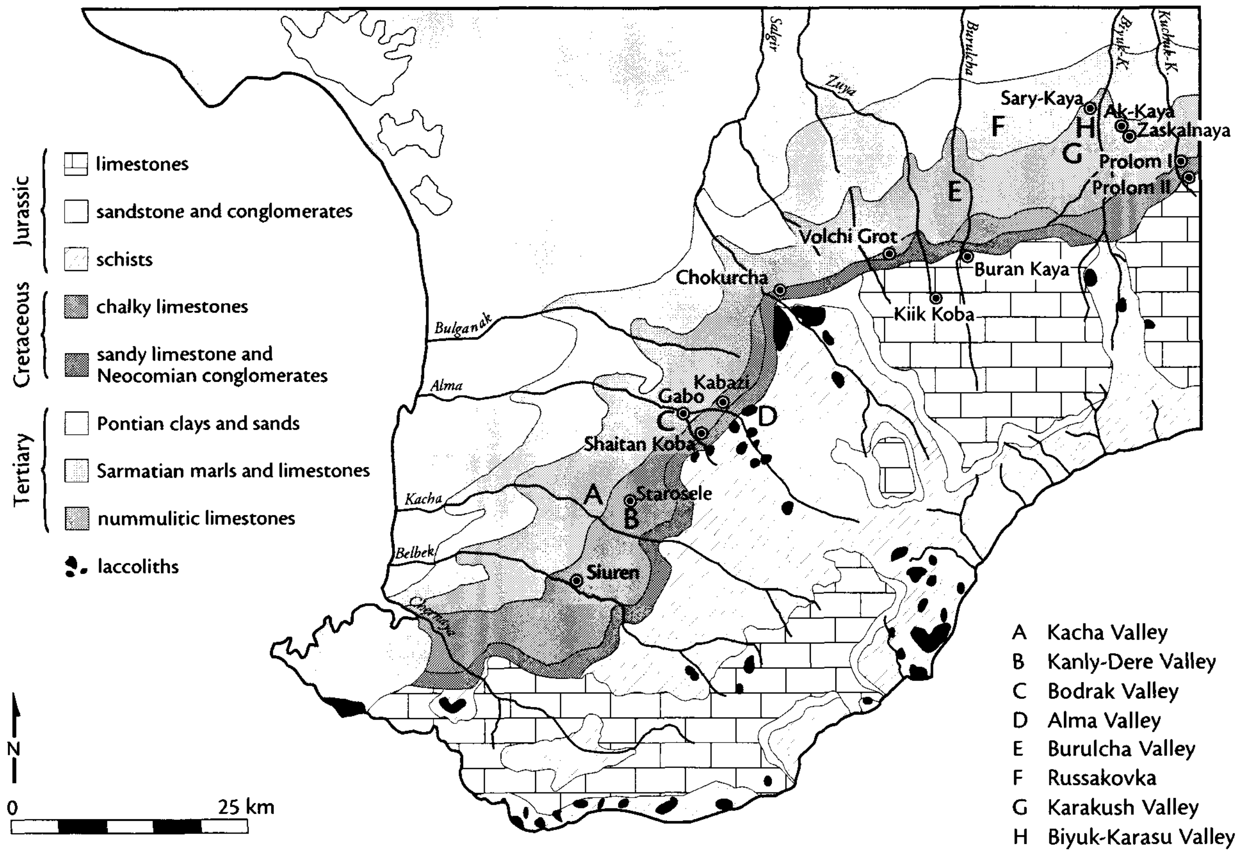

Figure 11-3—Map of raw material sources and important Middle Paleolithic sites in the southwestern part of the Crimean Peninsula. The sources are the result of sporadic, non-systematic excursions and therefore not representative. See Table 11-1 for descriptions of sources (A–H). (Adapted from Daniloff 1905:carte IV by K. Monigal.)

Analysis of Natural Site Formation Processes on the Basis of Workpieces

After analyzing the formation processes of archeological sites, Schiffer (1987) distinguished the cultural transformation processes (C-transforms) that include all human activities connected with the production, use, and discard of artifacts from geological and non-human activities. The latter, termed environmental or natural site formation processes (or N-transforms), are active during and after the discard of artifacts and include, among others, erosion, solifluction, cryoturbation, and bioturbation (Figure 11-1: *1*). If natural site formation processes were active, they may have disturbed the original context of artifacts discarded on an archeological living floor, or, even worse, may have led to a mixing of artifacts that were originally embedded in distinct archeological layers. Thus, they hamper the analysis of the cultural processes that are the main focus of archeological interest. Consequently, it is necessary to recognize the presence of natural site formation processes, and to estimate to what degree they distort the archeological data. In the past, the projection of excavated finds onto profiles and the refitting of artifacts were used to solve the problem of post-depositional processes. During their attempt to clarify the stratigraphic situation and to identify contemporaneous artifacts in disturbed multi-layered Middle and Early Upper Paleolithic cave sites in southern Germany, Rieder (1981/82; 1990) and Hahn (1988:108–117), for the first time, sorted artifacts into distinct nodules and treated them as equivalent of refits. Because artifacts from several geological layers accumulated in refits and workpieces, Hahn (1988:79–84) came to the conclusion that the actual number of human visits in the Aurignacian layers of Geißenklösterle Cave had to be reduced drastically. Only two assemblages, AH II and AH III, remained, although several archeological horizons had been defined during excavations.

The late Middle Paleolithic G-layers of the Sesselfelsgrotte (Richter 1997), dated to OIS 3, are another prominent example of the influence of natural formation processes on Paleolithic sites. A low rate of sedimentation was combined with an intensive, often

TABLE 11-1
Description of raw material samples mapped in Figure 11-3

Source	*Location*	*Sample no.*	*Fracture color*	*Fossil inclusions*	*Bands and streaks*	*Cortex*	*Nodule shape*	*Type of raw material deposit*
A	Kacha Valley	†	honey-colored	none	none	rolled	round	river terrace
B	Kanly-Dere Valley	†	dark grey to brown, white speckled	none	none	white up to more than 1 cm thick	round	primary (rock underneath Starosele)
C	Bodrak Valley	1 8	dark yellow-brown to yellow-brown	yellow-brown, ≤0.3 cm or light brown and needle shaped	medium brown with dark brown edge, not clearly limited streaks	white and beige, >0.4 cm thick, smooth	round	primary/ secondary source (cliff cut by river; material was sampled either out of river terrace or from debris near the primary source)
		2 10 11	dark grey	light grey, ≤2 cm, clearly limited	medium grey streaks	beige, irregular, partly weathered	round and flat	
		3	medium grey-brown	light grey, ≤1 cm, clearly limited	unclear, lighter streaks	beige, smooth, partly rolled	round	
		4	black	light grey, ≤0.7 cm, not clearly limited	none	white, smooth	round	
		5	medium grey-brown	light brown, ≤2 cm, clearly limited	light grey and dark grey streaks	beige and white, smooth	round	
		6 9	dark grey-brown	light grey-brown, ≤2 cm, in part clearly limited	light grey-brown streaks	white and beige, irregular	round	
		7	light grey-violet	light grey, inside yellow-brown, ≤0.5 cm, clearly limited	weak, light grey streaks	white and beige, smooth	round	
D	Alma Valley	1 2	dark brown	light grey, ≤0.5 cm, some ≤2 cm	black band underneath cortex	beige, weathered	round	residual (sampled from slope and river terrace)
		3	dark grey		brown band underneath cortex	white, >1 cm thick		
E	Burulcha Valley	1	dark brown	light brown or white, ≤1 cm	none	white to light grey	plaquettes and round nodules	primary, in layers directly from the rock
F	Russakovka	1 2 3	dark brown	light brown, only few, ≤0.4 cm, not clearly limited	none	beige, irregular	round	primary, at the base of the slope residual
G	Karakush Valley	1 2	dark brown to medium brown	light brown, ≤0.3 cm, not clearly limited	none	white to brown, pockmarked, rolled	round and flat	residual
H	Biyuk-Karasu Valley	1 2	dark brown to medium grey	Sporadically, light brown up to 0.4 cm	none	white	round and flat	residual

†Marks & Monigal 1998:125

repeated, human use of the comparatively small cave over a brief period. The G-layers, with a depth of only 50 cm, contained no fewer than six archeological horizons that were, in part, preserved as living floors. With the help of a cluster analysis, Richter (1997:50–62) determined that each human visit was correlated with a characteristic combination of workpieces discarded in different excavation units (e.g., squares in layers). The mapping of the clusters showed that the artifact concentrations were scattered vertically, and that the centers of the three-dimensional distributions were the places where the activities originally took place (*Doppelkegelmodell*: Richter 1997:54). In most cases, this was around fireplaces. Altogether, twelve visits were identified, with changes in the use of the occupational surfaces through time. After using workpieces (e.g., nodules) as the smallest units, the chronological resolution was higher than it was according to the stratigraphic data from the excavations: except for the uppermost layers, each archeological horizon represented a number of short visits, each of them using only a part of the cave. In the framework of the analysis of N-transforms in the G-layers of the Sesselfelsgrotte, combinations of workpieces were defined as the shortest recognizable human activities in space and time. In this case, the time axis was provided by the sedimentation rate of the cave in-filling, whereas the space was the excavated area.

The late Middle Paleolithic sites in the mountainous region of Crimea, however, seem to be less strongly affected by problems resulting from low, and at the same time, often changing, sedimentation rates. Still today, large quantities of colluvial sediments mixed with pebbles and boulders accumulate at the bottom of slopes exposed to the south. The combination of arid conditions that hamper vegetation, large seasonal ranges of temperature, and high rainfall within short periods of the year (Ferring 1998:fig. 2-5) have led to high rates of sedimentation, either as colluvium or as exfoliation. If sediment traps such as caves, rockshelters, or fallen boulders stop the process of erosion, long stratigraphies consisting of thin archeological horizons separated by archeologically sterile 5 cm to 30 cm levels are preserved. Distinct concentrations of artifacts and faunal remains, as well as fireplaces associated with unpatinated artifacts, indicate the in situ preservation of many archeological horizons in Kabazi II, Kabazi II, Starosele, Buran-Kaya III, and Chokurcha I that were studied by us. Because N-transforms seem to have less importance, this article is focused on the analysis of cultural site formation processes.

Analysis of Cultural Site Formation Processes on the Basis of Workpieces

Human activities before, during, and after the discard of artifacts were summed up by Schiffer (1987) under the term C-transforms. It has already been said that Crimean Middle Paleolithic sites are characterized by a high rate of sedimentation. This speaks for the presence of well-preserved, in situ living floors. At the same time, the thickness of the archeological horizons at many sites measures only several centimeters. This is seen as a strong argument for the hypothesis that surfaces were only briefly accessible. It follows that the rapid sedimentation often led to a preservation of real living floors where it is possible to correlate artifact concentrations with distinct Neandertal activities. There is still the chance, however, that more than one visit, each dedicated to different activities and separated by years, might have accumulated on a well-preserved living floor. In contrast to permanent settlements of agricultural communities, where artifacts from structures like houses, pits, or graves can be traced back to distinct activities over a short period, most Paleolithic communities are thought to have lived as highly mobile hunter-gatherers, leaving behind settlements with less pronounced structures. Ethnographic data from the Nunamiut (Binford 1978: 488–497) show the repeated use of campsites, especially of caves and rockshelters, within several years. As a result, artifacts and structures of different visits, dedicated to different activities, might be found on the same archeological surface.

In the past, the mapping of in situ artifacts, and especially the mapping of refits, was used to clarify the question of whether the distribution of artifacts was the result of a single episode or the result of more than one visit. If the overall distribution of artifacts shows a single concentration, with structures in the center or nearby, it is generally concluded that the discarded artifacts can be traced back to a single visit. If the overall distribution of artifacts shows more than one concentration, in theory two classes of refits can be distinguished: (1) a considerably high number of refits between concentrations is interpreted as an interaction of humans and is therefore taken as a strong argument for the simultaneity of the concentrations, or (2) the fact that refits are mainly distributed within the concentrations is seen as an indicator for isolated and therefore separated human activities. Because they are considered to be an equivalent of refits, the mapping of workpieces allows analogous considerations (Figure 11-1: *2*): the spatial distribution of artifacts from a nodule also provides information about the presence and the extent of interactions among artifact concentrations. At the same time, the analysis of workpieces leads to a larger and therefore more reliable data set.

As far as the question of the distribution of contemporaneous artifacts is concerned, only distinct nodules give suitable data. If the analysis is dedicated to *chaînes opératoires* of blank and tool production, it is possible to include all classes of raw material units; e.g., the geological formations, raw material sources, workpieces, and single pieces. The reconstruction of concepts and methods of blank and tool production with the help of workpieces has the advantage that the artifacts are sorted back into the units from which they came (e.g., the raw nodules), instead of classifying them into techno-typological classes that artificially interrupt the history of the core reduction. The completeness of all artifacts coming from one nodule may tell at least a part of this history.

The importance of an analysis of the *chaîne opératoire* that focuses on single nodules lies in the observation that different shapes of nodules might lead to different technological treatments, especially in initial core preparation. Among others, the refits of the Magdalenian open-air site of Étiolles are a good example of the correlation between different methods of preparation of bi-convex blade cores and the shape of the nodule (Pigeot 1987:fig. 12). For the Middle Paleolithic, a high correlation between the shape of nodules and the concept of blank production (Uthmeier 1998:488), as well as the lack of association between these two factors (Peresani 1998) have been reported. Only when artifacts are looked at in their original context—either after refits or after a sorting into workpieces—is it possible to securely detect the presence of such correlations.

All methodological aspects connected with the sorting of artifacts into workpieces mentioned so far were not new attempts, but variants of methods originally used for the analysis and interpretation of refits. With the transformation analysis, Weissmüller (1995:58–71) has developed a new method that is not only dedicated to on-site activities connected with the production and use of stone tools, but also looks for activities that took place off-site. Comparable to the work of Richter (1997), the assemblages in the Mousterian layers of Sesselfelsgrotte, dated to OIS 5 and analyzed by Weissmüller (1995:66), are defined as a combination of workpieces that share the same horizontal and vertical distribution. At the same time, it is assumed that the excavated area of the small rockshelter covers, at least, most of the originally inhabited space. In cases where N-transforms are considered to be inactive, it follows that workpieces with incomplete *chaînes opératoires* should have resulted either from the import or the export of artifacts (Figure 11-1: *3*). Thus, transformation analysis is a method that elucidates the mobility of hunter-gatherers, who, while on the move, transported tools, blanks, cores, and/or nodules (Weissmüller 1995:71). Since the beginning of human stone tool production, raw material had to be transported from outcrops to the sites where sharp edges were needed (Isaac 1989:304). While the transport of local nodules from the Lower Paleolithic onwards has been a generally accepted interpretation, there have been different opinions about artifacts prepared for future use. For the Upper Paleolithic, the mobility of even larger numbers of artifacts between campsites is widely accepted (Geneste 1990:fig. 3), sometimes reaching more than 30% of all blanks from a core (Hahn 1988:14, 247). For the Middle Paleolithic, there has been a long debate about whether Neandertals were producing mainly expedient tools or, to the contrary, also had long lasting and highly mobile curated tools (Binford 1979). Since the work by J.-M. Geneste (1988, 1990), we have good reasons to support the curated tools hypothesis and to assume that the biography of Neandertal stone tools was characterized by on-site production, as well as by transportation.

But to what extent were artifacts moved by Neandertals, in general? What percentage may we expect for example, compared to the Upper Paleolithic? Most attempts so far compare the number of artifacts from different raw material sources, often by grouping the distances between the outcrops and the sites (Floss 1994; Geneste 1990; Roebroeks et al. 1988). The interpretation is mainly focused on the number of artifacts that come from distant raw material sources. Probably due to vegetation and topography, distances for imported raw material in Central and Eastern Europe tend to be longer than in Western Europe (Floss 1994:355). Beside the general trends achieved by the analysis of regional and/or long distance raw material transport, it seems sure that a quantity of Middle Paleolithic artifacts moved within local logistical territories (Floss 1994:355). These movements within the range of local raw material procurement, from a campsite to more or less contemporaneous hunting stands, butchering sites, raw material outcrops, or to areas where organic resources were collected, are neither well known nor understood. In part, the lack of information is caused by the simple counting of artifacts by different raw material sources. The data raised tend to be incomplete, because artifacts might have been imported not only as single pieces, but also as nodules, and because artifacts might have been carried out of a site. The transformation analysis tries to estimate the overall number of artifacts transported into and out of the site, even if no or only a few refits were found. How does this work?

In the overwhelming number of cases, the reduction of lithics follows a general pattern that can be described, following Geneste (1986, 1988), as a sequence that starts with the acquisition (phase 0), is followed by the decortication (phase 1), the preparation and the flaking of blanks (phase 2), modification/

retouch (phase 3), the use of tools (phase 4), and, finally, the discard of artifacts (phase 5). By asking of every workpiece whether the artifacts cover all these phases, or represent only a part of them, transformation analysis helps to figure out in what condition a nodule or core was imported, what steps of the schematic *chaîne opératoire* took place on-site, and what artifacts were probably taken off-site. Because artifacts can be attributed to initial or final phases, it is possible to formulate hypotheses about the point in time when artifacts were used or discarded off-site (Figure 11-1: *3*). For example, if flakes with cortex are missing, it is assumed that decortication as an initial phase of the *chaîne opératoire* not only happened elsewhere, but also in the past. If all blanks of the core reduction except for the core itself were found within a workpiece, it is assumed that the core was taken to another campsite for future activities.

At the present state of knowledge, the acquisition of lithic raw materials during the Paleolithic seems to be, with only few exceptions, the result of an embedded strategy. If it is true that the search for nodules and visits to outcrops are more or less always combined with other activities, then the steps of the *chaîne opératoire* recognized as off-site activities give information about past and future campsites. The more steps of the core reduction that lack artifacts, the shorter is the section of the transformation that took place on-site and the longer is the time the workpiece spent at other sites. The condition of import can be defined as an indicator for the amount of time that has passed since a nodule was taken out of the outcrop: single pieces without cortex or workpieces that consist of few tools should already have had a longer biography when entering a site than workpieces that were imported as a raw nodule. In theory, it might also be considered that an increasing number of missing artifacts from initial phases of the *chaîne opératoire* correlates with the distance the workpiece has been moved and/or the number of stops between the outcrop and the discard. In reality, it is only possible to describe the variability of possible activities unaware of the fact that they might have been contemporaneous (in the sense of ephemeral camps), part of a past base camp, or the result of several short stops in the past. The same must be said about artifacts of workpieces that were exported. If only a few tools were exported, we may conclude that short activities at ephemeral campsites were planned, whereas the export of many decorticated nodules and cores may be seen as an indicator for the planning of longer stays. Again, these are theoretical expectations that cannot be proved.

Transformation analysis classifies the section of the *chaîne opératoire* produced on-site by using the number of cortical flakes, the presence or absence of blanks, and the dorsal scar patterns that indicate core and tool reduction steps. With this classification at hand, it is possible to formulate hypotheses about major aspects of regional settlement patterns: Do short sections of the *chaîne opératoire* dominate the workpieces of an assemblage and did the visit therefore have the character of a short stop? Or, to the contrary, are there more workpieces that represent the complete *chaîne opératoire* and indicate a longer episode? How many workpieces were brought into the site as raw nodules, and how many came in as prepared core blanks? Using the same criteria, and by applying a hierarchical system of classes, it is possible to compare the so-called transformation sections of workpieces that make up an assemblage (intra-site analysis). In a second step, it is possible to compare the overall transformation of different assemblages embedded in a stratigraphical sequence (Weissmüller 1995; Richter 1997) or from different sites (Chabai et al. in press).

The Conditions for Success: Site Preservation and Trench Size

Both transformation analysis and the methods to identify N-transforms are based on sorting stone tool assemblages into workpieces. At the same time, there are essential differences. Even if workpieces are known to be incomplete because the excavation covers only a part of the original settlement, a meaningful analysis of N-transforms is still possible. Like refits, artifacts from different layers that accumulate in a workpiece indicate that N-transforms were active. Because incomplete workpieces are thought to indicate off-site activities, the transformation analysis asks for assemblages that are not affected by N-transforms or insufficient trench sizes. Are these demands realistic, at all? As far as archeological horizons in Eurasia are concerned, the key for an in situ preservation of living floors suitable for the transformation analysis lies in a rapid sedimentation after humans left the site. Although the conditions are not as excellent as they are at the famous late Magdalenian hunting camps of the Paris Basin (Pigeot 1987), it has already been said that at most Crimean Middle Paleolithic sites studied by us, Pleistocene surfaces were buried quickly after they were abandoned by Neandertals.

In addition, not all artifacts are affected by N-transforms in the same way. Whereas small chips are easily removed by erosion, larger artifacts like flakes and cores are more resistant and may remain in their original positions. It is mainly this class of artifacts, greater than 3 cm, that is used for the reconstruction of the *chaîne opératoire*. Even when merely larger artifacts are analyzed, however, the transformation analysis still considers not only workpieces with a complete *chaîne opératoire* as important units of analysis, but also incomplete ones. During the first attempts in Geißenklösterle (Hahn 1988) and Sesselfelsgrotte (Weissmüller 1995; Richter 1997), the transformation analysis showed that many workpieces were not complete. Weissmüller (1995:67) was not sure to what extent artifacts were missing due to N-transforms or C-transforms (therefore he spoke of evacuation). Do we have more detailed criteria to establish if workpieces are incomplete because of natural site formation processes and/or insufficient areas of excavation, or because artifacts were taken away during cultural site formation processes? In our opinion, the mapping of the overall distribution of artifacts, as well as the mapping of the distribution of workpieces, can be used as criteria to establish whether the workpieces are representative for all on-site activities or not. As a first step, the overall distribution of finds (artifacts, bones, fireplaces, pits, etc.) is looked at for the following criteria:

(1) Within the excavated area, is there one concentration of finds, or are there several?
(2) Do the concentrations lie in the center of the excavated area and thin out towards the borders of the trench, or were only parts of the concentrations unearthed?

If it is obvious that only a part of the settlement was excavated, the analysis of the local topography may give information about the original size of the site:

(1) Is the settlement situated on a plain, or does the topography show steep slopes, etc.? Is it possible to estimate the size of the area with appropriate settlement conditions and therefore the potential overall size of the site?
(2) Within this area, is there any information about the presence or structure of other concentrations yet unexcavated, like artifacts coming from the surface? Or, to the contrary, do any older excavations yield information about this? In Starosele, for example, the distribution of the artifacts from Levels 1 and 3 excavated recently (Marks and Monigal 1998:120) enabled the reconstruction of numerous concentrations that were originally lined up in front of the long rockshelter, but were obviously not recognized as such during the first excavations.

Even in the worst case, when only a part of an originally much larger site was excavated, it is possible to determine areas of isolated and therefore complete activities by mapping the artifacts that belong to workpieces:

(1) Does the mapping of workpieces show clusters, and if so, are there any clusters surrounded by archeologically sterile areas?
(2) If not, is it possible to isolate single workpieces that fulfill these criteria?

The following list gives some theoretical examples for the distribution of artifacts assumed to be coming from the same living floor, and describes the consequences that different answers to the criteria stated above may have for transformation analysis.

Figure 11-4A shows the overall distribution of one or more concentrations situated well in the center of an excavated area. In this case, it is assumed that only a few artifacts were discarded on-site, but outside the excavated area. The artifacts missing in the *chaînes opératoires* of the workpieces were produced and/or used elsewhere. It is possible to reconstruct what artifacts were moved to and from the site, and what was left at other sites. Therefore, the transformation analysis gives meaningful information about the function of the site within a region.

Figure 11-4B shows the overall distribution of artifacts from several concentrations that are, in part, not completely excavated. In this case, the transformation analysis gives only meaningful information about those workpieces that are found within concentrations that are clearly delimited and were found at a considerable distance from the borders of the excavated area.

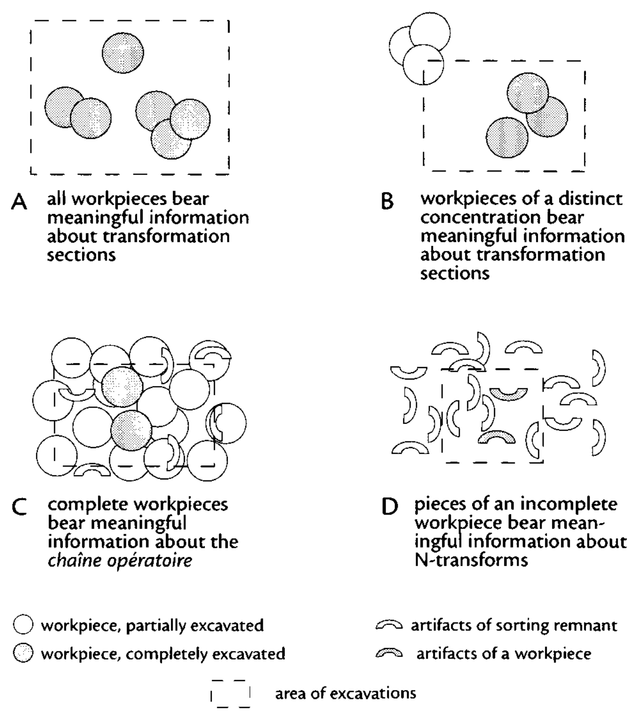

Figure 11-4—Hypothetical distributions of workpieces inside and outside the excavated area. For the transformation analysis, it is important that N-transforms and trench size can be more or less excluded as an explanation when phases of the *chaîne opératoire* are reconstructed as off-site activities. A workpiece is an accumulation of artifacts with identical macroscopic raw material attributes.

When the mapping of workpieces or refits does not show interactions with other, only partially excavated concentrations, then the cluster of workpieces may represent a distinct visit, or activity, at the site.

In Figure 11-4C, the overall distribution of artifacts shows no clustering, at all. Obviously, a large concentration (or several concentrations mixed after many people moved on the surface) was only partly excavated. Within the even scatter, single workpieces show a limited distribution. Because no zone of activity can be isolated, the transformation analysis does not allow a representative reconstruction of off-site activities of past, contemporaneous, or future campsites. Although only a defined, yet unrepresentative, part of all activities, each workpiece alone still represents human actions limited in space and time. Thus, the spatial distribution on-site, the off-site moves, and the *chaîne opératoire* of artifacts belonging to each complete workpiece can be analyzed as a non-representative snapshot of activities.

In Figure 11-4D, the distribution of artifacts shows concentrations neither in respect to zones of activity nor in respect to limited concentrations of workpieces. In this case, an interpretation of transformation analysis as on-site and off-site activities does not make sense. Incomplete workpieces may only help to identify problems of N-transforms.

Summary: a New Method for Old Problems

Because processes of N-transforms and C-transforms are both traced back to their smallest temporal cohesion in single nodules, the sorting of stone tool assemblages into workpieces offers advantages over conventional methods that operate on the level of geological formations or raw material sources. At the same time, the high resolution of the raw material sorting can be changed at any time by combining single pieces and workpieces with raw material sources and the latter with geological formations. In doing so, the assemblages initially organized for a transformation analysis can easily be compared with assemblages where the sorting into workpieces still has not been carried out or was not successful due to patination, for example.

The transformation analysis itself seems to be more problematic. Even if there are no patinated artifacts, one may argue that the demand for well preserved and, at the same time, completely excavated sites or concentrations is a principal obstacle that makes this method a promising but unrealistic approach. On the other hand, the requirements for complete and contemporaneous finds are a banal, yet general, problem for working in prehistory. Except for refits, any other conventional approach like the Bordian type list (Bordes 1950) or a classification based upon the presence or absence of type forms (Bosinski 1967) is confronted with the problem that artifacts that might essentially change the classification could have been deposited outside the excavation areas or are missing due to erosion (see also Rigaud and Simek 1987). The sorting and mapping of workpieces, however, does not only show that artifacts are missing. In contrast to conventional approaches, it is also possible to separate that part of the scatter that is more or less complete. Compared with refits, the part identified as being complete is supposed to be larger.

The transformation analysis itself tries to explain a defined part of an assemblage by means of production, use, and discard of artifacts. Following Geneste (1988, 1990), a given assemblage is understood as a local (on-site) part of activities dynamically embedded in a regional settlement pattern, with campsites visited in the past and planned for the future. To us, including the aspect of settlement dynamics into the analysis of stone tools by looking at nodules as the smallest units in time and space seems to be more promising than an analysis dedicated to the *chaînes opératoires* of geological formations. By reconstructing on-site and off-site activities site by site, and by establishing a regional pattern of raw material procurement and use, we are searching for correlations between concepts for blank production, tool production, and tool use, on the one hand, and segments of the regional settlement system, on the other. Finally, we can separate modes of artifact production related to functional aspects, such as season and duration of occupation or a specific game hunted, from cultural factors.

Theoretically, transformation analysis shares many features of the processual archeology approach (Bernbeck 1997:35–48) and the theory of cultural materialism (Harris 1979). It is assumed that Paleolithic artifacts and settlements have stored information that can be measured objectively and that are sufficient to reconstruct important aspects of material culture. Material culture itself, however, is not seen as resulting from economic adaptation alone. In general, it is assumed that the variability in Middle Paleolithic hunter-gatherer industries can only be explained multi-dimensionally. Among others, technical norms for tool production, closely tied to the social environment of their enculturation, should also play an important role, especially in the life of traditional societies (Apel 2000). But although the perception of an environment might differ due to cultural values, it is believed that natural conditions do limit the range of possible strategies for survival and therefore have a strong influence on the development of important social features such as the demography of a population or of single groups, the willingness of individuals or groups to cooperate and form alliances, the system of social norms and values, and the acceptance of technological innovations.

Within Workpieces: Conventional Data

Raw material units are treated as sub-assemblages. This means that attributes (Table 11-2) are counted or measured within each raw material unit in respect to the level of sorting, which are single pieces, workpieces, raw material sources, or geological formations. Except for maximum length measured for each artifact (Weissmüller 1995:62-63), the data are grouped (e.g., frequencies of different blank types). In many cases, attribute variability is divided into nominal classes. Others, like cortex on the dorsal surface, are measured on an ordinal scale, while only some, such as the weight of each unit, are based on metrics. To provide a shared basis for comparisons, we decided to describe the raw material itself by a combination of a given list of attributes (aspects of the structure of the cortex, the presence or absence of streaks, etc.). Some general observations, like the color of the fracture, have to be recorded individually because the variability seemed to be too extensive for a code.

The conventional data (Table 11-2) includes the total weight and the total number of artifacts, as well as the frequency of cortex classes and the maximal length of each artifact sorted into a raw material unit. The classes of blank types (compare Kurbjuhn, Chapter 14) were selected for their use for a quantitative analysis of the concepts and methods recognized during the reconstruction of *chaînes opératoires*. The reconstruction of a *chaîne opératoire* itself is based on an analysis of characteristic artifacts such as cores, crested flakes, blades, or Levallois flakes in a raw material unit. Several raw material units with identical technological features might be combined for the reconstruction of a *chaîne opératoire*. Modified pieces are divided into artifacts with simple modifications of lateral edges and artifacts that show surface shaping. To avoid misunderstandings, it must be stressed that this view of surface retouch does not follow the conventional distinction between unifacial and bifacial tools (for more details, see Richter, Chapter 13). As É. Boëda (1995b) has pointed out, two essentially different modes of blank production can be observed: blanks that result from the debitage of cores, on the one hand, and blanks that result from surface shaping, on the other. Therefore, the surface shaping is not modification in the conventional sense, but is part of the production of blanks (*biface support*) that is followed by the modification and/or use of working edges (*biface outil*). This approach is comparable to the type list that is generally used for the Crimean Middle Paleolithic (Chabai and Demidenko 1998). In addition, tools shaped by surface retouch may be made from nodules, as well as from flakes or blades produced in the course of different concepts and methods, and they may show surface retouch only on one side, like *limaces* or *pointes à face plan* (Demars and Laurent 1992:131, fig. 51:1-2, 4-6), or on both sides, like handaxes. Thus, it is useful to define criteria for surface-shaped tools. Surface-shaped tools are understood as artifacts that show a regulation of thickness, outline, and/or cross section by surface retouch that is produced by soft hammer technique. However, not every tool that shows surface retouch is necessarily a surface-shaped tool. Some *pointes à face plan* illustrated by Demars and Laurent (1992:129, fig. 50: 3, 5) show a lateral surface retouch that is restricted to the active part of the working edges only. It is therefore a modification for use, for hafting, etc. Only if the surface retouch produces one or more sequences of convex or flat scars that completely alter at least one side of the piece and are later used as a surface for further modifications of the working edges, are pieces classified as surface-shaped tools. Like cores, surface-shaped tools are analyzed by the method described by Richter (Chapter 13), the working step analysis.

Finally: the Classification of Transformation Sections

The essential data for transformation analysis include a classification of the transformation section and the spatial distribution of each raw material unit. More detailed information is found in Weissmüller (1995: 58–71) and Richter (1997:50–62). Here, only the essential features of transformation analysis are described. Transformation analysis is based on single pieces and all artifacts of a workpiece left at a site. As long as they do not belong to the modification and resharpening of tools, chips less than 3 cm are not taken into account. On the one hand, ordinary chips are not supposed to be moved between sites and, on the other hand, it is often not possible to securely assign them to a phase of the *chaîne opératoire*.

Table 11-2
Conventional data from raw material units

Identification of Raw Material Unit
site
year(s) of excavation
layer
individual number

1. DATA TAKEN FROM ALL ARTIFACTS > 3 CM

01 weight

02 number of all artifacts

03 blank type and frequency of cortex: number of artifacts in ordinal categories
1 nodule, completely covered by cortex
2 core, partly covered by cortex or without cortex
3 cortical flake or blade
4 flake or blade, partly covered by cortex
5 flake or blade, without cortex
6 blank type not identified (unclassified fragment, chunk)

04 longest possible measurement in mm: metrical category (measurement of individual artifacts, differentiated into the classes listed under 03)

2. DATA TAKEN FROM ALL ARTIFACTS BELONGING TO BLANK TYPE 3–5

05 blank types for technological analysis: number of artifacts in nominal categories
1 flake, simple
2 *couteau à dos naturel*
3 flake, crested
4 flake, lateral remant of crest
5 flake, pseudo-Levallois point
6 flake, Levallois
7 flake, Levallois point
8 blade, Levallois
9 blade, simple
10 blade, crested
11 flake, width > length (*Breitabschlag*)
12 flake, Kombewa
13 chunk
14 chip
15 flake, surface retouch
16 flake, resharpening

3. DATA TAKEN FROM MODIFIED PIECES

06 preservation of modified pieces: number of artifacts in nominal categories
1 modified piece, surface shaping, proximal fragment
2 modified piece, surface shaping, distal fragment
3 modified piece, surface shaping, complete
4 modified piece, retouch of simple blank, proximal fragment
5 modified piece, retouch of simple blank, distal fragment
6 modified piece, retouch of simple blank, complete

07 modified pieces, typology: number of artifacts in nominal categories
1 point
2 sidescraper, simple
3 sidescraper, double
4 sidescraper, convergent
5 sidescraper, *déjeté*
6 sidescraper, transverse
7 sidescraper, more that 2 working edges
8 endscraper
9 burin
10 backed piece
11 end retouch
12 notch
13 denticulate
14 bec
15 pebble tool
16 piece > 3 cm with use retouch
17 piece < 3 cm with use retouch
18 modified piece, surface shaping, 1 working edge
20 modified piece, surface shaping, 2 working edges
21 other modifications

Analysis of operational steps

The transformation section itself is defined as the total number of phases of a *chaîne opératoire* that are recognized as being conducted on-site. Single pieces with no equivalents in respect to their raw material attributes were imported. Workpieces, with two or more artifacts with identical raw material attributes, are examined for the presence and frequency of artifacts that indicate different phases of the *chaîne opératoire*, e.g., pieces with cortex, core trimming elements, and wastes from modification or rejuvenation. The classification of the transformation section is based on the presence or absence of these artifact classes (Figure 11-5). The borders of the transformation section are defined as the initial and final phase of the sequence of the *chaîne opératoire* that happened on-site. Apart from workpieces that have passed through the entire *chaîne opératoire*, from the preparation of a nodule to the use and discard of formal tools, workpieces that represent only a part of the *chaîne opératoire* are of special interest. They yield information about

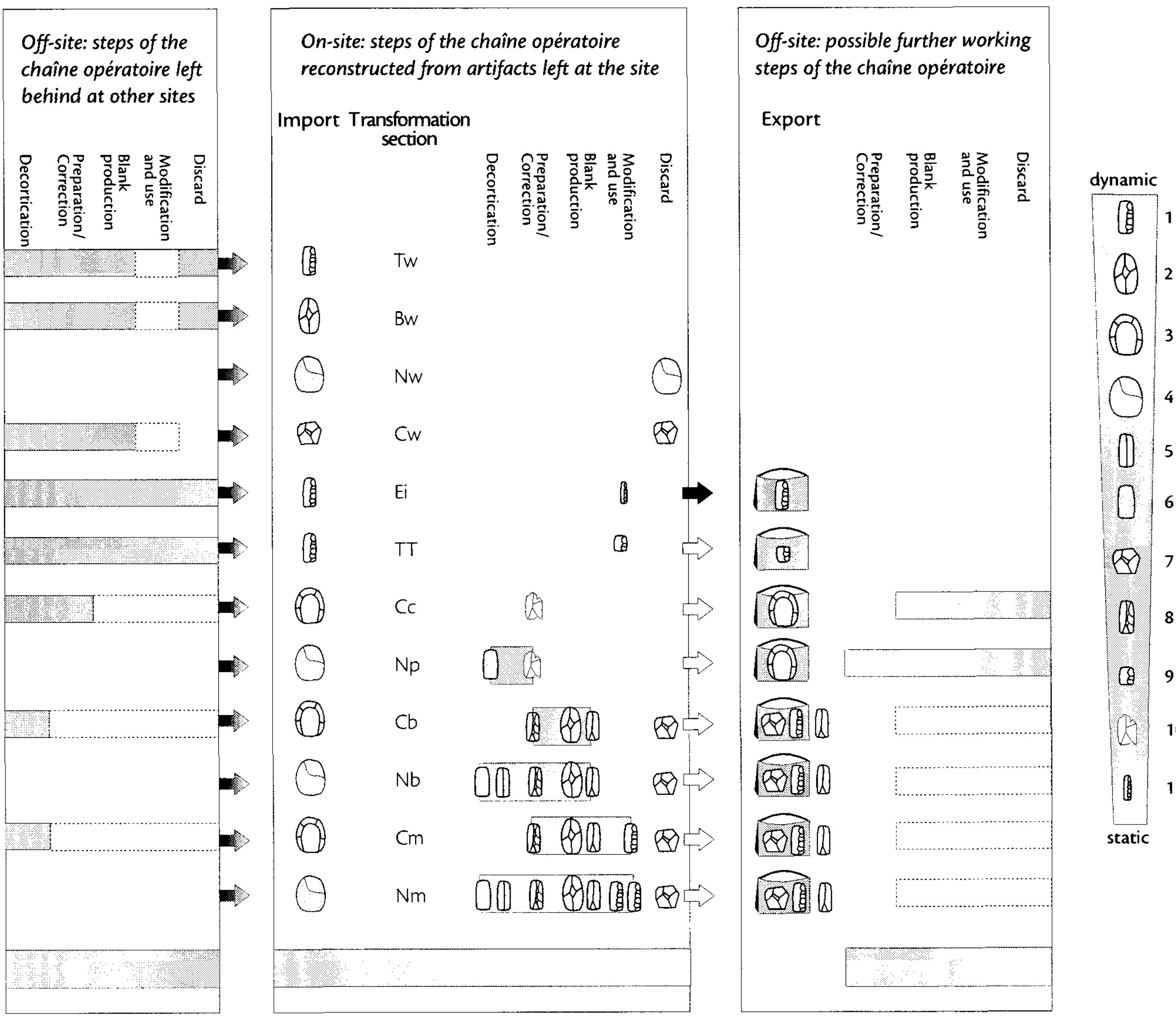

Figure 11-5—Overview of the main categories for the classification of the transformation section of a single piece or workpiece. Left: securely reconstructed (grey) and possible (white) phases of the *chaîne opératoire* conducted before the workpiece entered the site. Center: reconstructed transformation section based on artifacts discarded on-site (in grey: limits of the transformation section; blanks and modified pieces produced in between might be exported). Right: unquestionably (black arrows) and possibly (white arrows) exported artifacts (inside the "bag"; the export of cores and modified pieces can be securely reconstructed, because static objects are left on-site). Far right: schematic representation of static and dynamic objects: 1–modified piece; 2–target flake; 3–core blank; 4–raw nodule, possibly tested; 5–flake; 6–cortical flake; 7–reduced core; 8–core preparation flake; 9–tool fragment; 10–chunk; 11–chip from modification.

the regional movements of people. The temporal relationship among phases of the *chaîne opératoire* present and missing is constructed by the hypothesis that the more the reduction of lithics moves from the cortex towards the interior of a nodule, the younger are the artifacts. Modification or use of working edges is only possible after the preparation of a core and the detachment of blanks. If artifacts are missing from initial or final phases, it is concluded that their detachment and possible use happened off-site. If, for example, a workpiece consists of blanks without cortex, some tools, and a core, within the methodological framework it is a logical consequence that the decortication of the nodule happened previously. At the level of workpieces, it is probable that initial phases of the *chaîne opératoire*, when missing, belong to past human activities. Missing artifacts of late phases of the *chaîne opératoire*, to the contrary, were taken away for future activities. If, for example, a workpiece consists of cortical flakes only, it is assumed that a nodule was prepared for future core reduction at another place.

If artifacts are missing in between the earliest and latest phase present, while at the same time the distribution of artifacts indicates complete preservation and excavation of the workpiece, it is concluded that the missing artifacts were transported to other sites after their detachment.

Apart from the crucial question of whether the assemblage or concentration analyzed is indeed complete, another more theoretical problem might also hamper the classification of the transformation section. This is closely tied to the aim of the method itself: the mobility of artifacts between sites. The following hypothetical example should illustrate the problem: a nodule is imported into a site, the cortex is removed, and a core is prepared. Is it a probable scenario that all blanks except the core are taken to another site? Because only a core was actually discarded on the site, the attempt to classify the transformation section would end up with an import of a single piece, although all previous phases of the *chaîne opératoire* also happened on-site. To us, however, this scenario seems not very probable. It is more plausible to assume that not all artifact classes have the same chance to be moved between sites. The results of the work of Geneste (1990) pointed in the same direction when he described that Neandertals during the Middle Paleolithic in Aquitaine more often took scrapers from one site to another than other artifact classes. Concerning their potential to be transported, Weissmüller (1995:67–68) divided artifacts into static and dynamic objects (Figure 11-5). Dynamic objects, such as flakes and blades, are thought to have a high mobility potential, whereas static objects such as chips, waste from rejuvenation, tool tips, and chunks, tend to fall down after detachment without being moved any farther. Objects with a tendency to be static are produced during all phases of the core preparation, debitage, and modification. Therefore, it is highly unlikely that all artifacts of a phase of a *chaîne opératoire* are moved. Or, if traces of a phase of the *chaîne opératoire* are missing completely, then they must have been produced and discarded off-site. Dynamic objects with a high potential of being moved are expected to be produced neither at the start nor at the end of a *chaîne opératoire*, but most probably during blank production and blank modification.

Weissmüller (1995:69) suggested that there must have been on-site flaking if two artifacts belonging to the same nodule are present, no matter if a core has been found or not. In fact, the term workpiece originally refers to this assumption. For Weissmüller, the transport of considerable quantities of blanks and/or modified pieces played only a minor role in Neandertal strategies of stone tool production and use. With only a few exceptions, he expected that only single pieces were taken from one campsite to another. For us, this view seems to be too dogmatic. As an alternative, we consider that the probability that several artifacts of the same workpiece were actually produced on-site increases with the presence of static objects, a growing number of unmodified blanks, the presence of core trimming elements, and the fact that the artifacts belong to different phases of a *chaîne opératoire*. To the contrary, the presence of several formal tools made of dynamic objects from the same workpiece might be the result of importation, especially when the raw material source is far away. The following list, translated from Weissmüller (1995: 68–69), gives an overview of the classes used by us to distinguish different transformation sections within raw material units (compare also Figure 11-5 and Kurbjuhn, Chapter 14).

(1) Single pieces imported as dynamic objects onto the site, but without on-site debitage or modification:

Bw (Weissmüller 1995:68: Go) = a single blank without debitage, brought onto the site and discarded without formal modification.

Tw (Weissmüller 1995:68: Wo) = a single modified blank (e.g., a formal tool) without debitage, brought onto the site and discarded after use.

Cw (Weissmüller 1995:68: Ko) = a single core, brought onto the site, at least after decortication, probably after preparation and some reduction, but discarded without further reduction on the site.

Nw (Weissmüller 1995:68: Ro) = a single unprepared nodule without reduction.

(2) Single pieces detached as static objects:

Ei (Weissmüller 1995:68: Ei) = an isolated tip, detached or broken off from a formal tool in the course of its use. The formal tool entered the site as a modified piece, and was exported after the tip was lost.

(3) Two or more artifacts from the same workpiece as dynamic and/or static objects:

TT (Weissmüller 1995:68: WE) = two or more fragments of a formal tool that was imported as a dynamic object and broke into static pieces during its use; a part of the formal tool might have been exported afterwards.

Mi (Weissmüller 1995:68: Mi) = two or more isolated pieces (static objects) resulting from the modification of a blank that was brought onto the site as a dynamic object, modified and probably used, and exported afterwards.

TM (Weissmüller 1995:68: WM) = a formal tool with one or more detached flakes from modification and/or rejuvenation.

Cc (Weissmüller 1995:69: Kk) = correction of a core. Two or more chunks or core trimming elements, without or very little cortex, that were detached as static objects during the re-preparation of a core. As an object with the potential of mobility, the core might be discarded, but might also be missing.

Np (Weissmüller 1995:69: Rp) = preparation of a raw nodule. Two or more chunks or core trimming elements with a high frequency of cortex, or two or more cortical flakes that were detached as static objects during decortication of a nodule. As an object with a potential of mobility, the core might be discarded as well, but might also be missing.

Cb (Weissmüller 1995:69: Kg) = blank production from a core. Two or more flakes or blades, with part of a crest or not, without or with very little cortex. The pieces result from the debitage of a core that was (at least in part) decorticated off-site. If the core is present, one more flake is sufficient for a classification. If several blanks are present, they might also include core-trimming elements. Because flakes and blades without crests and cores are supposed to be dynamic objects, several pieces including the core might have left the site.

Nb (Weissmüller 1995:69: Rg) = blank production from a raw nodule. Two or more cortical flakes or blades, flakes with cortex, flakes with part of a crest or not, in combination with artifacts with none to little cortex. The artifacts result from decortication, preparation, and flaking of a nodule that was brought directly from the source onto the site. If the core is present, one more cortical flake is sufficient for this classification. If several blanks are present, they might also include core-trimming elements. Because flakes and blades without crests and cortex, as well as cores, are supposed to be dynamic objects, several pieces might have left the site.

Cm (Weissmüller 1995:69: Km) = blank production from a core with modification of blanks. The artifacts needed for the classification are the same as for a Cb (blank production from a core), with additional proof for the modification of blanks into formal tools. Because tools are dynamic objects, it might happen that only a tool tip proves the modification of a blank. Because this class represents the entire *chaîne opératoire*, many dynamic objects occur, and the workpieces might be to a large extent incomplete between initial and final phases. Therefore, a great diversity of possible combinations of artifacts leads to the same classification of the transformation section. The following two examples should illustrate this. A classification as Cm is based on the presence of several flakes without cortex, a crested flake, several formal tools, and a core. Also classified as Cm are a crested flake and a resharpening flake. For the latter example, the biography of the workpiece is much longer than it seems at first sight. From a prepared core brought onto the site, at least one flake and one core trimming element were removed, and at least one blank was modified, resharpened, and then exported together with the core (and several other blanks/tools?).

Nm (Weissmüller 1995:69: Rm) = blank production from a raw nodule with modification of blanks. This transformation section is similar to Cm, with additional cortical flakes, and a high frequency of cortex.

Originally, the hierarchy of classes listed above was designed for Mousterian assemblages with no or only random bifacial (surface-shaped) tools. The Crimean Middle Paleolithic assemblages studied by us, however, are in part characterized by considerable frequencies of surface-shaped tools (Chabai 1998a). If surface shaping is recognized, either by the presence of a surface-shaped tool or by the presence of typical flakes and chips of its production, then the classes of Weissmüller are given the notation */facial. While some workpieces only include one surface-shaped tool and the rest of the *façonnage*, others might consist of conventional debitage and (unifacial) surface shaping. When surface-shaped tools are not only made from nodules, but also from ordinary flakes, this happens quite often. Because the number of classes should be restricted, it is not useful to extend the existing list with additional numbers of classes for these hybrid workpieces. Thus, only the general presence or absence of surface shaping is recorded.

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Planning Depth and Saiga Hunting: On-Site and Off-Site Activities of Late Neandertals in Level B1 of Buran-Kaya III

Thorsten Uthmeier

Buran-Kaya III, situated near the eastern bank of the Burulcha River and approximately 20 km southwest of Belogorsk, belongs to the eastern group of Paleolithic sites on the Crimean Peninsula. Buran-Kaya III itself is a partly collapsed rockshelter (Marks and Monigal 2000a:213) with an entrance exposed to the south. Today, the space under the roof is 3 m to 5 m wide and up to 6 m deep (Yanevich 1998:133). In the direction of the river, a steep cliff drops about 10 m down to the river terrace (Figure 12-1). The Burulcha River has a differential flow depending on the season from higher elevations to the northern steppe zone and, in doing so, has cut its bed deeply into the second ridge of the Crimean Mountains. Although a part of this second ridge is characterized by small valleys or even canyons and elevated questas in western Crimea, the landscape around Buran-Kaya III (Figure 12-1) consists of gentle hills and wide valleys that connect the northern steppe plain with higher regions of the first ridge of the Crimean Mountains. There are, however, also more elevated limestone massifs, as at the Zaskalnaya sites, steep cliffs near Sary Kaya, and deeply incised rivers like the Burulcha at Buran-Kaya III.

The topographic setting must be considered as attractive to Pleistocene hunters. The combination of a wide valley suitable for the seasonal migrations of big herds of ungulates, a small river with aquatic resources, the possibility of hunting parts of herds or individuals, and the excellent overview from elevated areas must have seemed advantageous to those looking for a promising logistical territory. The assumption that hunting, especially of *Saiga tatarica* (Patou-Mathis, Chapter 8), and, perhaps, gathering for other food resources were the main reasons to come to this area is underlined by the fact that there was no easy access to raw material in the vicinity of Buran-Kaya III. The nearest known outcrops are close to Tsvetochnoye and Russakovka, some 10 km to 15 km downstream along the Burulcha River, as well as in the vicinity of Zaskalnaya in the Biyuk-Karasu Valley, more than 20 km to the east (Demidenko, Chapter 9). According to our own preliminary surveys, the riverbed of the Burulcha River lacks suitable raw materials (pebbles larger than 3 cm) for a distance of 5 km from the site. The fact that not only rockshelters, but also Middle Paleolithic open-air sites like Krasnaya Balka and Sary-Kaya are known from eastern Crimea again reinforces the assumption that, in some cases, Neandertals made their decisions to stay in a region mainly based upon the availability of food sources. Apart from access to water, other simple criteria that are often supposed to be relevant for the placement of Paleolithic camp sites, such as short distances to raw material sources and/or any given topographical structure, such as caves or rockshelters, seem to have been less important.

Because the history of the excavations and the stratigraphic sequence have already been described in detail (Yanevich et al. 1996; Yanevich 1998; Monigal, Chapter 1), I only want to repeat some important aspects regarding Layer B. The excavations, including sondages made before 1996, are supposed to have uncovered the entire extension of preserved in situ archeological layers, since tests to the west, east, and south all exposed sharp erosional contact between the in situ layers and steeply bedded slopewash (Demidenko, Chapter 9).

In general, the stratigraphy of Buran-Kaya III is characterized by a low rate of sedimentation. Although the archeological layers span, with several hiatuses, a time range of more than 38,000 years (Pettitt 1998a; Marks and Monigal 2000a), the thickness of the rockshelter fill measures only 3 m at the entrance and 1 m at the back wall. As a consequence, only minimal

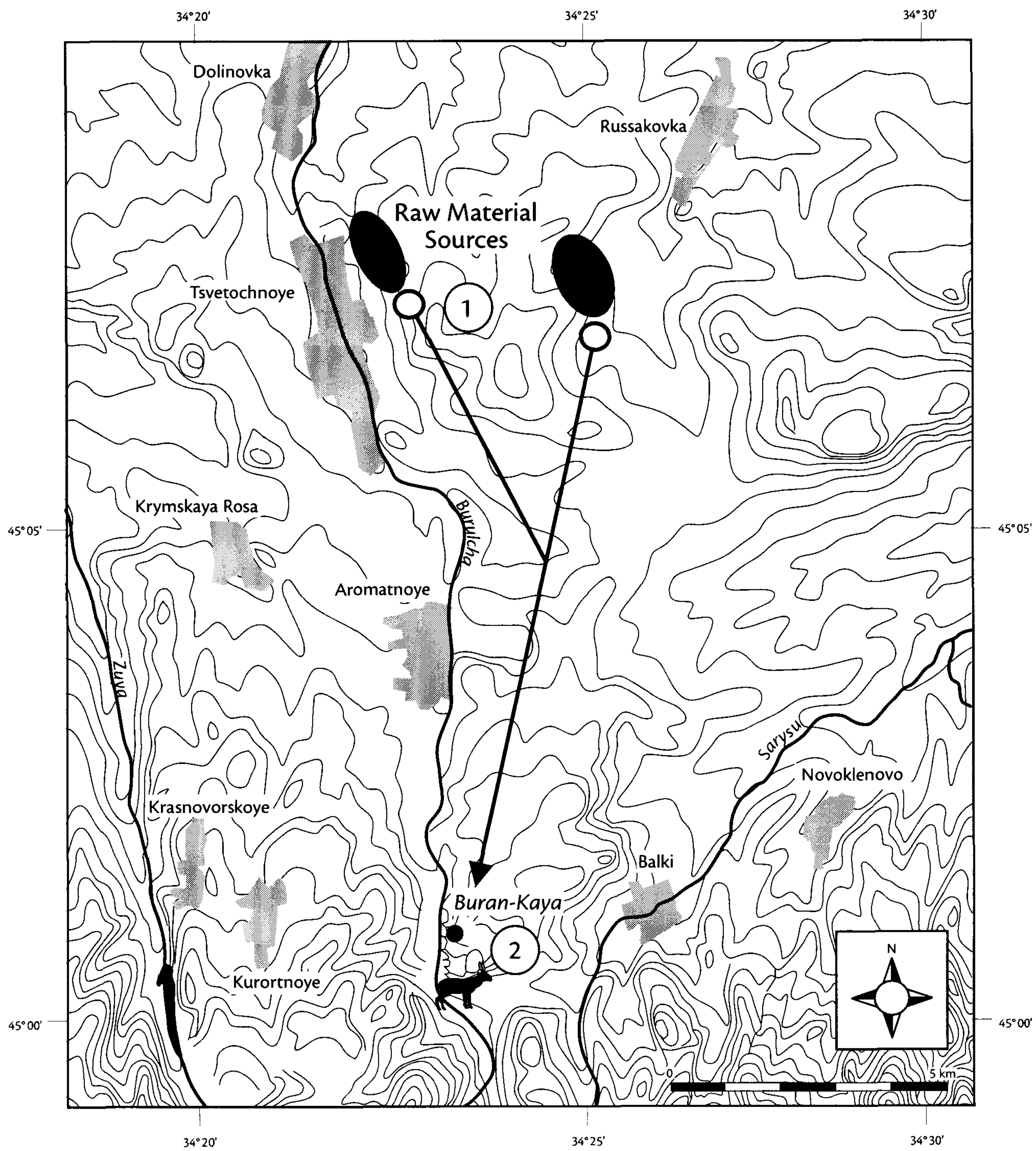


Figure 12-1—Map of the vicinity of Buran-Kaya III (2) and major outcrops of Cretaceous flint (1).

or no sterile sediments were observed between most archeological horizons during the 1996, 1997, and 2001 excavations. While Layer B is separated by thin, archeologically sterile sediments from the underlying Eastern Szeletian horizon C (Monigal Chapter 5) and from the overlaying Upper Paleolithic Layers 6-5, 6-4, and 6-3 (Yanevich 1998; Monigal, Chapter 1), no sterile sediments except for some local lenses of debris were found within Layer B itself. Layer B, with a thickness of 30 cm to 35 cm, is described as fresh limestone debris, perhaps pointing to a cold (stadial) environment, within a sandy silt matrix. Despite marked lithological similarities, however, two separate levels were recognized, based on differential sediment coloration. Whereas Level B, with a thickness of 0 cm to 15 cm, is yellow-brown, the underlying Level B1 is dark-brown to black and 20 cm thick. The dark color of Level B1 is supposed to have resulted, at least in part, from a number of fireplaces that were destroyed by weathering and/or intensive human activities. No intact fireplace and no clearly limited zones of activity were observed, however, during the excavations.

The numerous stone artifacts from Buran-Kaya III Levels B and B1 are classified as Middle Paleolithic Kiik-Koba facies type, characterized by high numbers of simple convergent tools (convergent scrapers and points), and plano-convex surface-shaped points and scrapers of comparably small size. Today, the marked typological differences between assemblages of Kiik-Koba type and other industries of the Crimean Micoquian are considered to result from intensive and repeated, but short-term, camps far away from raw material outcrops (Demidenko, Chapter 9). Absolute AMS dates (Marks and Monigal 2000a:table 1) place Levels B and B1 of Buran-Kaya III not only at the end of the development of the Crimean Micoquian, but also at the very end of European Middle Paleolithic, in general. If the dates are correct, then the finds from Levels B and B1 of Buran-Kaya III also represent some of the youngest-known traces of Neandertals, because in the upper layer of the eponymous site, the Kiik-Koba facies was associated with the remains of *Homo sapiens neandertalensis* (Bonch-Osmolowski 1941, 1954).

Given the stratigraphic position of Levels B and B1 between the Streletskaya-related Level C, and the clearly Upper Paleolithic of Level 6-5 (Monigal, Chapter 1), this Middle Paleolithic of Kiik-Koba facies is interstratified between two Upper Paleolithic occupations.

The techno-typological analysis by Demidenko (Chapter 9) showed long reduction sequences of scrapers, an intensive resharpening of simple and surface-shaped tools, as well as an intensive use of cores and preforms for blank production. The present article focuses on the settlement pattern that might explain these observations. The data used here are derived from a sorting of artifacts from the 1996 excavation of Level B1 into raw material units and they are interpreted as resulting from different on-site and off-site activities. The method used is a transformation analysis based on raw material units as equivalents of single pieces or workpieces (Weissmüller 1995; Uthmeier, Chapter 11). Additional information comes from the analysis of operational steps in the production of surface-shaped tools (Richter 1997; Richter, Chapter 13) and the analysis of the numerous faunal remains (Patou-Mathis, Chapter 8).

The Sample: Artifacts from the 1996 Excavation of Buran-Kaya III Level B1

Despite the fact that the typo-technological analysis (Demidenko, Chapter 9) and the transformation analysis presented here are based on the same artifact sample from the 1996 excavation of Level B1 at Buran-Kaya III, there are some differences between the data sets (Table 12-1). Most of these differences, however, result from the exclusion in this study of unretouched pieces under 3 cm in maximum dimension, as well as patinated or burned artifacts. Neither group of artifacts can be used because: (a) the sorting of raw materials into separate, distinct nodules (workpieces) by macroscopic attributes cannot be done on such material and (b) transformation analysis looks for the presence or absence of phases of the *chaîne opératoire* within these small raw material units by classifying artifacts, in part, by their dorsal scar pattern, which is difficult with very small pieces. Thanks to modern excavation methods, including sieving, the sample includes 13,690 items, of which 92.5% are unretouched chips under 3 cm (Figure 12-2) and these do not appear in our data. Among chips under 3 cm, we found 126 retouched pieces, including chips from the resharpening of tools, broken tool tips, and others. Because unretouched chips under 3 cm are excluded from our sample, artifacts smaller than 3 cm account here only for 16.8%. In addition, 610 heavily burned pieces recognized by Demidenko and 49 patinated artifacts were excluded from the sample for the transformation analysis. Altogether, that part of the assemblage used for transformation analysis comprises 866 artifacts.

Other differences between our and Demidenko's samples, however, relate to different classifications. Unaware that a good part of the tools counted by Demidenko might be patinated artifacts excluded from our sample, we were obviously much stricter in the classification of formal tools and pieces with irreg-

TABLE 12-1

Comparison between the complete list for blank categories given by Demidenko (Chapter 9) and the sample used in the transformation analysis (this chapter). For categories that were used for the transformation analysis (shaded), a correlation index (Pearson's *r*) was calculated that shows that both sets of data are nearly identical.

Category	*Demidenko*	*This analysis*
Simple chips	13,690	7
Burned pieces	610	15
Waste rejuvenation	110	119
Chunks		42
Flakes and blades	367	382
Cores, preforms, and nodules	15	18
Simple tools	269	170
Irregular or marginal retouch	88	68
Surface shaped tools	56	45
Total	15,215	866
Correlation *r* (Demidenko/this analysis) = 0.945		
Items not used in the sample for this analysis:		
Due to uncertain classification of *chaîne opératoire* phase		
Simple chips	13,690	
Due to classification as "sorting rest"		
Heavily burned pieces	610	
Patinated pieces	49	
Total	15,215	

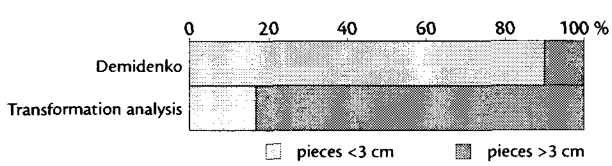


Figure 12-2—Pieces less than 3 cm in the original sample of Level B1 (Demidenko, Chapter 9) and in the sample used for the transformation analysis. Since the sorting of raw material was based on macroscopic attributes, simple chips < 3 cm were excluded from the transformation analysis.

TABLE 12-2

Comparison of the general structure of Levels B and B1 of Buran-Kaya III (in numbers and percentages). According to the correlation index (Pearson's *r*) calculated for formal tools and blanks, the assemblages are nearly identical.

Tools (reduced list)	*Level B1*	*Level B*	*Level B1*	*Level B*
Bifacial points	21	7	5.1	5.3
Bifacial scrapers	5	4	1.2	3
Bifacial denticulates	2	–	0.5	–
Bifacial fragments	22	4	5.3	3
Bifacial preform	6	2	1.5	1.5
Retouched pieces	88	34	21.3	25.8
Simple scrapers	42	8	10.2	6.1
Transversal scrapers	19	14	4.6	10.6
Double scrapers	7	9	1.7	6.8
Convergent scrapers	48	17	11.6	12.9
Points	68	16	16.5	12.1
Denticulates	7	3	1.7	2.3
Notches	4	–	1	–
Perforators	2	1	0.5	0.8
Endscrapers	2	–	0.5	–
Burins	2	–	0.5	–
Unifacial fragments	68	13	16.5	9.8
Correlation *r* (tool classes B1/B) = 0.8816				
Total tool fragments	224	53	54.2	40.2
Total complete tools	189	79	45.8	59.8
Total bifacial tools	56	17	13.6	12.9
Total unifacial tools	357	115	86.4	87.1
Total tools	413	132	100.0	100.0
Blanks	*Level B1*	*Level B*	*Level B1*	*Level B*
Obj. of primary flaking	25	12	0.2	0.6
Chips	13,690	1,776	92.5	89
Flakes	322	73	2.2	3.7
Blades	45	4	0.3	0.2
Cores	–	–	–	–
Burned pieces	610	106	4.1	5.3
Waste of rejuvenation	110	24	0.7	1.2
Correlation *r* (blank classes B1/B) = 0.9998				
Total blanks	14,802	1,995	100.0	100.0

ular retouch. Compared with Demidenko's data then, the number of tools in the data used for the transformation analysis is much lower. Because unretouched flakes and blades are consequently more numerous, a number of simple tools he recognized were seemingly not classified by us as retouched at all, or, in some cases, were classified as waste from rejuvenation. Some preforms, nodules, or heavily fragmented bifacial tools, as well as some small tool fragments in Demidenko's type list were most likely classified by us as chunks. Although differences of this kind may be in accordance with our expectations, it is at the same time important that independent classifications of the same assemblage lead to similar, if not identical, results. Here, the correlation coefficient Pearson's *r* (which ranges from –1 for a perfect negative, 0 for no, and +1 for a perfect positive correlation) was used to examine the degree of similarity (Benninghaus 1982:214–229). If only the artifact categories studied for transformation analysis are compared, the different classifications discussed here are nearly identical ($r = 0.945$).

The same correlation coefficient was used to investigate the degree of differences or similarities between Levels B and B1 (Table 12-2). The correlation coefficient, calculated separately for the reduced list of formal tool types and blank categories, shows striking degrees of similarity. The distribution of the frequencies of formal tools highly correlates, with $r = 0.882$. The frequencies of blanks, with $r = 0.999$, indicate that the assemblages are statistically identical in this aspect. This has two implications for the overall interpretation: first, Level B1 may be taken as representative for both Kiik-Koba levels in terms of formal tool and blank frequencies. It is therefore reasonable to conclude that results obtained in the course of the analysis of Level B1 are also relevant for Level B. In both levels, nearly identical activities must have taken place. Second, there are good reasons to think that the same technological repertoire was used to perform comparable *chaînes opératoires* in both levels. Because the same reduction and rejuvenation sequences occur, it is concluded that the same, or very similar, strategies of raw material procurement and similar movements in the landscape led to the striking similarities in the frequencies of formal tools and blanks. The fact that even the numbers of burned pieces are very similar can be seen as an indicator for a comparable intensity of the use of fireplaces and hearths during the stays of Neandertals in both levels.

Some General Observations Concerning On-Site and Off-Site Transformation of Stone Artifacts in Buran-Kaya III Level B1

The question as to what extent the transformation of raw material from nodules to blanks took place on-site is often estimated by cortex frequencies. The interpretation of cortex frequencies is based on two theoretical assumptions. The first is that, because core reduction starts with the outer cortex and only after decortication and preparation reaches the inner part of the nodule, the presence of cortical flakes and high numbers of flakes partially covered with cortex is taken as an argument that the initial flaking of raw nodules took place on-site. If, at the same time, blanks without cortex appear in significant numbers, it is concluded that, in many cases, a great portion of the entire *chaîne opératoire* was conducted on-site. Second, because raw material acquisition is thought to be embedded in other subsistence activities (Floss 1994:322–328), it is assumed that the frequency of cortex declines with an increasing distance to the raw material source: the more stops taken in between, the more often blanks were flaked from a nodule. Thus, if the provenance of the raw material is not known, a high percentage of cortical flakes and flakes with partial cortex is usually taken as an indicator for the procurement of mainly local raw material.

In the present data set, cortical blanks, blanks partially covered by cortex, and blanks without cortex on their dorsal surfaces have been counted; cores, however, were not studied for the condition of the cortex. In Level B1, 78 pieces (9%) are totally covered by dorsal cortex (Figure 12-3). Blanks that are partially cortex-covered account for 389 pieces (46%), and those without cortex make up 384 pieces (45%). The simple data structure, together with the above-mentioned theoretical implications, seem to reflect complete reduction on-site, with some initial cortical flakes and an equal proportion of flakes with some cortex derived from preparation, and flakes without cortex as products of a more evolved debitage. Without further controlling variables, one might conclude that many local nodules went through decortication and interior flaking on-site.

Is it as simple as that, however? As an alternative, the following twofold treatment of raw material may also be postulated based on the data and theoretical implications presented above: Neandertals imported many blanks without cortex from more distant campsites, whereas some local nodules were decorticated and prepared, but these were taken to other sites without the flaking of their interiors (leaving cortical flakes and flakes with partial cortex at the site). It becomes clear that as soon as more complicated strategies of raw material procurement are considered, with different treatments of local and distant raw material sources, simple variables might lead to false interpretations. Because sophisticated strategies for raw material procurement (Chabai et al. 2000; Demidenko, Chapter 9), as well as for on-site and off-site tool production (Marks and Monigal 1998), are known for the Late Middle Paleolithic of Crimea, additional analysis is needed.

W. Weissmüller has suggested (1995:62) that the longest measurement taken for every artifact provides preliminary information about the on-site and off-site transformation of stone tools. According to Weissmüller (1995:fig. 19), in theory, two ideal distributions for the frequency of the longest measurements of all artifacts of an assemblage can be distinguished.

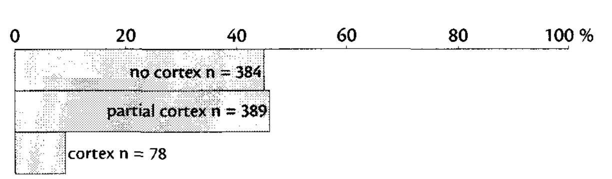


Figure 12-3—Frequency of cortex categories in Buran-Kaya III Level B1 (N = 851).

In the first, a normal (Gaussian) distribution, where most of the pieces are medium-sized, indicates an assemblage where cores and blanks, in most cases, were transformed only partly on-site. The weak representation of large flakes points to initial off-site reduction, such as decortication and core preparation. The fact that only a few small flakes and chips are present shows that the repeated preparation of striking platforms, as well as final flaking steps, such as the modification of blanks, also must have been conducted off-site. In the second, to the contrary, an exponential increase of small artifacts indicates an assemblage that was largely transformed on-site. With increasing numbers of flakes struck off a core or nodule, the longest measurement of the blanks decreases; as striking platforms are prepared very often, and blank edges are modified and resharpened, the number of small chips increases rapidly. All in all, 866 artifacts from Level B1 of Buran-Kaya III were measured, and the number of pieces in each mm class was counted. The interpretation of the diagram (Figure 12-4) needs caution, because all unretouched chips under 3 cm are missing in the measured sample. Between the largest artifact measuring 70 mm and artifacts measuring 32 to 30 mm, the graph shows an exponential growth towards small artifact sizes. In addition, Demidenko (Chapter 9) counted 4,241 chips between 29 and 15 mm, and 9,449 chips less than 15 mm. Thus, we can reconstruct an overall distribution of the longest measurements that is highly biased towards small artifacts and therefore fits well into Weismüller's second model (1995:fig. 19 left). Combined with the data from the different cortex classes, we may conclude that considerable numbers of complete nodules were brought to Buran-Kaya III and decorticated, and that, at the same time, the assemblage was intensively reduced on-site.

How many nodules were imported? Were the imported nodules reduced until an exhausted core was discarded, or were preforms and/or core blanks produced on-site and later exported? Did Neandertals from Buran-Kaya III carry any curated tools to the site, as was the case at European Middle Paleolithic sites (Geneste 1989; Weissmüller 1995; Richter 1997; Uthmeier 2000)? If so, what tool types did they prefer to carry while on the move? These questions need a more detailed analysis, which in this chapter is based on the sorting into raw material units.

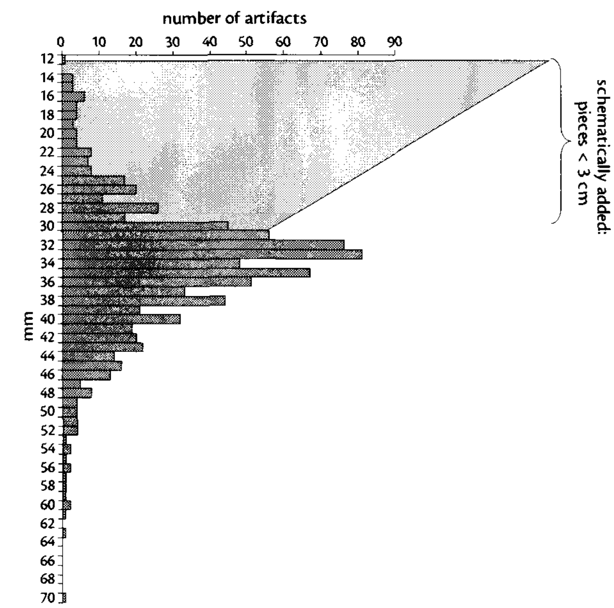


Figure 12-4—Longest measurements of all artifacts used for the transformation analysis from Buran-Kaya III Level B1. Because artifacts less than 3 cm were only considered when retouched, the sample is biased towards artifacts greater than 3 cm. The shaded area shows chips < 3 cm counted by Demidenko (cf. Table 12-1).

Raw Material Units and Procurement Strategy

Raw material units are defined by a combination of macroscopic attributes, such as the structure and the color of the fracture, the color and structure of the cortex, and the presence or absence of microfossils. Under the premise that the sorting looks for unique combinations, raw material units (RMUs) fall into one of four classes:

(1) single pieces with only one artifact that shares no raw material attributes with any other artifact from the analyzed assemblage;
(2) workpieces with two or more artifacts that are thought to belong to a single nodule;
(3) raw material sources with two or more artifacts that belong to different nodules, but fall within the variability of attributes observed in nodules from a known raw material source;
(4) formations with two or more artifacts whose provenance can only be traced back to the geological genesis.

Although other classes were listed above, the sorting attempts to recognize as many raw material units as possible that equal either single pieces or nodules. After initially excluding 13,690 unretouched chips less than 3 cm in size, 49 patinated artifacts, and 610 heavily burned pieces, 866 artifacts with an overall weight of 4,228 grams remained for the attempt to find distinct nodules.

In total, 115 raw material units were distinguished (Figure 12-5). Because contact with fire did not lead to fissures or breakage, but to a change of color, the artifacts of one raw material unit with 15 artifacts had to be excluded. Fifty-nine raw material units fulfill the criteria for workpieces: each of them is thought to include only artifacts from a distinct nodule, each imported, possibly as different shapes, into the site and then flaked to different extents. Forty-five raw material units are single pieces that must have been imported as individuals and discarded on-site. Altogether, single pieces and workpieces interpreted as isolated episodes and, like refits, mirror physical and social activities of humans account for 90.4% of all raw material units. For 10 units, it remained unclear whether they represent single nodules or belong to more than one nodule from the same source. This uncertainty is often the result of many shared attributes, but slightly different cortex, or the presence of more than one core or preform within the same unit.

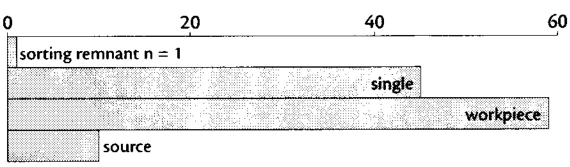


Figure 12-5—Classes of sorting into raw material units. Single pieces are unique in the sample and workpieces represent individual nodules, comparable to refits.

In the rich primary raw material sources of Crimea, the shape of the raw nodules is often diverse (Demidenko, Chapter 9; Uthmeier, Chapter 11). Especially when foliated surface-shaped tools, like leaf points, were produced, a preference for flint plaquettes has been described in some Paleolithic industries (e.g., for Buran-Kaya III Level C: Marks and Monigal 2000a:217). If raw material units include cores with cortex, cortical flakes, or blanks with partial cortex, it may be possible to determine the original shape of the flaked nodule. For the Level B1 material, three different shapes were distinguished: round nodules, round-but-flat nodules (sometimes also called flat pebbles: Marks and Monigal 2000a:217), and plaquettes (Figure 12-6). Fifty-nine raw material units, including many single pieces, did not allow a meaningful classification of the original nodule shape. Among the remaining, there are 35 round-but-flat nodules, 12 round nodules, and 9 plaquettes. Obviously, flat-but-elongated pebbles were preferred. Combined, they make up 78.6% of all reconstructed shapes for raw nodules.

Another simple, but instructive, attribute that facilitates recognition of certain preferences in the raw material procurement of Level B1 Neandertals is the

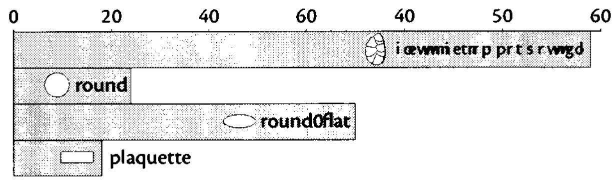


Figure 12-6—Shape of nodules for 115 raw material units. Classification was not possible in cases where artifacts with cortex were absent.

appearance of the cortex (Figure 12-7). Chalky cortex that can easily be wiped away is seen as an indicator for primary raw material sources. Cortex that is thin but can be scratched is correlated with secondary residual raw material sources, where the embedding limestone disappeared due to chemical or physical destruction and the more resistant flint nodules remained. If the cortex is heavily rolled and cannot be removed, or has been totally washed away, it is concluded that the pebble came from a river terrace. For 39 raw material units that had artifacts without any cortex, classification was impossible. Where classification was possible, 49 nodules came from primary sources, while 27 nodules were taken from residual sources. At first glance, the total absence of raw material collected from river terraces is amazing, for exploiting river terraces is the simplest strategy of raw material procurement. However, besides the fact that river terraces often only bear pebbles of poor quality, our own survey confirmed that the river bed of the Burulcha River is, at least for a distance of 5 km from the site, free of any siliceous material of a suitable size for flaking.

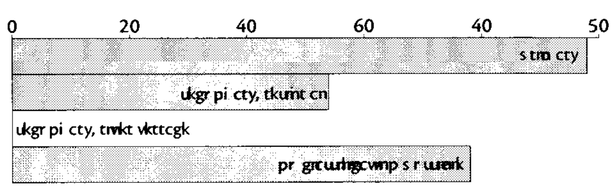


Figure 12-7—Classification of the cortex of 115 raw material units in reference to geological origin.

The attributes used here to describe the raw materials that were brought into the rockshelter of Buran-Kaya III do not provide clear evidence for their provenance. Most of the outcrops of primary Cretaceous flint known so far from eastern Crimea are supposed to belong to the same geological formation that came to the surface at different places. In addition, many outcrops sampled by us were quite diverse in the shape of the raw nodules, and sometimes also in the color of the fractures. The fact that the variability in color of the fractures is limited, and ranges, in most cases, from dark brown to dark grey, points to the outcrops of Tsvetochnoye and Russakovka, some 10 to 15 km north of Buran-Kaya III. Here, dark grey nodules of different shape were found at the base, whereas brown flints appeared towards the top of the profiles.

There are exceptions, however. Among the raw material units, we recognized a single piece (Kurbjuhn, Chapter 14: RMU 96) made of a reddish-brown flint that is unique in its black streaks and its white translucence. Surprisingly, we found this exotic raw material not only in Buran-Kaya III Level B1, but also, with little variance in the color, in Starosele Level 1 and in Chokurcha I Level I, also as single pieces.

What we can learn from our analysis of simple raw material attributes about Neandertal behavior is that they preferred a direct exploitation of primary sources, and that they more often chose flat pebbles or plaquettes. In other words, we see preferences in the selection of certain qualities and shapes. Furthermore, the fact that the raw material acquisition tends to follow a visible strategy that looked for good quality flat nodules and plaquettes reinforces the assumption that the Neandertals who came to Buran-Kaya III knew that there was a local shortcut to any siliceous materials. Because they *planned* their visits to Buran-Kaya III, they were able to choose preferred raw materials in advance and, if they had not passed a region where rich primary raw materials of the desired quality were available, they must have collected the nodules during micro-moves in the vicinity of previous campsites.

Natural Loss or Artifact Transport by Neandertals? N-Transforms and C-Transforms in the 1996 Level B1 Sample

As noted above, 866 unpatinated artifacts from the 1996 excavation of Level B1 were sorted into 115 raw material units. Apart from one unit with burned artifacts, 114 (= 851 artifacts) of them were recognized as single pieces (45 RMUs), distinct nodules (59 RMUs), or as units where it was not clear if they represented distinct nodules or more than one nodule from the same raw material source (10 RMUs). Figure 12-8 shows the number of raw material units for classes of artifact frequencies. The number of artifacts in the raw material units ranges from a minimum of 1 piece (single pieces) to a maximum of 45 pieces (workpieces). The median of the distribution is 5 pieces per unit, showing that one-half of the raw material units include 1 to 5 artifacts only. In general, the mainly low frequencies of artifacts in raw material units emphasize the high resolution of the sorting. The fact that many units classified as "source" also have only between 2 and 14 artifacts, can be used as an argument that they also represent workpieces, in this case, with a more diverse cortex of the nodule. According to Weissmüller (1995:69), it is more likely that two or more Middle Paleolithic flakes from the same nodule reflect on-site reduction of cores, rather than that they were produced off-site and imported. Although this view might be too dogmatic, and some workpieces with low frequencies of tools might also relate to importation, it still must be asked why there are so many units with only a few artifacts in them. A superficial answer is banal: because many nodules are incomplete. What is the source of that incompleteness, however? Does it go back to C-transforms (Schiffer 1989), where the Neandertals took a nodule or preform to the site, struck off only a few flakes, and then exported the core, preform, or the surface-shaped tool together with simple blanks? Or, to the contrary, did N-transforms (Schiffer 1989) reduce the original number of artifacts in workpieces? And finally, were missing artifacts discarded nearby, but outside of the excavated area?

First of all, the data used here are biased towards artifacts larger than 3 cm. In the sense of Weissmüller (1995:67–68), chips of small size are static objects that fall down after their detachment. According

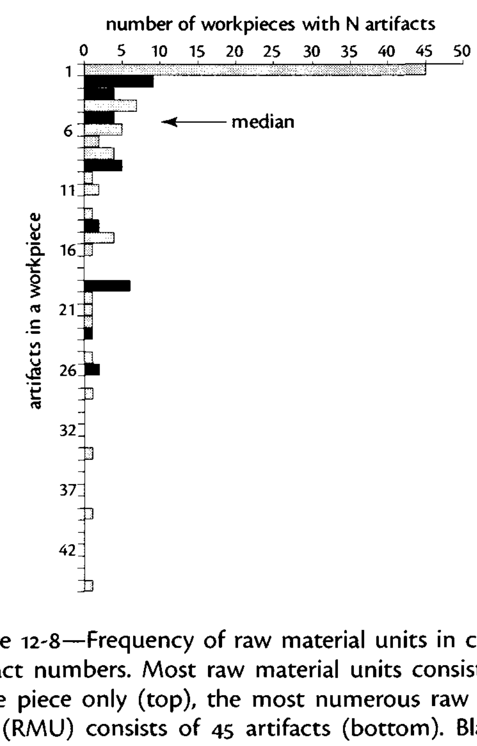


Figure 12-8—Frequency of raw material units in classes of artifact numbers. Most raw material units consist of one single piece only (top), the most numerous raw material unit (RMU) consists of 45 artifacts (bottom). Black bars include RMUs classified as "source."

to the numbers given by Demidenko (Chapter 9), unretouched chips <3 cm account for 92.5% of the assemblage. In the well-preserved Magdalenian concentrations of Marsangy (Schmider and Croisset 1995: table 2) where long blades were flaked, the number of chips and waste from flaking less than 5 cm in size ranges between 64% (*amas* 21) and 49% (*amas* K19-20). On the living floors of the Micoquian G-layers of Sesselfelsgrotte, with an on-site production of Levallois flakes and surface-shaped tools such as flat handaxes or bifacial knives, the proportion of chips ranges between 60% and 80% (Richter 1997:86–117). These examples of well-preserved sites illustrate that the number of static objects clearly indicates an in situ preservation of, at least, most square meters of Buran-Kaya III Level B1 excavated in 1996. As a consequence, we have to add unknown numbers of simple chips under 3 cm to the artifacts sorted into each raw material unit. The frequency of chips in the G-layers of Sesselfelsgrotte permits the assumption that especially high numbers of chips occur when surface retouch is used to produce preforms for typologically bifacial tools (Boëda 1995b: *biface supports*). In the framework of the transformation analysis, this means that raw material units where surface retouch indicates the production of bifacial tools or bifacial preforms, the occurrence of only a few pieces larger than 3 cm is a more realistic value than it appeared on first glance.

Nevertheless, it is still an open question whether N-transforms and/or C-transforms were active after the deposition of the artifacts. Taking into consideration that the sedimentation rate was generally low, and that the thickness of Level B1 is approximately 20 cm (whereas excavations at other sites like Kabazi II saw archeological horizons measuring only 2 to 5 cm), it is very probable that the assemblage analyzed here is a mixture of several visits by Neandertal groups. According to a comparison of Levels B and B1, the activities during many of these visits tend to be similar in terms of tool and blank frequencies. High numbers of faunal remains (Patou-Mathis, Chapter 8) and artifact densities reaching an average of no less than 2,500 pieces per square meter (Demidenko, Chapter 9) speak for the intensity of these visits. It is assumed that, together with weathering, the movements of humans on the Pleistocene surface might have destroyed a considerable number of fireplaces, the remains of which are thought to be responsible for the characteristic dark color of the sediments in Level B1. Other data suggest that a restricted amount of space was used during these repeated visits. Profiles published so far (Marks and Monigal 2000a:fig. 2) show that the sediments of Level B1 form a depression. This depression may have led to today's spatial distribution not only because finds were trapped in it, but also because the depression may have been a preferred structure for activities of humans near the warmth of the rockshelter's back wall. Within the spatial distribution for the artifacts of the transformation analysis sample, squares that mark the maximum artifact frequencies are found in the center of the 1996 excavations (Figure 12-9: Д8, Г7, Г8). From there, the density of finds declines dramatically towards the back wall and, less markedly, towards the borders of the excavations.

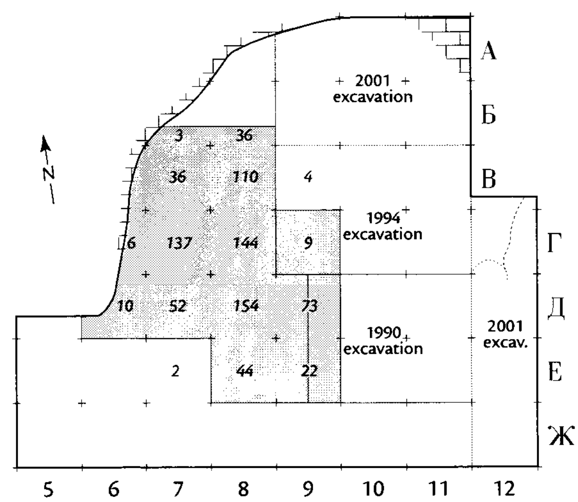


Figure 12-9—Artifact densities (artifacts > 3 cm and retouched chips) in squares of the 1996 excavation (shaded). Decreasing artifacts densities speak for one, more or less complete concentration.

While this distribution gives the impression of a unique, homogeneous concentration that might have been cut at its edges and, therefore, incomplete due to erosion (Demidenko, Chapter 9) and excavation area size, the detailed mapping of the spatial distribution of raw material units (Kurbjuhn, Chapter 14) proves the opposite. For workpieces, it is still possible to recognize single episodes of flaking. Many distributions of artifacts that come from a single nodule show a maximum in one square or two neighboring squares, and a decline towards one direction (see for example Kurbjuhn, Chapter 14: RMU 2, RMU 3, RMU 4, RMU 10, RMU 13, RMU 16, RMU 41, RMU 46). A spatially limited distribution, surrounded by decreasing artifact densities, is exactly what we can expect when areas where nodules or cores were flaked are preserved in situ. The maximum density marks the place where the knapping originally took place, and declining artifact densities result from the discard of waste products (Boëda and Pelegrin 1985:figs. 11 and 12). In contrast to the cited experiment, where these areas tend to be small and measure only 2 to 3 m², the spots in Buran-Kaya III Level B1 have been stretched by human movements on the living floor. Natural movements of artifacts was minimal, since most artifacts are neither rolled nor patinated, but show fresh and sharp edges.

That the overwhelming number of the maximum artifact densities within workpieces are situated fully inside the 1996 excavation area leads to the assumption that the sample used here is in situ, untouched by severe N-transforms, and is representative of the activities that were conducted by Neandertals on-site. In other words, low artifact frequencies in the workpieces of Buran-Kaya III Level B1 mainly result, apart from the exclusion of simple chips under 3 cm in size, from import or export by humans.

When Raw Material Becomes Expensive: the *Chaîne Opératoire*

The technological repertoire of Level B1 was analyzed by looking at 65 raw material units classified as workpieces or raw material sources (Figure 12-10; compare also this chapter, "Results of the Transformation Analysis II: On-Site Production"). Comparable to refits, they are seen as sub-assemblages that resulted from the reduction of single nodules or cores. In contrast to conventional approaches, where artifacts are compared within techno-typological categories, this method allows a view of entire sequences of the *chaîne opératoire*. Because many details of the *chaîne opératoire* for Level B1 are found in Demidenko (Chapter 9), it is described here only very briefly, according to different phases of the *chaîne opératoire*.

Phase 0, Raw Material Acquisition

The strategy of raw material procurement has already been described in detail above: flat pebbles or plaquettes from primary sources of Cretaceous flint were preferred.

Phase 1, Decortication, and Phase 2, Blank Production

Fifteen artifacts were classified as cores. However, it is not clear whether these were originally considered as sources for conventional blank production. They do not follow Levallois, Quina, or discoidal concepts, neither are they volumetric cores. While some of them have deep negatives that resulted from hard hammer technique, for others, classification of the flaking technique is difficult to determine. Nevertheless, we are convinced that apart from one core that was obviously used as an alternative source for some flakes, all other cores must be classified as preforms for surface-shaped tools that were discarded because of hinge fractures, bad flaking angles, etc. Among the blanks, some thick flakes, detached off-axis and completely or partially covered by dorsal cortex, were flaked by soft hammer technique (Figure 12-10: *1*). It is probable that the primary flaking of flat pebbles transformed into surface-shaped blanks or tools began with the removal of these thick *déjeté* flakes. Other flakes of this form, however, were detached with a direct, hard hammer technique (Figure 12-10: *2*). No fewer than 259 flakes resulting from surface retouch were recognized by their narrow flaking angle, their lipping, a curved longitudinal section, and typical dorsal scar patterns with thin scars of previous surface detachments. Some of the platforms were carefully faceted, others were also abraded before the blow. They indicate an intensive production of surface-shaped, in most cases bifacially retouched, plano-convex blanks.

Phase 3, Modification

Taking into consideration that prepared cores following any conventional concept in the sense of Boëda et al. (1990) are missing, it becomes obvious that modified blanks in Level B1 often came from the initial flaking of preforms for surface-shaped tools (Figure 12-10: *1–2*). In addition, intensive use of flakes from surface retouch as blanks for unifacial tools (Figure 12-10: *3*) gives the impression that raw material was sparse. In 32 of 65 workpieces, or 49.2% (Table 12-3, transformation sections Np to Nm/surface), that reduced nodules or preforms, a part of the waste of surface shaping served as blanks for tools (Figure 12-13).

Since Boëda's (1995b) analysis of the Micoquian levels of Kůlna cave, it has become obvious that the surface shaping of nodules and blanks is an alternative concept to the conventional production of blanks from prepared cores. He showed that the same working edges appeared both on simple flakes and on bifacial *biface supports*. The advantage that Boëda saw in bifacial blanks was the possibility of a recurrent resharpening of working edges, especially when they were, as at Kůlna, plano-convex/plano-convex. In contrast to simple blanks, where the retouch of the modified edges tends to become steeper when repeated and, finally, is in danger of hinge fractures, the angles of surface-shaped (bifacial) blanks remain stable. As a consequence, surface-shaped tools were recognized as artifacts with long life histories that often, like scraper reduction sequences (Dibble 1995), cross the borders of typological categories (Richter 1995:203–206, Chapter 13).

While this concept is widely known, we have documented another example of a similar use of simple blanks and surface-shaped *biface supports* in Level B1 of Buran-Kaya III. It is not based on the desire for

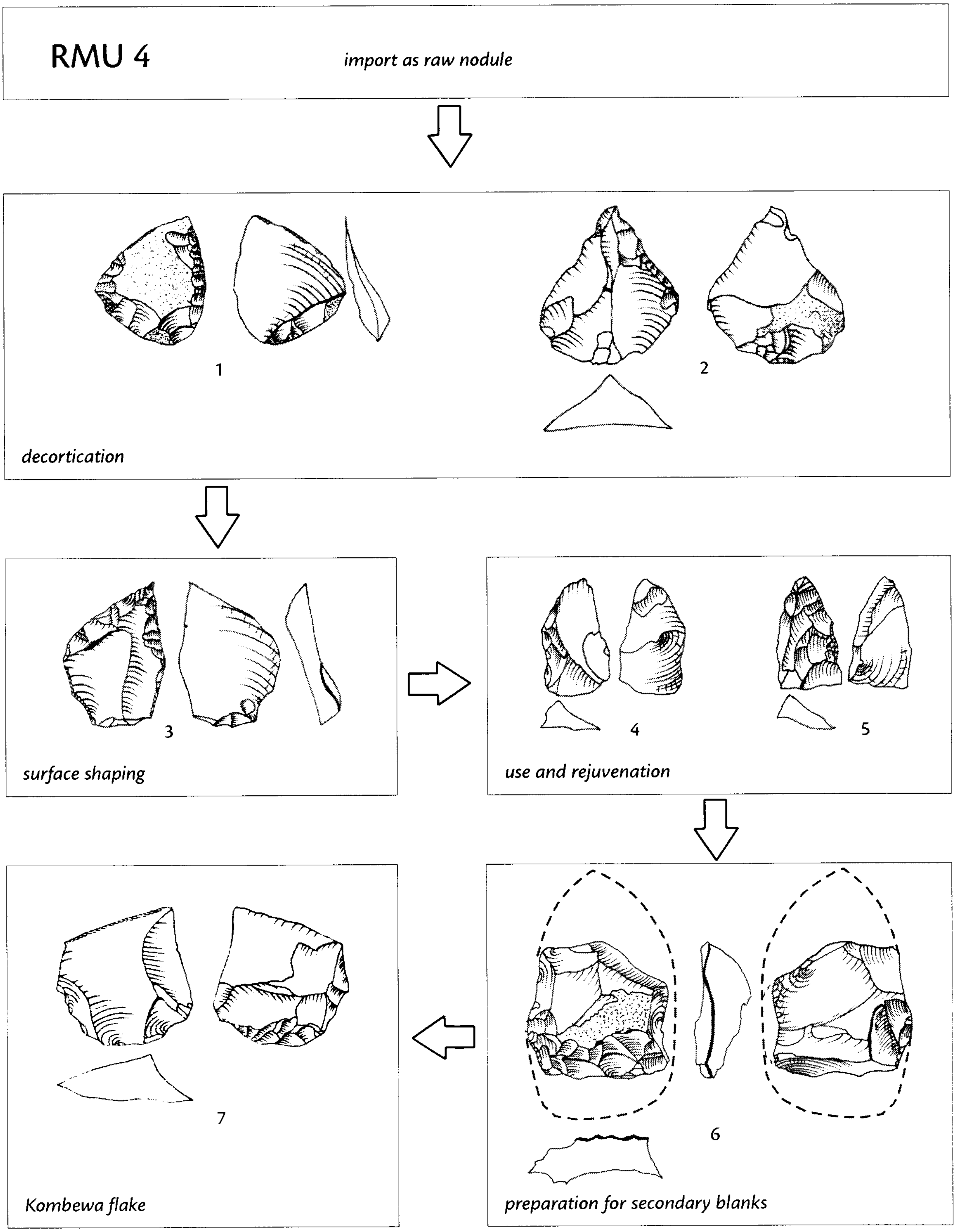


Figure 12-10—Raw Material Unit (RMU) 4's artifact classification by major phases of the *chaîne opératoire*. Because they show a unique combination of raw material attributes, it is concluded that all artifacts belong to the same nodule; missing pieces are either less than 3 cm or were exported.

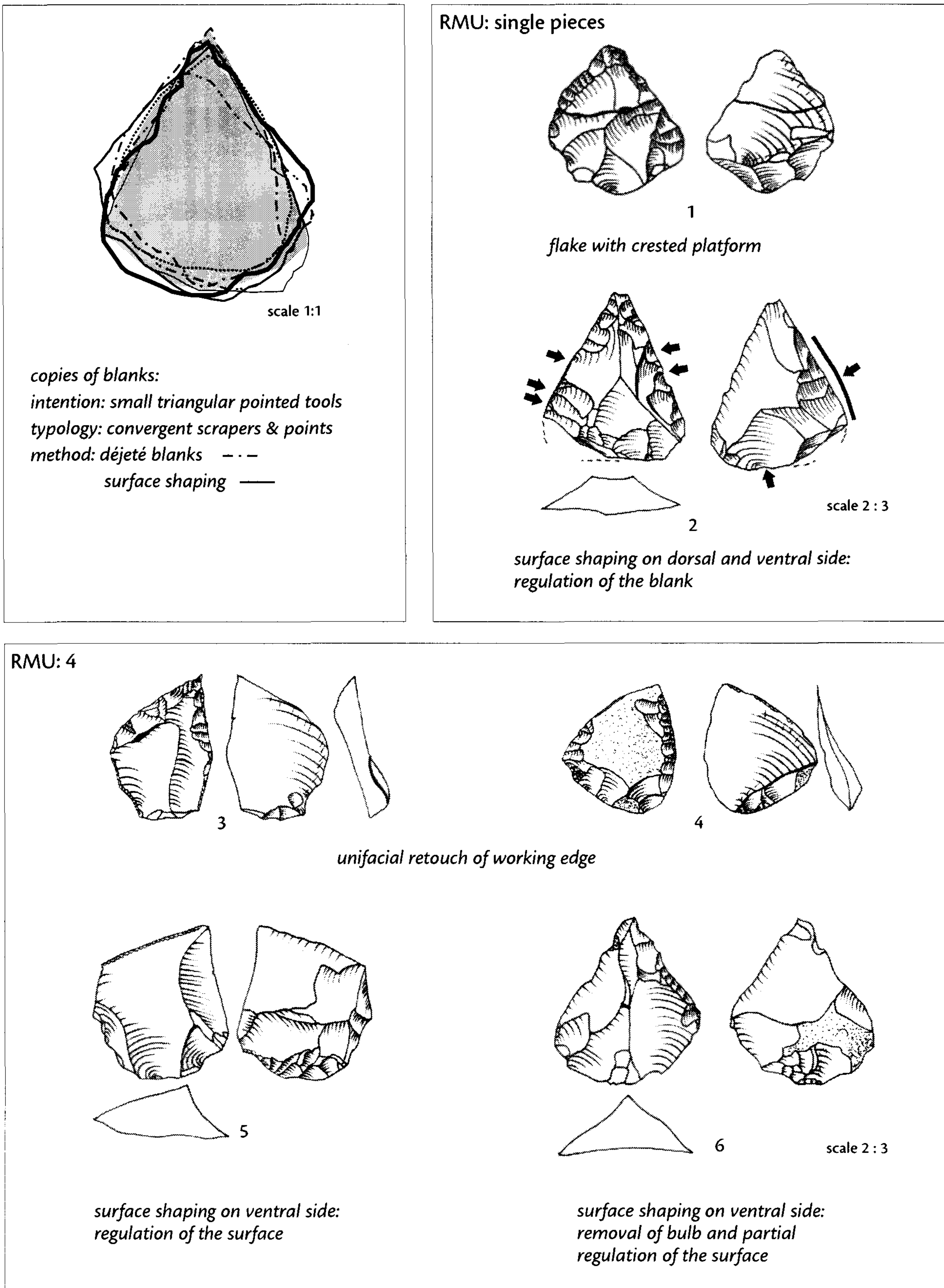


Figure 12-11—Small triangular pointed blanks that result from different methods of production. Identical outlines of simple tools and surface-shaped (bifacial) tools speak for surface shaping as an alternative strategy for the production of desired blank types. *Biface supports* are not the result of long tool life histories, but due to re-tooling and re-hafting processes.

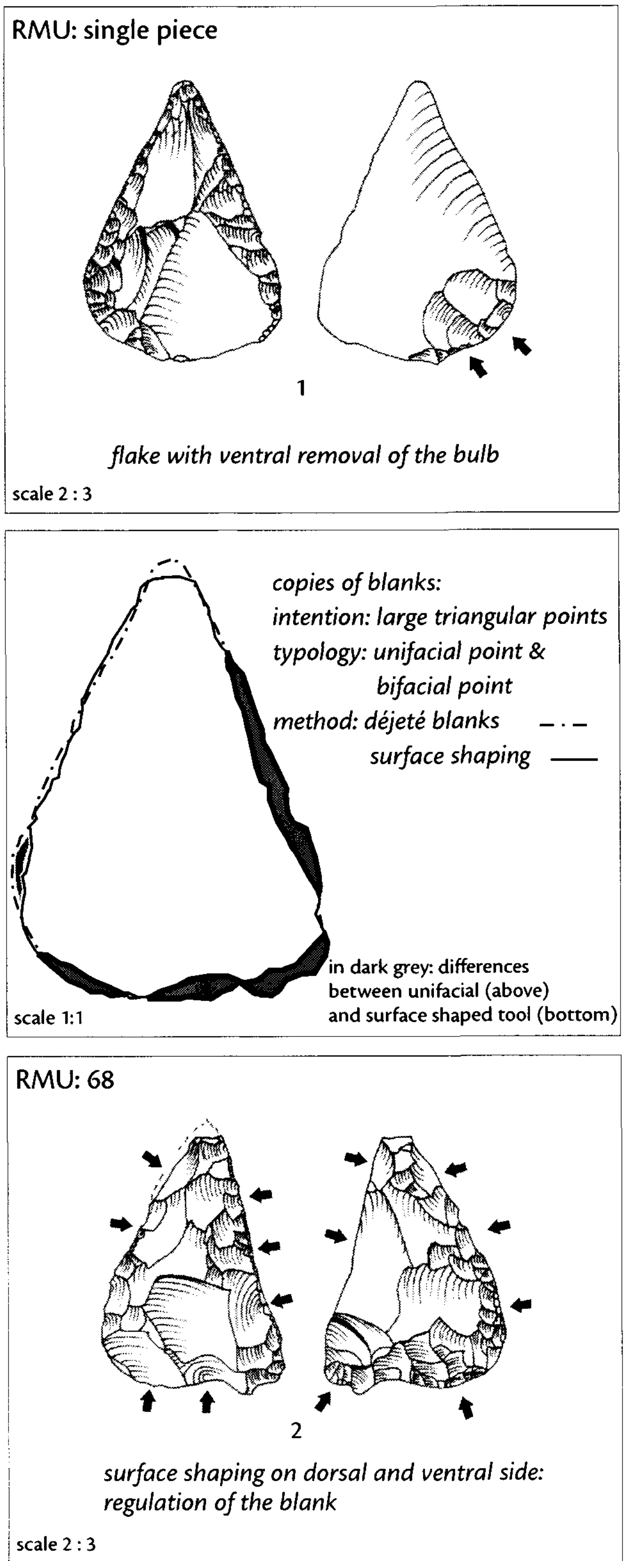


Figure 12-12—Large elongated triangular pointed blanks that result from different methods of production. Identical outlines of simple tools and surface-shaped (bifacial) tools speak for surface shaping as an alternative strategy for the production of desired blank types. *Biface supports* are not the result of long tool life histories, but due to re-tooling and re-hafting processes.

long and diversely lived working edges. Instead, it is caused by a need for blanks with identical outline, length, and width measurements. Two triangular blank types, a smaller one with its greatest thickness near the butt (Figure 12-11), and a more elongated one (Figure 12-12), seem to have been of pronounced importance. For small triangular blanks, some simple blanks fit into the outline that was desired (Figure 12-11: *1, 3, 4*). Others needed additional ventral thinning (Figure 12-11: *5*), a complete surface shaping of the ventral surface (Figure 12-11: *6*), or dorsal and ventral shaping (Figure 12-11: *2*) to make them bifacial blanks. Based on technique of blank production and the number of modified working edges, these artifacts fall into different type categories: simple sidescraper (Figure 12-11: *4–6*), convergent scraper (Figure 12-11: *1*), unifacial point (Figure 12-11: *3*), and bifacial point (Figure 12-11: *2*). All of these pieces have nearly identical outlines (Figure 12-11). This is also true for two elongated triangular blanks that were modified into a point (Figure 12-12: *1*) and a bifacial convergent scraper (Figure 12-12: *2*). Whereas the first tool only needed the removal of the bulb via additional ventral thinning (Figure 12-12: *1*), the second had to be reduced to a certain extent, since large ventral scars show that the piece originally was bigger. Only intensive surface shaping led it to have the same outline as its unifacial twin (an analysis of the complete operational sequence of this piece is found in Richter, Chapter 13). Because several tool classes, including simple scrapers, are involved, one simple explanation must be rejected: from our point of view, it is not very probable that a metrical standard for the discard of heavily used tools led to the observed metric similarities. It seems more plausible that the lack of a conventional blank production called for this strategy. Because prepared cores were missing, the needed blank form had to be achieved by alternative methods.

For the Micoquian assemblage of Lichtenberg, similar observations have already been made, but only for surface-shaped foliates that sometimes show amazing similarities in their outlines (Veil et al. 1994:33–35). The fact that some foliates from Starosele Level 1 also have identical outlines (Marks and Monigal 1998:fig. 7-17:c,d,f) can be taken as another example for the assumption that the production of exact copies was a widespread phenomenon in the production of bifacial tools in the Crimean Middle Paleolithic. To us, the hypothesis that surface-shaped tools are one-to-one copies of simple blanks, was new. On the other hand, such behavior is closely related to ventral thinning, a strategy that is supposed to be necessary during re-tooling and re-hafting when the bulb does not fit into the shaft (Mellars 1996:fig. 4.14). In general, use-wear analyses have proved that hafting was well known in the Crimean Middle Paleolithic (Kay 1999:170; Hardy et al. 2001). In Level B1 of Buran-Kaya III, there are

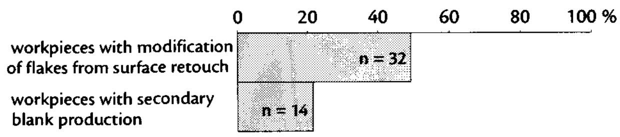


Figure 12-13—Selected technological features of the *chaîne opératoire* in 65 workpieces with blank production, as percentages.

also macroscopic arguments for it. In RMU 68, a bifacial convergent scraper (Figure 12-12: *2*) shows a large, hinge-terminated dorsal scar at the base, that was employed as a final thinning of the piece after the edges were modified. Like the tiny retouch at the basal part of the lateral edges of a point (Figure 12-11: *3*), the scar at the base of the previously described bifacial convergent scraper (Figure 12-12: *2*) may have resulted from lateral damage while the pieces were moving in a haft (Shea 1989). Detailed analysis of the operational steps of selected surface-shaped tools from Level B1 (Richter, Chapter 13) also came to the conclusion that bifacial tools were re-sharpened while still hafted (Andrefsky 1998:figs. 2.17, 2.18).

Phase 4, Use

Forty-eight tool tips indicate intensive use of retouched pieces. Some of them result from breakage after constant pressure, while others were clearly struck off by an intentional, controlled blow either from the side (Figure 12-10: *5*) or directly on the ventral surface (Figure 12-10: *4*). Thus, the latter have to be classified as waste from rejuvenation. No less than 71 resharpening flakes were counted, pointing to heavy use of working edges. At the moment, use-wear analyses are needed to decide whether the waste from lateral tool rejuvenation was re-used as a tool afterwards. In the Saalian Middle Paleolithic site of La Cotte de St. Brelade (Callow and Cornford 1986), use-wear analysis showed that lateral sharpening flakes were indeed used as tools after they were detached. For this cave on the Pleistocene seashore, a correlation between a lack of raw material and high frequencies of lateral sharpening flakes was explained in terms of an alternative blank production strategy after the rising sea level covered local raw material outcrops (Cornford 1986).

Phase 5, Discard, or: Back to Phase 2, Secondary Blank Production

The ratio calculated for retouched formal tools and unretouched pieces greater than 3 cm (Table 12-1) is 1 : 3. If irregular retouched pieces are also taken into account (Table 12-1), the ratio is 1 : 2. It follows that the percentage of modified and therefore intensively used blanks is very high. Use-wear analysis on unretouched pieces (Beyries 1987:103; 1988) confirms that simple retouch often marks only the end of the life history of stone artifacts with cutting edges. In Biache-Saint-Vaast (Beyries 1988) for example, only 5% of a sample that included both retouched and unretouched pieces showed no traces of use wear. Especially when a soft material, like fresh meat, is worked, traces of use-wear only develop after a considerable amount of time (Veil et al. 1994:54–58; Schütz et al. 1990:251). Experiments (Schütz et al. 1990:251) proved that the primary butchering of *Dama dama* can be carried out with only three simple flakes. Thus, it is possible that the ratio between used artifacts and pieces discarded without use was even higher than the above calculations suggest, based on retouched tools only. In Buran-Kaya III Level B1, a heavy duty usage of surface-shaped bifacial tools that resulted in broken tool tips was also observed. It can only be assumed that these artifacts indicate secondary butchering, such as on-site bone breakage to extract marrow. The analysis of Richter (Chapter 13) gives further information on the use of surface-shaped tools. It is concluded that they were hafted. Their discard, as well as the surface-shaped copies of simple blanks, must be seen as traces of retooling and re-hafting processes.

Although the *chaîne opératoire* has already been described as an intensive use of blanks and formal tools, there are several workpieces that exhibit another method used to avoid an early discard of raw material volume. A simple method was the use of a ventral side as a flaking surface. Five Kombewa flakes prove that this method was part of the technological knowledge of Neandertals from Level B1. What needs to be explained is the several blanks that were struck along prepared crests: 4 crested blades, 4 off-axis points each with a partly crested lateral edge, and 9 pseudo-Levallois points. A detailed analysis of the operational steps of an abandoned bifacial shaped tool (Figure 12-14) from RMU 4 (Figure 12-10: *6*) led to the hypothesis that Kombewa flakes might have also been flaked from exhausted bifacial pieces and unacceptable preforms. The earliest operational step (Figure 12-14: *2* step 1) was dedicated to plano-convex surface shaping. Large ventral scars of the plan surface retouch show that the piece must haven been much larger at the beginning of its reduction. Two bifacial tool tips from the same nodule also support this observation (Figure 12-10: *4, 5*). According to the logic of transformation analysis, the second tool tip indicates the former presence of a second bifacial tool, manufactured after the nodule was intentionally broken into two pieces at the very beginning of its reduction. The tool tips confirm the hypothesis that the analyzed piece originally was used as a bifacial tool before it became a bifacial Kombewa core. Perhaps during the time of use, perhaps afterwards, the piece was broken at its proximal end (Figure 12-14: *2* step 2). This might also have hap-

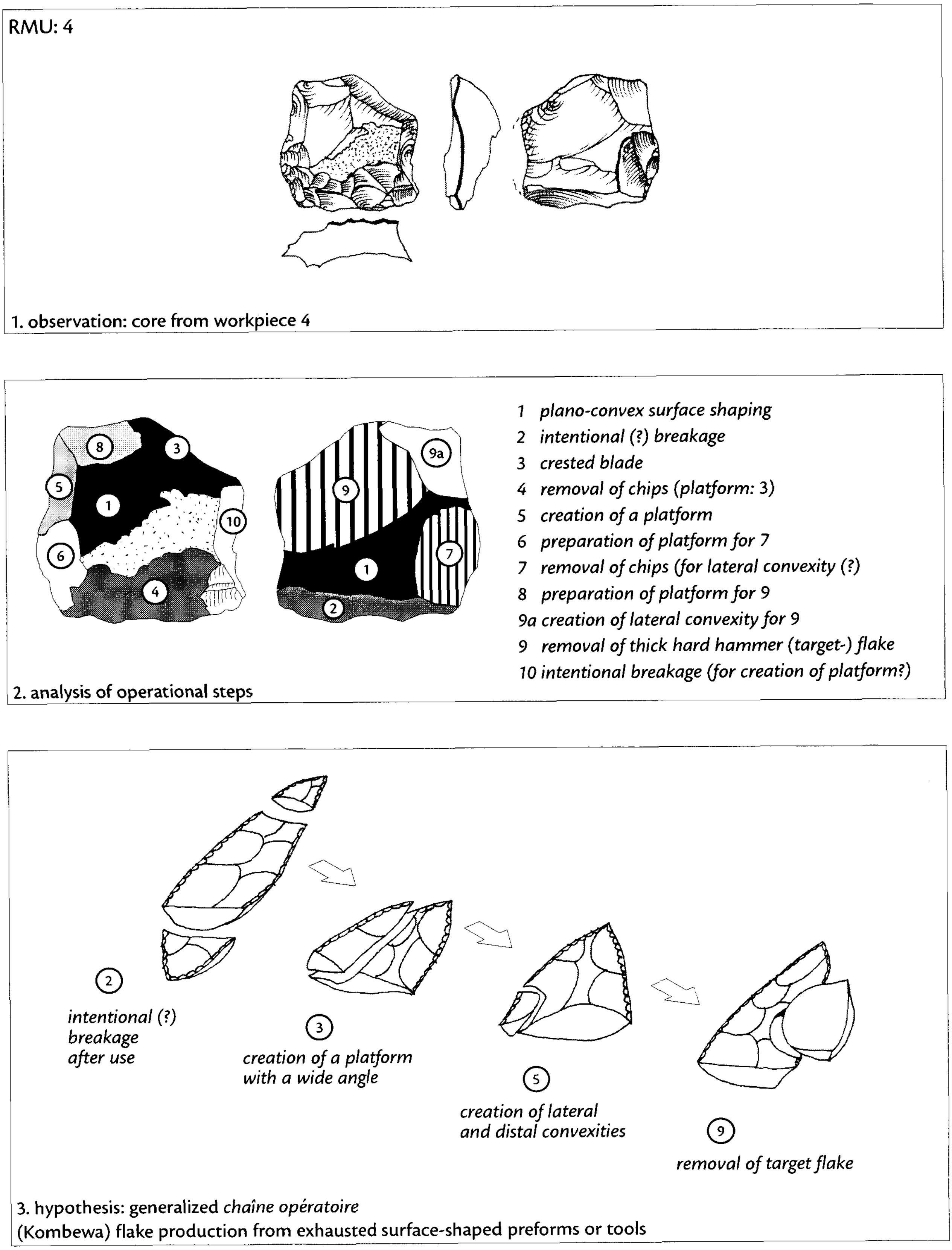


Figure 12-14—Secondary blank production from exhausted bifacial tools and unacceptable preforms. The method is similar to the Kombewa method, but produces flakes with a dorsal scar pattern that shows negatives of surface shaping instead of a (second) ventral surface.

pened at the distal end that is now covered by scars of later operational steps. These later operational steps include the detachment of a crested blade (Figure 12-14: *2* step 3) and some chips that prepared platforms for the flaking of the ventral surface (Figure 12-14: *2* steps 5, 6, and 8). If they were found on a prepared core, these scars on the ventral surface would have been classified as preparation of distal (Figure 12-14: *2* step 7) and lateral convexities (Figure 12-14: *2* step 9a) for the knapping of the target flake (Figure 12-14: *2* step 9). At the end, the exhausted bifacial core was intentionally broken with a ventral blow near its right lateral edge (Figure 12-14: *2* step 10). Aware that it is often difficult to distinguish conventional debitage from by-products from the surface shaping of bifacial tools, we still do not think that our Kombewa flakes (Figure 12-10: *7*) fall into the variability of failed removals from the ventral retouch of plano-convex bifacial tools (Boëda 1995b) and, therefore, are simply by-products of surface retouch. For three reasons, we are convinced that they represent a last attempt to maximize the overall output from the reduction of exhausted bifacial tools or broken preforms. First, the described operational steps occurred at the very end of the biography of the piece. Second, several final, yet logical, operational steps do prepare the detachment of the last flake, rather than trying to rescue the former bifacial blank. Third, we have the impression that a hard hammer technique was used and that these flakes are too thick for plano-convex surface shaping. From 65 (Table 12-3: transformation sections Np to Nm/surface) workpieces related to core production, surface-shaped preforms, or surface-shaped tools, 14 (21.5%) show secondary blank production of this kind (Figure 12-13). Finally, it must be stressed that these observations remain reasonable, if hypothetical, until refits are found.

Because workpieces are comparable to refits, artifacts of the same workpiece, at least in Middle Paleolithic times, were made by the same person. Since all technological aspects described above accumulate in single workpieces, as in RMU 4 (Figure 12-10 and Kurbjuhn, Chapter 14), it must be concluded that the complete *chaîne opératoire* was part of the technological knowledge of the Neandertals that visited Buran-Kaya III. Therefore it is highly likely that these Neandertals were adults.

To avoid the need for new raw material supplies, the Neandertals of Level B1 used a set of technological strategies to optimize the output of the *chaîne opératoire* from a given amount of raw material for working edges and standardized tools for hafting. At the same time, they successfully minimized useless waste. The following list summarizes the most characteristic features of the *chaîne opératoire*:

(1) The use of thick cortical flakes and of thin flakes from surface retouch, both derived from the production of surface-shaped blanks, for simple tools.
(2) In cases where suitable blanks could not be found, blanks of secondary quality were prepared by thinning and surface shaping for re-tooling and re-hafting processes.
(3) For resharpening purposes, the terminal ends of points and convergent scrapers were removed.
(4) Lateral sharpening flakes were detached mainly for rejuvenation, and perhaps as alternative blanks for cutting.
(5) Bifacial artifacts were resharpened while fixed in the haft.
(6) Exhausted surface-shaped tools or preforms of lesser quality were used as cores for the controlled detachment of thick flakes (secondary blank production).

A Reflection upon the Classification of Transformation Sections: Debitage and Surface Shaping

Transformation analysis classifies workpieces (e.g., artifacts from single nodules) according to the number of phases of the schematic *chaîne opératoire* (Weissmüller 1995:58–71) that can be reconstructed on-site (for more details see Uthmeier, Chapter 11). Based on the discarded artifacts, the sequence that was conducted on-site is called the transformation section (Weissmüller 1995:58: *Transformationsausschnitt*). The length of the transformation section is measured by the presence of artifacts that are defined as indicative for certain operational steps (e.g., cortical flakes for decortication). Some workpieces might represent all operational steps of the *chaîne opératoire*, while others might have reached the site as single pieces only. Sometimes, intermediate operational steps and/or phases of the *chaîne opératoire* might be missing, as well. By following the logic of transformation analysis, it is possible to reconstruct the qualitative presence of artifacts not actually found on-site. In part, it is also possible to reconstruct their numbers and add them to the sample. Beforehand, it is not known whether N-transforms, small excavation areas, or C-transforms led to the observed incompleteness (Weissmüller 1995: 71: *Evakuation*). Only in situ and completely excavated concentrations allow the conclusion that missing artifacts are the result of importing and exporting by humans. In these cases, the transformation analysis allows an insight into segments of human movements within the landscape.

Originally, the classification of transformation sections proposed by Weissmüller (1995:58–71; see also Uthmeier, Chapter 11) was developed for unifacial Mousterian assemblages. We have seen, however, that the *chaîne opératoire* used at Buran-Kaya III Level B1 (and many other assemblages of the Crimean Micoquian) is dedicated to the production and modification of surface-shaped tools, and at the same time makes intensive use of by-products from this primary production sequence. To avoid the invention of new classes for transformation sections that include, for example, the production of a surface-shaped blank, its modification into a bifacial tool, and the use of by-products of this surface retouch for modified pieces, only the presence or absence of surface retouch is indicated by the suffix */surface (Figure 12-15). This classification is only given for the process of surface shaping itself. In other words, as soon as there are indications for the use, modification, or production of a bifacial tool, the conventional classes are extended with */surface. On the other hand, single pieces that are made on flakes from surface retouch are treated conventionally (e.g., Bw or Tw). This is done because the process of production of surface-shaped blanks (decortication, primary flaking, surface retouch) is considered to be initially dedicated to the use of a surface-shaped (often bifacial) tool, rather than to the production and use of its by-products. Figure 12-15 sums up the modifications we added to Weissmüller's classification of transformation sections. Furthermore, it illustrates that the point at which surface shaping can be recognized within the reduction sequence is, to some extent, floating. For flint plaquettes, for example, surface retouch is often established from the beginning. Round pebbles, on the other hand, may be decorticated with a hard hammer technique and identified as simple ad hoc cores if discarded before surface retouch was applied (transformation sections Np or Nb).

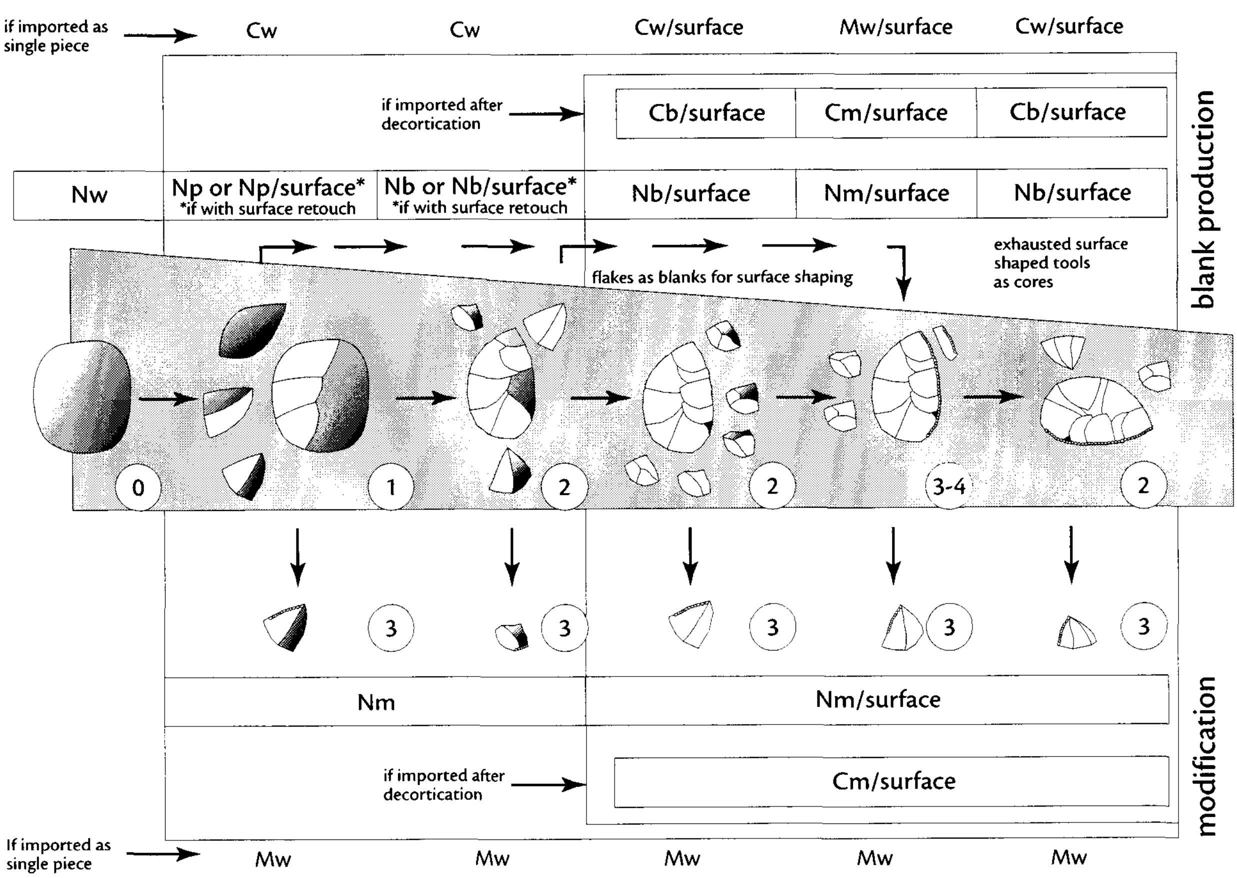


Figure 12-15—Classification of transformation sections for raw material units with surface shaping (defined as the production of blanks with surface retouch), modification of by-products, and/or secondary blank production: *w*–single piece without other artifacts, *p*–preparation only, *b*–blank production, *M/m*–modification, *T*–tool, *N*–RMU was imported as nodule, *C*–RMU was imported as core, *surface*–surface shaping on-site.

Transformation Sections in Buran-Kaya III Level B1: an Overview

The data for the transformation analysis comes from 114 raw material units (Figure 12-16) that are described in detail in a separate catalogue (Kurbjuhn, Chapter 14). Before starting, it is important to stress that the analysis of single pieces and workpieces leads to significant results, no matter if Level B1 is the equivalent of one visit or, as it seems more probable, of several visits. Like refits, workpieces reassemble the original context of sub-assemblages, which all contain contemporaneous artifacts.

Forty-five raw material units are single pieces (Figure 12-16 and Table 12-3: transformation sections Bw to TT). According to the demands of our sorting, each single piece in this sample is unique in its combined macroscopic raw material attributes. By definition, blanks for single pieces were not produced from nodules, preforms, or cores of the analyzed sample. For several reasons discussed above, we are of the opinion that it is permissible to suggest most of these single pieces were not only detached outside the area excavated in 1996, but at some other, yet unknown, sites. These sites may include previous sites near the raw material sources, as well as contemporaneous sites within the local site territory (Higgs and Vita-Finzi 1972:30) of Buran-Kaya III.

Thirty-four (29.8%) single pieces were classified as artifacts discarded without any further on-site flaking.

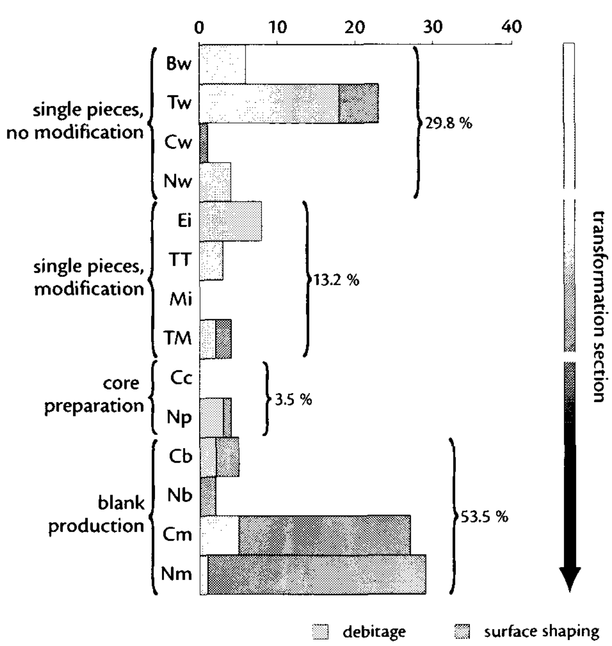


Figure 12-16—Classification of transformation sections for 114 raw material units. Each bar shows the total number of raw material units classified as such (in dark grey: RMU with surface shaping "*/surface").

This group of imported artifacts that were only used, but not resharpened, on-site is dominated by 15 simple tools and 5 surface-shaped bifacial tools (Figure 12-16 and Table 12-3: transformation section Modification without or Tw). Six flakes (Figure 12-16 and Table 12-3: transformation section Blank without or Bw), 4 nodules (Figure 12-16 and Table 12-3: transformation section Nodule without or Nw), and 1 core (Figure 12-16 and Table 12-3: transformation section Core without or Cw), complete the artifacts that were discarded without on-site flaking.

Another 11 single pieces are blanks and tools that were imported, but more intensively used (transformation sections Ei to TM). From 8 simple tools, only isolated tool tips or waste from rejuvenation remained at the site, while the tool itself was exported afterwards (Figure 12-16 and Table 12-3: transformation section isolated End of a tool or Ei). Another 3 simple tools broke during use, but a fragment was taken away (Figure 12-16 and Table 12-3: transformation section Tool with Tip or TT).

In four cases, a blank was modified after import, and both the tool and the waste of the modification were discarded on-site (Figure 12-16 and Table 12-3: transformation section Tool modified or TM).

In sum, raw material units that include artifacts with flaking during use, but without blank production, include 15 (13.2%) items. Altogether, 5 surface-shaped tools (Figure 12-16: Tw), 2 surface-shaped preforms (Figure 12-16: TM), 11 simple tools (Figure 12-16: Ei, TT), 1 core or preform (Figure 12-16: Cw), 8 blanks (Figure 12-16: Bw, TM), and 4 nodules (Figure 12-16: Nw) were imported and discarded without any or only minor flaking. The remaining 65 (57%) raw material units were dedicated to the production of blanks (transformation sections Cc to Nm). While 33 started with a nodule, 32 began with imported cores or surface-shaped preforms. The reduction not only started, but also ended at different stages of the *chaîne opératoire*.

Following the analysis of the *chaîne opératoire*, there were mainly surface-shaped tools that resulted from the flaking of either raw nodules or already decorticated and/or prepared preforms. The classification of the latter depends on the absence (then: cores) or presence of traces of surface retouch (then: surface-shaped preforms—transformation sections with the extension */surface). The production sequence of 4 raw nodules (3.5%) stopped after initial preparation (Figure 12-16: Np). In 61 (53.5%) raw material units, the lithic reduction went further. In 7 cases, however, no formal tools occurred and only blanks remained at the site (Figure 12-16: transformation sections Core with blanks or Cb, Nodule with blanks or Nb). Because no cores or surface-shaped preforms were found in these workpieces

(Table 12-3: RMU 23, RMU 66, RMU 26, RMU 58, RMU 32, RMU 38, RMU 57), there must have been export of the latter artifact categories. For 27 out of 54 raw material units with blank production and modification, flaking started with cortical flakes, indicating that raw nodules were brought to the site (Figure 12-16: Nodule with modified blanks or Nm). In 27 raw material units, the reduction sequences began with cores or surface-shaped preforms (Figure 12-16: Core with modified blanks or Cm). As far as formal tools are concerned, 48 raw material units saw the production and modification of a surface-shaped blank and/or the modification of by-products (Table 12-3: Cm/surface or Nm/surface), whereas the number of raw material units with only unifacial tools accounts for 6 items (Table 12-3: Cm or Nm).

The assumption that surface shaping dominated the blank production of Level B1 is strongly supported by the occurrence of flakes from surface retouch in most of the transformation sections (Figure 12-17). They were predominantly recognized in raw material units where blank production was observed either from partly or completely decorticated nodules (Figure 12-17: Cb, Cm) or from raw nodules (Figure 12-17: Nb, Nm). Flakes from surface retouch, however, are also found in raw material units classified as single pieces. If it is true that they were imported, then surface-shaped tools were also produced at previous and/or contemporaneous sites, and by-products were imported from these sites as simple tools (Figure 12-17: Tw) or blanks (Figure 12-17: Bw). Because some single pieces were found at the border of the concentration of the 1996 excavations (Figure 12-19), it is also possible that some of these pieces were detached on-site, but not in the excavated area.

Figure 12-18 shows the overall percentage and number of cortical blanks, blanks partially covered by dorsal cortex, and blanks without dorsal cortex for each transformation section, separated by debitage from cores and surface shaping. Cortical blanks and blanks with cortex are numerous. This is true for single pieces (Figure 12-18: Bw to Ei) and for sections indicating on-site blank production. Apart from those that are recognized as starting from raw nodules by the presence of cortical flakes (Figure 12-18: Np, Np/surface, Nm, Nm/surface), there are transformation sections with blank production from pieces imported as cores (Figure 12-18: Cb, Cm) and bifacial preforms (Figure 12-18: Cb/surface, Cm/surface) that include between 30% to 60% of partially cortical blanks. High percentages of blanks with partial cortex in transformation sections with surface shaping are explained by the main focus of the production process being the surface-shaped, often bifacial, tool. In this case, the reduction was stopped when the outline and cross-section reached the desired form. If, as in Buran-Kaya

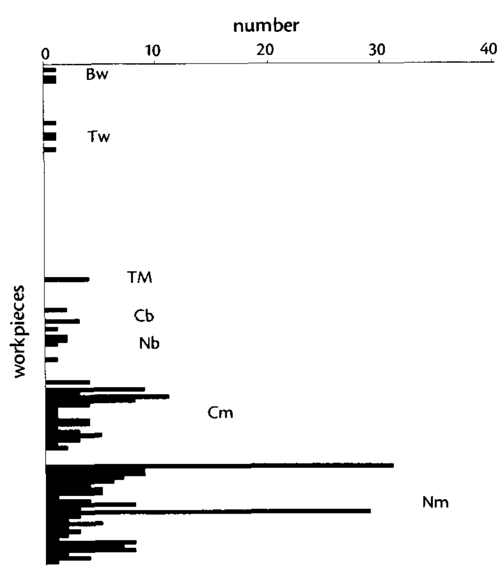


Figure 12-17—Frequency of flakes from surface retouch in 114 raw material units. Each bar indicates the number of flakes from surface retouch in a raw material unit. Transformation sections are grouped as: *Bw*–single blanks, *Tw*–single tools, *TM*–imported blanks modified on-site, *Cb*–on-site blank production from cores, *Nb*–on-site blank production from nodules, *Cm*–on-site blank production from cores and modification of blanks, *Nm*–on-site blank production from nodules and modification of blanks.

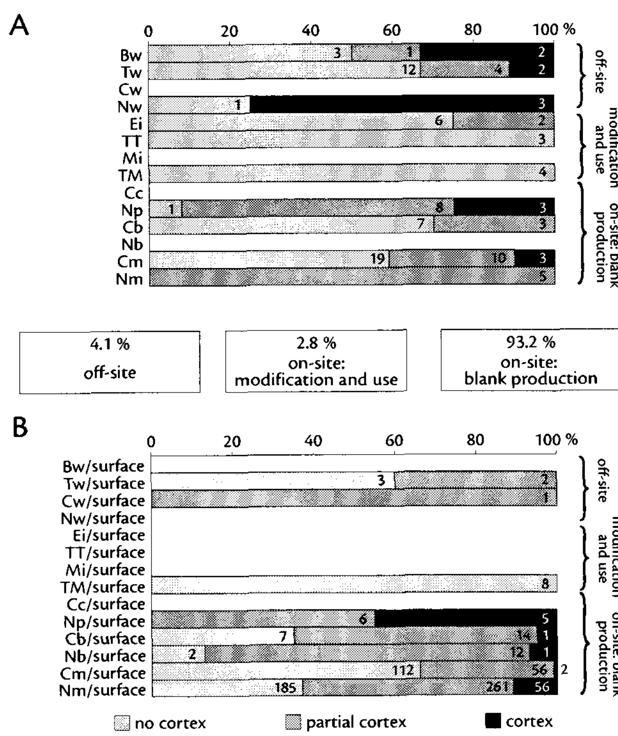
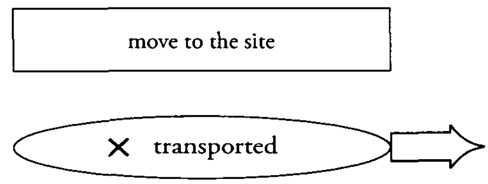


Figure 12-18—Cumulative percentages of different cortex categories in transformation sections without (A) and with (B) surface shaping. Numbers indicate frequencies of artifacts in transformation sections.

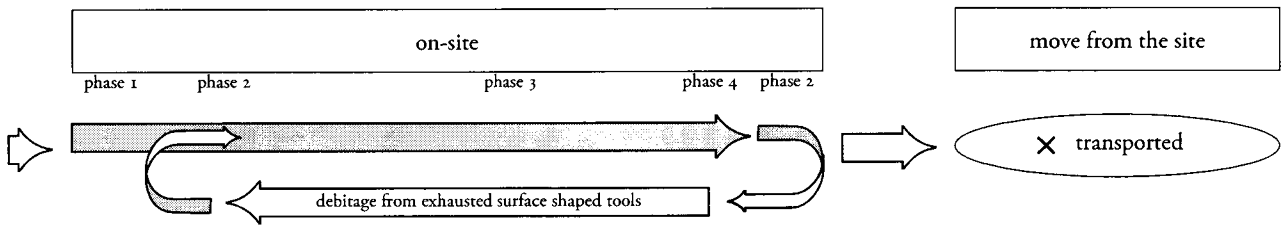
TABLE 12-3
Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section



	Transformation section†	RMU	Number of artifacts	Weight	Import of raw nodule	Import of cores or surface shaped preforms	Import of simple tools	Import of surface shaped tools	Import of blanks
Blank without flaking, discarded	Bw	72	1	8	.	.	.	.	1
	Bw	88	1	5	.	.	.	.	1
	Bw	92	1	3	.	.	.	.	1
	Bw	93	1	2	.	.	.	.	1
	Bw	107	1	2	.	.	.	.	1
	Bw	108	1	5	.	.	.	.	1
Tool without flaking, discarded	Tw	42	1	18	.	.	1	.	.
	Tw	69	1	46	.	.	1	.	.
	Tw	70	1	21	.	.	1	.	.
	Tw	74	1	20	.	.	1	.	.
	Tw	76	1	10	.	.	1	.	.
	Tw	77	1	12	.	.	1	.	.
	Tw	78	1	3	.	.	1	.	.
	Tw	80	1	5	.	.	1	.	.
	Tw	83	1	4	.	.	1	.	.
	Tw	86	1	5	.	.	1	.	.
	Tw	87	1	2	.	.	1	.	.
	Tw	95	1	3	.	.	1	.	.
	Tw	96	1	5	.	.	1	.	.
	Tw	97	1	18	.	.	1	.	.
	Tw	100	1	24	.	.	1	.	.
	Tw	110	1	2	.	.	1	.	.
	Tw	112	1	1	.	.	1	.	.
	Tw	114	1	1	.	.	1	.	.
	Tw/surface	71	1	13	.	.	.	1	.
	Tw/surface	75	1	12	.	.	.	1	.
	Tw/surface	81	1	11	.	.	.	1	.
	Tw/surface	90	1	5	.	.	.	1	.
	Tw/surface	91	1	12	.	.	.	1	.
	Cw/surface	105	1	10	.	1	.	.	.
Imported nodules	Nw	73	1	16	1	.	.	.	.
	Nw	79	1	19	1	.	.	.	.
	Nw	84	1	7	1	.	.	.	.
	Nw	101	1	8	1	.	.	.	.
Isolated edges, resharpened tool exported	Ei	98	1	2	.	.	.	1	.
	Ei	103	1	2	.	.	.	1	.
	Ei	104	1	2	.	.	.	1	.
	Ei	106	1	2	.	.	.	1	.
	Ei	109	1	1	.	.	.	1	.
	Ei	111	1	1	.	.	.	1	.
	Ei	113	1	1	.	.	.	1	.
	Ei	115	1	1	.	.	.	1	.

TABLE 12-3 CONTINUED

Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section



Discard without flaking	*Decortication*	*Simple blanks from debitage (or initial preparation of surface shaped tools)*	*Blanks from façonnage of surface shaped tools*	From these are	*Modification of blanks and/or discard of simple tools*	*Among simple tools: modification of flakes from surface shaping?*	From these or/and from nodules, preforms, chunks	*Modification of surface shaped blanks and/or discard of surface shaped tools*	*Use (tool-tips) or resharpening (resharpening flakes)*	*Among blanks: secondary flaking from exhausted surface shaped tools?*	*Discard of surface shaped preforms or cores after flaking*	*Export of cores (flakes, tools, core trimming elements left on-site)*	*Export of surface shaped preforms (= flakes from surface retouch left on site)*	*Export of surface shaped tools (blanks from façonnage/tool tip/resharpening left on-site)*	*Export of simple tools (resharpening chips, tool-tips, and/or fragment left on-site)*
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TABLE 12-3 CONTINUED

Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section

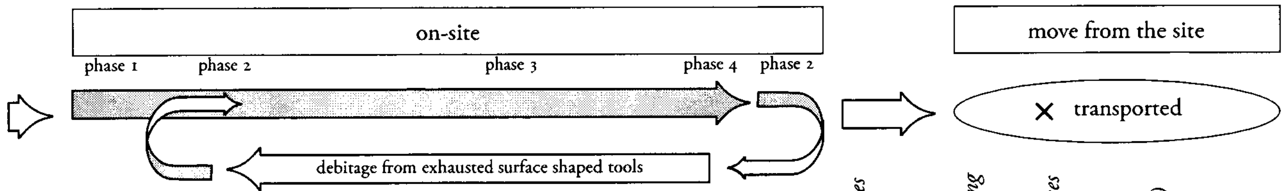
move to the site

× transported

	Transformation section†	*RMU*	*Number of artifacts*	*Weight*	*Import of raw nodule*	*Import of cores or surface shaped preforms*	*Import of simple tools*	*Import of surface shaped tools*	*Import of blanks*
Tool fragment	TT	82	1	4	.	.	.	1	.
	TT	99	1	2	.	.	.	1	.
	TT	102	1	11	.	.	.	1	.
Modification only	TM	7	2	16	.	.	.	1	.
	TM	89	2	10	.	.	1	.	.
	TM/surface	30	2	14	.	.	.	1	.
	TM/surface	65	6	21	.	.	.	1	.
Preparation of nodule	Np	1	7	66	1	.	.	.	.
	Np	62	3	17	1	.	.	.	.
	Np	67	2	21	1	.	.	.	.
	Np/surface	15	11	41	1	.	.	.	.
Blanks from core	Cb	23	4	9	.	.	.	.	1
	Cb	66	6	34	.	1	.	.	.
	Cb/surface	26	3	14	.	1	.	.	.
	Cb/surface	58	4	27	.	1	.	.	.
Blanks from nodule	Nb/surface	32	2	7	1	.	.	.	.
	Nb/surface	38	5	11	1	.	.	.	.
	Nb/surface	57	8	45	1	.	.	.	.
Blanks, some modified, from imported cores or surface shaped preforms	Cm	33	5	30	.	1	.	.	.
	Cm	35	2	15	.	1	.	.	.
	Cm	36	6	38	.	1	.	.	.
	Cm	39	4	16	.	1	.	.	.
	Cm	94	3	29	.	1	.	.	.
	Cm/surface	5	10	32	.	1	.	.	.
	Cm/surface	9	4	88	.	1	.	.	.
	Cm/surface	13	25	112	.	1	.	.	.
	Cm/surface	22	9	30	.	.	.	1	.
	Cm/surface	24	6	28	.	.	.	.	1
	Cm/surface	27	23	92	.	1	.	.	.
	Cm/surface	28	14	53	.	1	.	.	.
	Cm/surface	29	8	30	.	1	.	.	.
	Cm/surface	31	2	11	.	1	.	.	.
	Cm/surface	34	4	13	.	1	.	.	.
	Cm/surface	37	2	7	.	1	.	.	.
	Cm/surface	41	16	58	.	1	.	.	.
	Cm/surface	43	9	35	.	1	.	.	.
	Cm/surface	47	15	86	.	1	.	.	.
	Cm/surface	52	8	39	.	1	.	.	.
	Cm/surface	54	9	21	.	1	.	.	.
	Cm/surface	56	8	26	.	1	.	.	.
	Cm/surface	59	15	57	.	1	.	.	.
	Cm/surface	60	5	12	.	1	.	.	.
	Cm/surface	61	4	17	.	1	.	.	.
	Cm/surface	68	3	31	.	1	.	.	.
	Cm/surface	85	2	10	.	1	.	.	.

TABLE 12-3 CONTINUED

Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section



Discard without flaking	*Decortication*	*Simple blanks from debitage (or initial preparation of surface shaped tools)*	*Blanks from façonnage of surface shaped tools*	From these are	*Modification of blanks and/or discard of simple tools*	*Among simple tools: modification of flakes from surface shaping?*	From these or/and from nodules, preforms, chunks	*Modification of surface shaped blanks and/or discard of surface shaped tools*	*Use (tool-tips) or resharpening (resharpening flakes)*	*Among blanks: secondary flaking from exhausted surface shaped tools?*	*Discard of surface shaped preforms or cores after flaking*	*Export of cores (flakes, tools, core trimming elements left on-site)*	*Export of surface shaped preforms (= flakes from surface retouch left on site)*	*Export of surface shaped tools (blanks from façonnage/tool tip/resharpening left on-site)*	*Export of simple tools (resharpening chips, tool-tips, and/or fragment left on-site)*
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Table 12-3 continued

Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section

move to the site

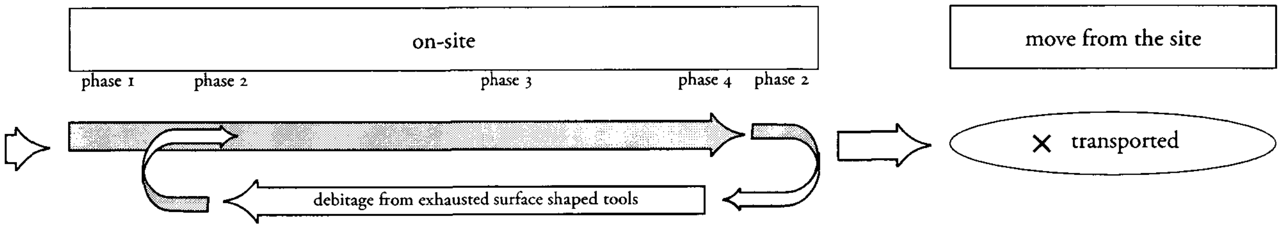
× transported

	Transformation section†	*RMU*	*Number of artifacts*	*Weight*	*Import of raw nodule*	*Import of cores or surface shaped preforms*	*Import of simple tools*	*Import of surface shaped tools*	*Import of blanks*
Blanks, some modified, from imported nodules	Nm	20	5	31	1	.	.	.	.
	Nm/surface	2	39	150	1	.	.	.	.
	Nm/surface	3	26	119	1	.	.	.	.
	Nm/surface	4	34	218	1	.	.	.	.
	Nm/surface	6	28	162	1	.	.	.	.
	Nm/surface	8	23	115	1	.	.	.	.
	Nm/surface	10	21	114	1	.	.	.	.
	Nm/surface	11	19	80	1	.	.	.	.
	Nm/surface	12	22	106	1	.	.	.	.
	Nm/surface	14	7	34	1	.	.	.	.
	Nm/surface	16	19	127	1	.	.	.	.
	Nm/surface	17	6	31	1	.	.	.	.
	Nm/surface	18	19	115	1	.	.	.	.
	Nm/surface	19	19	94	1	.	.	.	.
	Nm/surface	21	20	148	1	.	.	.	.
	Nm/surface	25	46	198	1	.	.	.	.
	Nm/surface	40	26	115	1	.	.	.	.
	Nm/surface	45	15	111	1	.	.	.	.
	Nm/surface	46	20	75	1	.	.	.	.
	Nm/surface	48	19	48	1	.	.	.	.
	Nm/surface	49	4	12	1	.	.	.	.
	Nm/surface	50	13	59	1	.	.	.	.
	Nm/surface	51	11	38	1	.	.	.	.
	Nm/surface	53	9	17	1	.	.	.	.
	Nm/surface	55	9	26	1	.	.	.	.
	Nm/surface	63	14	30	1	.	.	.	.
	Nm/surface	64	15	78	1	.	.	.	.
					Total imported pieces				114
					38	29	19	20	8
					Formal tools discarded on site				

†The following abbreviations for transformations sections are used in the table:
Chapter 11 provides a detailed definition of each.
Bw–Blank without debitage/modification
Tw–Tool without debitage/modification
Cw–Core without debitage/modification
Nw–Nodule without debitage/modification
Ei–Isolated end of a tool
TT–Tool fragments
TM–Tool modified
Np–Nodule prepared
Cb–Core with blanks
Nb–Nodule with blanks
Cm–Core with modified blanks
Nm–Nodule with modified blanks
*/surface–with surface shaping

TABLE 12-3 CONTINUED

Overview of occurrences and frequencies of artifact categories that lead to a classification of the transformation section



Discard without flaking	*Decortication*	*Simple blanks from debitage (or initial preparation of surface shaped tools)*	*Blanks from façonnage of surface shaped tools*	From these are	*Modification of blanks and/or discard of simple tools*	*Among simple tools: modification of flakes from surface shaping?*	From these or/and from nodules, preforms, chunks	*Modification of surface shaped blanks and/or discard of surface shaped tools*	*Use (tool-tips) or resharpening (resharpening flakes)*	*Among blanks: secondary flaking from exhausted surface shaped tools?*	*Discard of surface shaped preforms or cores after flaking*	*Export of cores (flakes, tools, core trimming elements left on-site)*	*Export of surface shaped preforms (= flakes from surface retouch left on site)*	*Export of surface shaped tools (blanks from façonnage/tool tip/resharpening left on-site)*	*Export of simple tools (resharpening chips, tool-tips, and/or fragment left on-site)*
.	3	1	.		.	.		.	1	.	.	1	.	.	.
.	3	3	28		12	×		.	5	.	.	.	.	1	2
.	3	9	9		9	×		1	4	.	.	.	.	.	.
.	1	14	9		7	×		3	7	×	.	.	.	.	.
.	.	12	7		5	.		5	4	.	.	.	.	1	.
.	4	7	6		6	×		2	2	.	2	.	.	.	.
.	.	13	4		4	×		1	3	.	.	.	.	.	.
.	2	11	5		.	.		.	1	×	.	.	.	1	1
.	2	8	5		3	×		2	4	×	1	.	.	.	.
.	1	4	1		1	×		.	1	.	.	.	.	1	.
.	1	12	4		4	×		.	2	.	.	.	.	1	.
.	2	1	1		1	×		.	2	.	.	.	.	1	.
.	.	15	4		1	×		.	.	.	.	.	.	.	.
.	.	6	8		5	×		.	5	×	.	.	.	.	.
.	1	12	3		9	×		3	.	×	1	.	.	.	.
.	8	1	29		8	×		4	2	×	2	.	.	.	.
.	1	13	3		9	×		2	7	.	.	.	.	.	.
.	2	8	2		1	.		2	1	×	.	.	.	.	.
.	1	9	5		2	×		1	4	.	.	.	.	.	.
.	6	8	2		3	×		.	3	.	.	.	.	1	.
.	1	.	3		1	.		.	.	.	.	.	.	1	.
.	2	8	2		3	×		.	1	.	.	.	.	.	.
.	2	6	1		1	×		.	2	.	.	.	.	1	.
.	.	.	8		1	×		.	1	.	.	.	.	1	.
.	1	.	7		1	×		.	1	.	.	.	.	1	.
.	2	3	8		2	.		.	1	×	.	.	.	1	.
.	1	11	2		2	.		.	1	×	.	.	.	1	.
	Total artifacts flaked and discarded on-site (Ei to Nm/surface)										807	Total exported artifacts			57
34	79	334	239		152	32		40	106	14	9	13	5	33	6
23					152			40							

III, flat nodules and plaquettes were the starting point, then high frequencies of partially cortical flakes must be expected. For transformation sections where flakes or scars from surface retouch do not occur and, for typological reasons, a reduction of imported cores must be assumed (Figure 12-18: Cb, Cm), the overall quantities of artifacts is low and tend to be unreliable for a percentage comparison. That among these low quantities of artifacts, many flakes with cortex do appear might be explained by the hypothesis that these cores, in reality, are partly decorticated preforms for surface-shaped tools, discarded after initial primary flaking with a hard hammer technique. If they were true, fully prepared cores, one would expect not only target flakes from some concept or method, but also many more flakes without cortex. Thus, the high percentage of partially cortical blanks in transformation sections that indicate the import of cores or preforms (Cb, Cb/surface, Cm, Cm/surface) implies a more or less direct transport from the raw material source to Buran-Kaya III. If there had been longer stays in between, then one would have to expect fewer blanks with cortex, since they would have been detached, used, and discarded on the way to Buran-Kaya III. Adding the 29 raw material units identified as resulting from the reduction of imported raw nodules, it becomes clear that Neandertals came (several times) directly in one move of approximately 10–15 km from the outcrop or from a neighboring camp to Buran-Kaya III.

In this chapter thus far, the 114 raw material units, their classification, and their cortex frequencies have been discussed. What about the overall artifact frequencies (Figure 12-18)? The overall frequencies of artifacts are calculated for off-site blank production without on-site flaking, off-site blank production without debitage, but with modification on-site, and on-site blank production and modification. Of all discarded artifacts (851), a total of 794 (93.3%) were flaked on-site within 65 raw material units. In most cases, they were workpieces. Only 34 (4.1%) artifacts were brought as single pieces to the site and then immediately discarded. Of all artifacts, 23 (2.8%) came from 12 tools or blanks that were resharpened and/or modified on-site.

Spatial Distribution of Transformation Sections

Raw material units and their classification as transformation sections have mainly been discussed above without reference to their spatial distribution. It was noted that, in many cases, the distribution of artifacts from a raw material unit has a maximum areal extent of less than one square meter, with decreasing artifact densities in the neighboring square meters. This was interpreted as a sign of an in situ preservation of small areas of knapping that were enlarged by human movements on the occupation surface. Were there any areas with an accumulation of transformation sections that indicate special activities? Because transformation sections allow only interpretations in terms of the length of the *chaîne opératoire* conducted on-site, results of mapping of transformation sections are restricted to: (1) areas where single pieces and/or tools, nodules, and cores were abandoned after little (TM, Np, Cc) or no flaking (Bw, Tw, Cw, Nw, Ei, TT), indicating a zone of arrival; (2) areas where a production of blanks started from nodules or cores without reaching phases of surface retouch (Nb, Nm, Cb, Cm); and (3) areas where a more or less complete *chaîne opératoire* took place (Nb/surface, Nm/surface, Cb/surface). Or, conversely, did the proposed multiple visits lead to a homogeneous scatter of artifacts where no zones of activity could be recognized, at all? To answer these questions, the overall spatial distribution of transformation sections in square meters from the 1996 excavation is discussed below. The data set used here treats square meters as units and transformation sections as attributes. For each square meter excavated, the number of occurrences of different transformation sections was counted. In other words, because artifact frequencies are not included, the data are based on the unweighted maximal spatial distribution of each raw material unit, measured at the square meter level and classified as a specific transformation section.

A descriptive comparison of the distribution of 11 transformation sections is difficult and, so, single pieces were mapped together (Figure 12-19). The distributions of long transformation sections with surface shaping that indicate the production and modification of formal tools (Nm/surface, Cm/surface) and transformation sections that correlate with the discard of imported single pieces are widely spread. Both are characterized by high densities in the center of the excavated area. Nodules and cores that were classified as conventional debitage (Cb) or assigned to transformation sections without modification (Cb/surface; Nb/surface) are situated within the borders of this central concentration, but, at the same time, are less widely spread than those with an optimal, full length *chaîne opératoire*. This is explained as an early discard of conventionally flaked cores and nodules, or as resulting from unsuccessful attempts to produce bifacial tools (Cb). Compared to transformation sections with modification, a more restricted distribution of those without formal tools must be expected, because formal tools indicate a longer history and more intensive use than do unretouched blanks. Therefore,

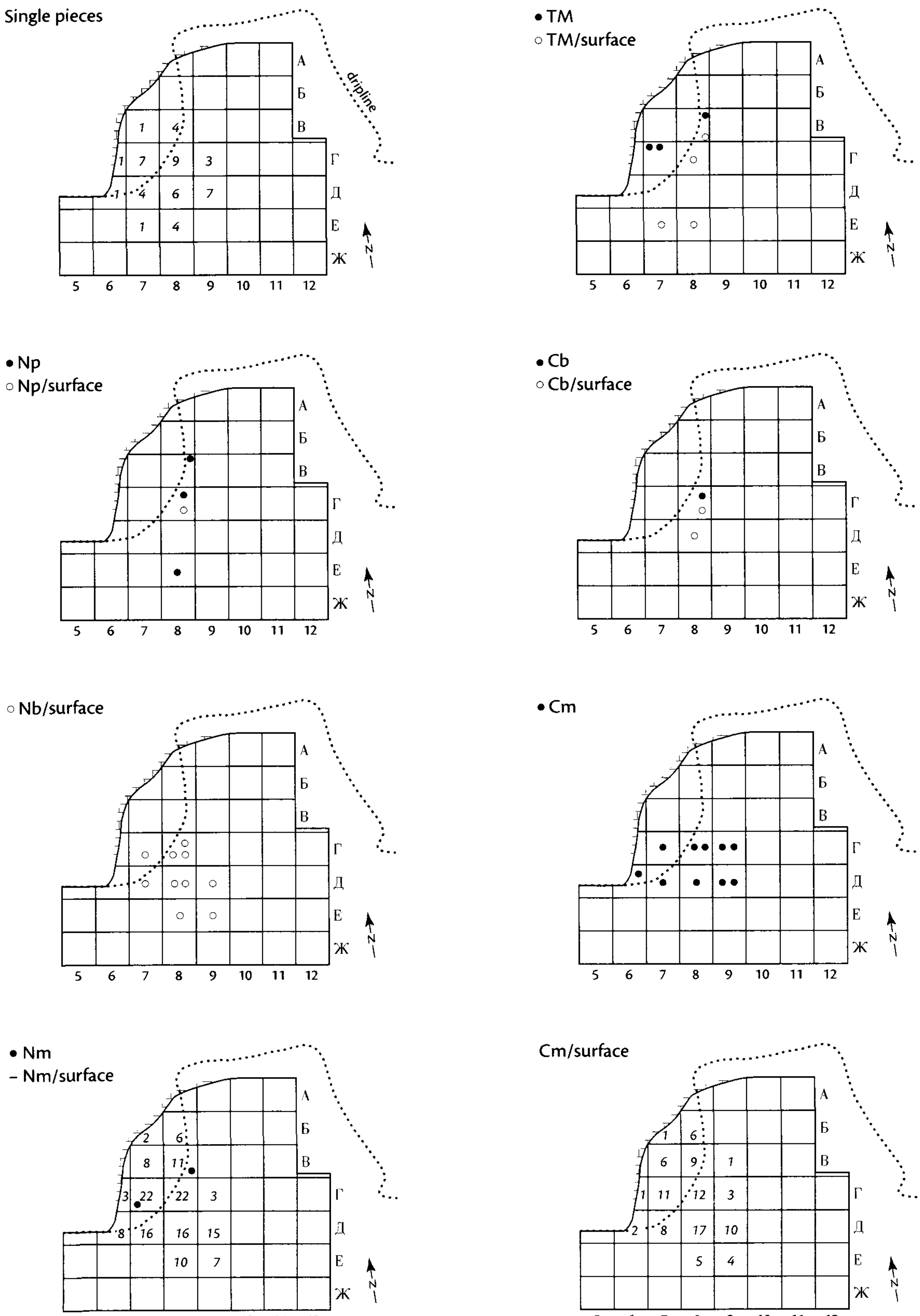


Figure 12-19—Distribution of transformation sections in the square meters excavated in 1996. Square meters are treated as units, the classification of transformation sections as variables. For example, 3 raw material units classified as "Cm" are found in 7 square meters, with different frequencies because the spatial distribution of raw material units sometimes overlaps.

formal tools are more often used at a considerable distance from the place where they were originally detached from the core.

The central concentration described above can be separated from areas at the northern and southern border of the excavated area where nodules were prepared (Np, Np/surface) and blanks were modified (TM). Thus, indeed, there seems to be a zone in the periphery of the center where short transformation sections are exclusively found.

For more secure results, the data discussed above were ordered statistically with a cluster analysis (shared nearest neighbor clustering, WinBasp-software, distance measure: Euclidean distance). Within the dendrogram (Figure 12-20), three clusters can be distinguished on the level of four neighbors considered. Because on this level no units are sorted into residue, it is chosen as the most appropriate ordering. The interpretation of the clusters follows the cluster statistics given in Table 12-4. It turns out that cluster 3 includes all transformation sections documented in the sample. That means that raw material units with both short and long life histories were discarded in square meters that belong to this cluster. At the same time, the entire *chaîne opératoire* was conducted here. The greatest emphasis lies on surface shaping. Clusters 1 and 2, however, are characterized by a decline in transformation sections. Still, the dominance of surface shaping is recorded throughout the clusters. The mapping of the results obtained from clustering (Figure 12-21: A) shows a coherent cluster, cluster 3, in the center of the excavated area. Its spatial distribution occupies an area that was recognized as a zone of maximum artifact densities (Figure 12-9). The other two clusters, clusters 1 and 2, are distributed in accordance to their similarity with cluster 3: cluster 2, in direct contact to cluster 3, and cluster 1 in its wider distribution.

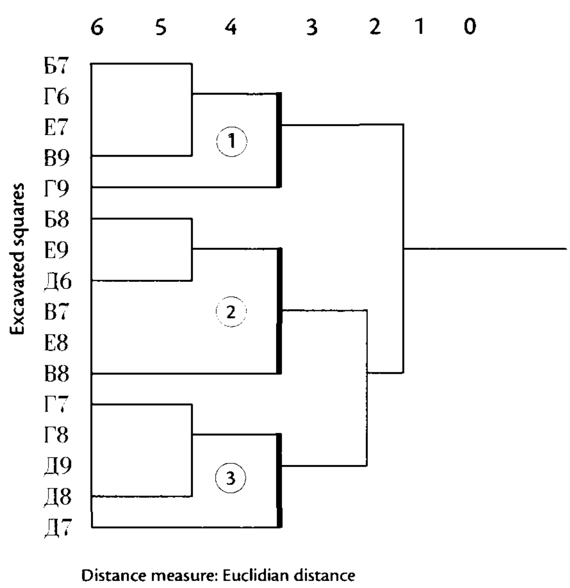


Figure 12-20—Results of a nearest neighbor clustering of transformation sections in square meters (1996 excavation) in a dendrogram. On the level of 4 nearest neighbors, 3 clusters can be distinguished.

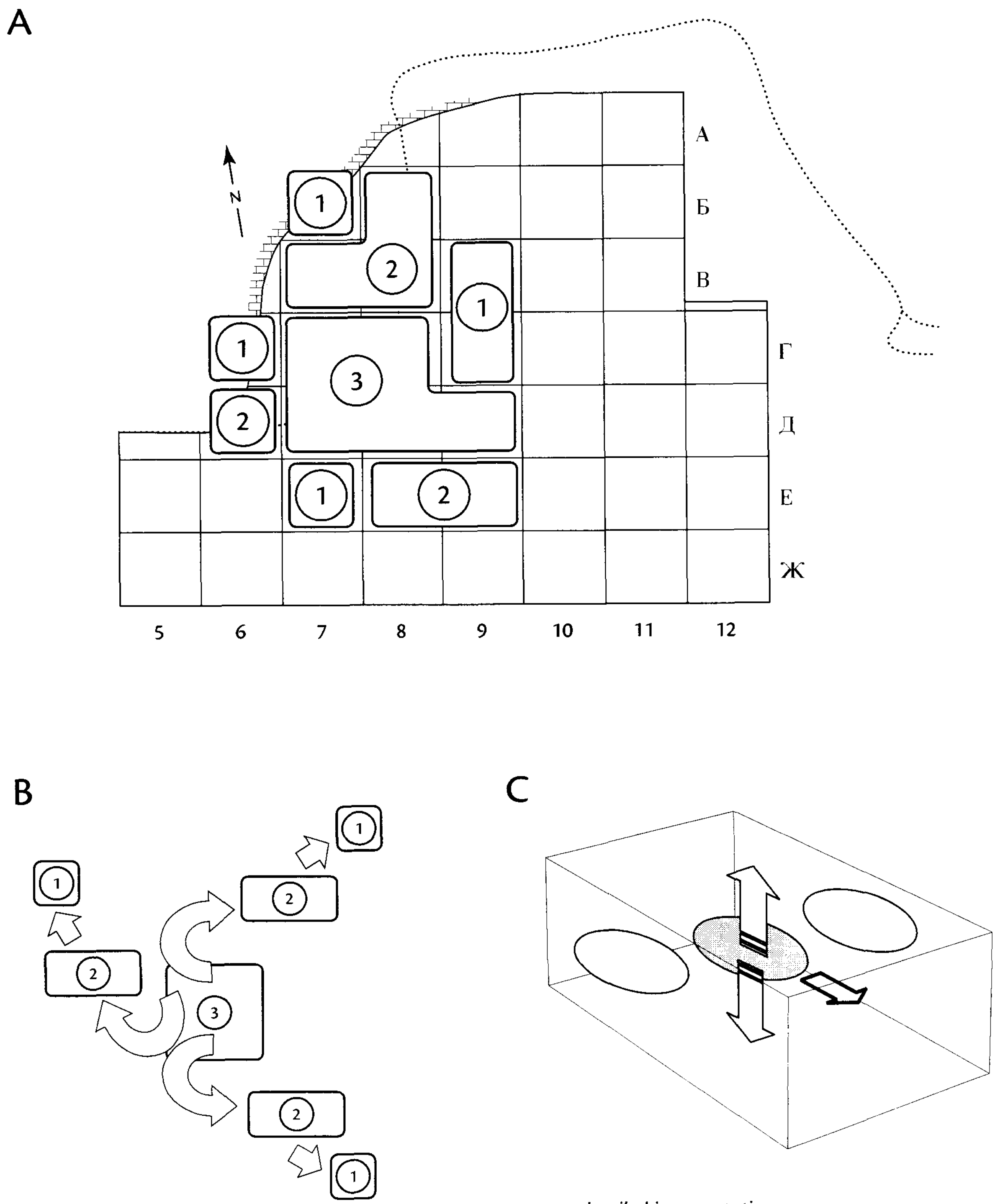
The spatial distribution of the clusters is explained by simple artifact densities: where more artifacts were found, the more transformation sections occurred. With decreasing artifact densities, the number of transformation sections decreases as well. Taking into consideration, however, that the mapping of workpieces showed in situ knapping areas of single nodules often laying side by side or over each other, the clusters also mirror Neandertal's movements on the surface. In a kind of center and periphery mode (Figure 12-21: B), some artifacts were moved from the center of the concentration, where the main area of activity was, to the borders. It seems as if clusters 1 and 2 describe a kind of centrifugal movement, possibly caused by people leaving and entering the central activity zone. It must be noted that the ordering of the cluster analysis mainly reflects non-proportionately high artifact densities in the central zone of activity. Details such as small zones of arrival, containing waste of initial flaking (Np, Np/surface, Cb, Cb/surface) and recognized in the individual mappings of transformation sections, are not measured because the transformation sections involved do not have enough individual pieces to survive in the overall cluster analysis.

Both the mapping of artifact densities (Figure 12-9) and the analysis of the spatial distribution of transformation sections (as zones of activity: Figures 12-19 and 12-21) came to the same results: Buran-Kaya III Level B1 consists of a single concentration. From a general perspective, low artifact densities at the border of the concentration correlate with low numbers of trans-

Table 12-4

Statistical results of a nearest neighbor clustering of transformation sections in square meters (1996 excavation). Compared to cluster 3, clusters 1 and 2 show declining occurrences of transformation sections.

type	*Residue*	*Cluster 1*	*Cluster 2*	*Cluster 3*
TM	–		1	2
Np	–		2	1
Np/surface	–			1
Cb	–			1
Cb/surface	–			2
Cm	–	2	1	7
Cm/surface	–	6	32	58
Nm	–		1	1
Nm/surface	–	8	50	91
TM/surface	–	1	2	1
single	–	9	10	33



overall interpretation:
centrifugal movements from center
to periphery of a single concentration

detailed interpretation:
artifacts were vertically moved by N-transforms
and horizontally moved by C-transforms

Figure 12-21—Spatial distribution of the results from the nearest neighbor clustering (A) shown in Figure 12-20, an overall interpretation (B) as movements into and out of a central zone of activity, and an interpretation of the movements of artifacts of a single raw material unit (C) resulting from N-transforms (vertical movements) and C-transforms (horizontal movements).

formation sections. The fact that there are qualitative differences, however, suggests intentional transport of tools (cluster 2: TM, Nm) and the unintended transport of blanks (long transformation sections in clusters 1 and 2) from center to the periphery. Because most of the workpieces individually mapped by Kurbjuhn (Chapter 14) clearly show zones where the knapping originally took place, an additional model of artifact movement and preservation must be sought. Why is it so difficult to subdivide the main concentration into different activities, while it is possible to isolate micro-activities that derive from the detachment of single workpieces within this concentration? Richter (1995:fig. 40) reconstructed the vertical and horizontal distribution of workpieces in the éboulis-rich sediments of the Micoquian G-layers of Sesselfelsgrotte as the result of artifact movement up and down in the course of N-transforms. The vertical depth where the maximum number of pieces occurred marked the stratigraphic position where the knapping originally took place. Here, in Level B1 (Figure 12-21: C), it seems as if C-transforms, (e.g., movements caused by walking humans), must be added to Richter's model. However, the hypothesis that several repeated visits accumulated in the 20 cm-thick Level B1 cannot be rejected. There must have been some factor or factors, however, that averted a severe mixture of artifacts. Obviously, one was a minimal sedimentation that embedded each visit, separating it from earlier and later visits. Otherwise, it would have been impossible to recognize distinct knapping areas on the maps of the workpieces (Kurbjuhn, Chapter 14). Because artifacts were moved slightly up and down by N-transforms within the limits of Level B1, this was not visible during the excavations. In addition, the visits might have been less intensive than originally thought, and/or areas of activity might have changed from visit to visit within the center of the excavated area (cluster 3).

Results of the Transformation Analysis I: Import

Transformation sections are temporal sequences of the *chaîne opératoire*. (The basic data for the following analysis is shown in Table 12-3.) Each raw material unit represents such a temporal sequence. Some, like single pieces, are short and restricted to use only, while others went through a much longer sequence. All 114 raw material units, however, originally entered the concentration as a single artifact: for those discarded immediately (Bw, Tw, Cw, Nw) or shortly after their import (TT, Np), the original blank is often easy to determine, whereas others were largely reduced or exported and their original blank has to be reconstructed. This is done with the help of discarded flakes and other by-products of their production. If, for example, many cortical flakes and partially cortical flakes are combined with a bifacial tool, then it can be concluded that a raw nodule was imported. If, conversely, only flakes without cortex were found, then a decorticated preform must have been the starting point for the reduction. As long as flakes are present, it is possible to recognize the initial artifact, even if the core, the bifacial preform, or the surface-shaped tool was exported. For single surface-shaped tools that reached the site in reduced shape, however, the blank often remains unknown.

A detailed list of the imported blanks is found in Table 12-3; Figure 12-22 illustrates the data in a diagram. While for some 13 blanks, the shape is undetermined, in part due to the export of the modified pieces after resharpening and in part due to complete bifacial retouch, it was possible to reconstruct the majority of imported blanks. Among those discarded on-site without flaking or after rejuvenation only, simple flakes and flakes of surface retouch dominate with 11 items each. The occurrence of flakes from surface retouch has to be seen in combination with the fact that 4 surface-shaped tools made on flakes, and one bifacial tool made from an unknown blank are also found among the imported artifacts (Table 12-3: Tw/surface). Given the assumptions that (1) the

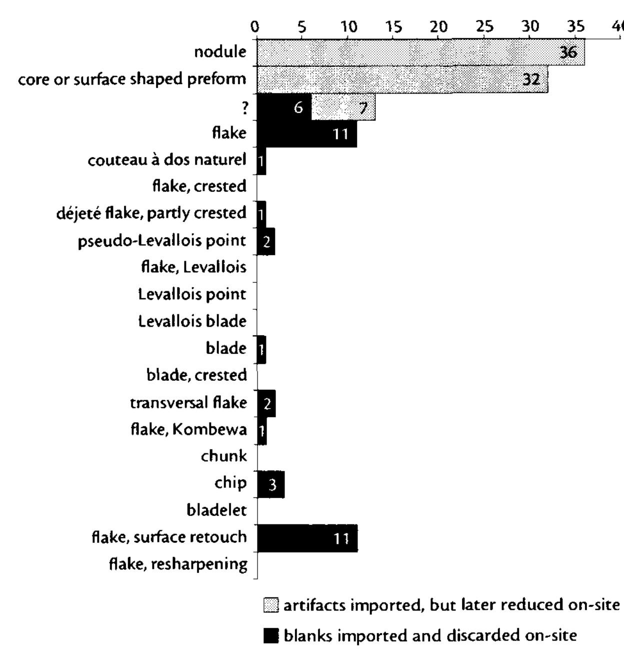


Figure 12-22—Frequencies of imported blanks due to discarded items (black bars) and reconstructed items. Raw material units flaked on-site were mainly imported as nodules, cores, or surface-shaped preforms.

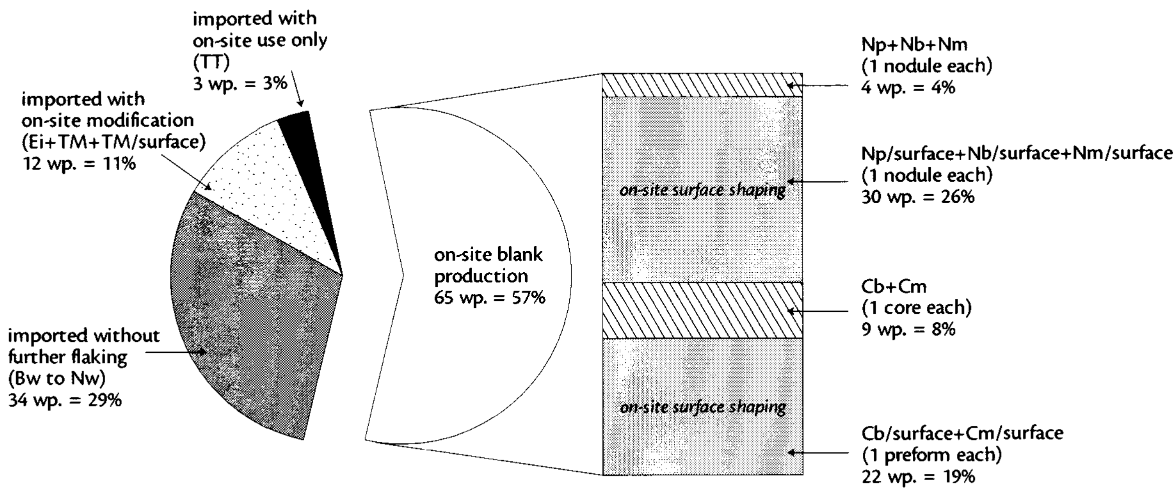


Figure 12-23—Biography of imported blanks. Slightly more than one-half of all raw material units underwent intensive flaking on site (right), mainly for the production of surface-shaped (bifacial) tools or preforms.

provenance of the raw material must be 10 to 15 km to the north and (2) that imported artifacts were generally transported within one move, it is certain that a *chaîne opératoire* similar to the one described for Level B1 existed at places where the imported blanks were produced. The fact that some blanks were detached along prepared (crested) edges does not necessarily suggest the presence of prepared cores. As has been shown for the *chaîne opératoire* of Buran-Kaya III Level B1, the import of 1 partly crested *déjeté* flake, 2 pseudo-Levallois points, and 1 Kombewa flake may also derive from a *chaîne opératoire* dedicated to the production of surface-shaped tools. However, it is interesting that together with 3 transversal flakes, some more voluminous blanks were chosen for a move to Buran-Kaya III.

Thirty-six nodules and 32 cores or bifacial preforms, the latter often with considerable amounts of cortex, came from distant raw material sources and, with the exception of 4 nodules (or raw material pieces) discarded as such, were reduced on-site. For what purpose were artifacts or nodules imported and how successful was their reduction on-site? Slightly fewer than a third (29%) of all 114 imported pieces were discarded without any flaking (Figure 12-23: Bw to Nw). They belong to the tool set that was probably used during moves and at the beginning of the visits to Buran-Kaya III. Twelve blanks or tools (11%) were initially modified or resharpened (Figure 12-23: Ei, TM, TM/surface) and 3 artifacts (3%) broke during usage (Figure 12-23: TT). Therefore, all in all, 15 imported blanks or tools (14%) were modified and/or used after they reached the site. Sixty-five nodules, cores, or bifacial preforms (57%) were flaked on-site (Figure 12-23 stacked bar at right), and most of them ended up in raw material units that were classified as surface shaping processes (Figure 12-23: Np/surface, Nb/surface, Nm/surface, Cb/surface, Cm/surface).

Nevertheless, some of the blanks were already modified when they entered the site. Among single pieces, 18 simple and 5 surface-shaped tools reached the site as already modified formal tools (Table 12-5). Detailed information is available only for simple tools from the transformation analysis data. Apart from 4 points and 4 retouched pieces, the typological classification of 11

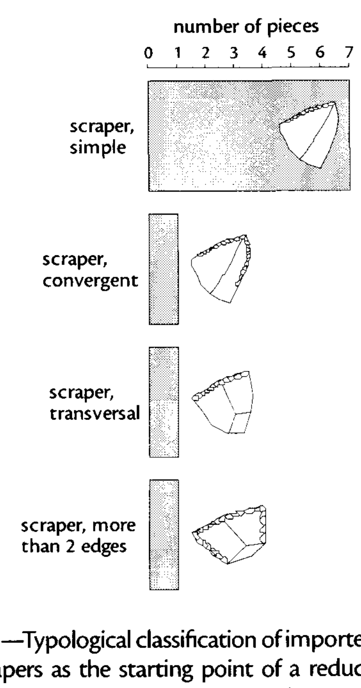


Figure 12-24—Typological classification of imported sidescrapers. Simple scrapers as the starting point of a reduction sequence reconstructed by Demidenko (Chapter 9) are more numerous, perhaps because they bear a reserve of working edges.

sidescrapers is of special interest. In this group (Figure 12-24), simple scrapers dominate (7) over convergent scrapers, transversal scrapers, and scrapers with more than 2 working edges (1 each). What conclusions can be drawn from this in respect to the factors that influenced the choice of tools taken by Neandertals while on the move? Compared with the observation of Demidenko (Chapter 9), who describes a reduction sequence of scrapers that starts with simple scrapers and ends with convergent scrapers, it can be said that, in most cases, the scrapers that were moved belong to an initial phase of this reduction sequence. Obviously, Neandertals calculated a long use-life for these scrapers in advance, because the scrapers they took on their travels have a reserve of working edges. The fact that this is not in accordance to Geneste's conclusions (1985: 521) is explained by the assumption that Buran-Kaya III was reached after direct moves from previous camps. Suggesting a speed of 3–4 km/h, these moves, over a distance of approximately 10 to 15 km each, may have taken between half a day and a day only. During that time, the simple scrapers were not used intensively enough to be transformed into convergent scrapers.

For 8 surface-shaped tools, no typological information is available because only tool tips were left on-site. Three surface-shaped tools are only documented as fragments, and 1 simple tool was exported after rejuvenation. We probably have to add some more pieces of unknown typological classification, however, because they were imported and exported without leaving any traces of their presence at the site. If hafted tools were not exhausted and, therefore, resharpened or re-tooled, then they were exported without any discard when Neandertals moved to future camps.

Results of the Transformation Analysis II: On-Site Production

Because the transformation analysis treats workpieces as refits, it is possible to calculate artifacts that were produced on-site, but not found during the excavations due to N-transforms or C-transforms (Uthmeier, Chapter 11). Cores or preforms are added if a raw material unit contains only by-products of their production. Additional simple flakes (or tools) and surface-shaped tools are calculated for raw material units that include waste of modification or rejuvenation, but lack a tool.

The frequencies calculated for the overall production of blanks in Level B1 (Figure 12-25) shows a dominance of simple flakes and flakes from surface retouch. Apart from the often-stressed assumption that nearly all on-site production sequences were dedicated to surface shaping of preforms or bifacial tools, there are few other striking technological features. The absence of any target flakes from classical concepts like Levallois, discoidal, or Quina has already been mentioned. Some *couteaux à dos naturel* result from primary flaking of raw nodules, and several transverse flakes can be explained by unsuccessful knapping of flat pebbles. Because our conventional classification of Kombewa flakes looked for flakes with double ventral surfaces, thick flakes detached with hard hammer technique from bifaces or preforms, are hidden in the simple flake category.

The advantages of transformation analysis is illustrated by the additional number of 18 cores or bifacial preforms that were produced on-site, but are not found in conventional classifications because they were exported. Together with 21 unknown blanks that left the site as surface-shaped tools and 6 flakes from exported simple tools, the number of blanks that was reconstructed accounts for 45 items. If added to the actual discard per transformation section, the reconstruction of the minimal number of missing artifacts allows a more adequate calculation of the transformation index (as blanks per imported artifact: Figure 12-26). The calculation is based not only on blanks from primary flaking and surface retouch, but also on waste from modification and rejuvenation. Although the index is calculated for each transformation section (without differentiation of conventional debitage and

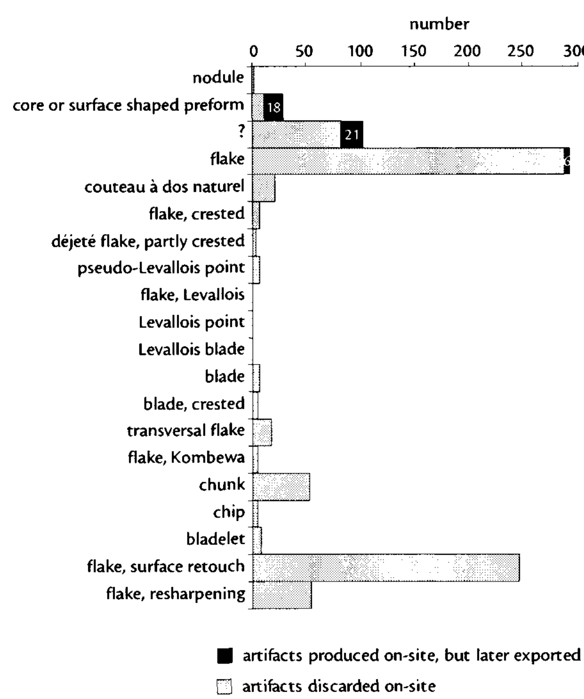


Figure 12-25—Frequencies of blanks produced on-site based on discarded items (black bars) and reconstructed items.

surface shaping), only those with blank production on-site are discussed below (Figure 12-26: Np/all to Nm/all). It is no surprise that the transformation index reaches its highest ratio in raw material units where the complete *chaîne opératoire* started with the import of a raw nodule (Figure 12-26: Nm/all). In these raw material units, on average 19.30 artifacts were detached from every nodule. With ratios between 8.50 and 6.00 artifacts per core or nodule, all others are much lower and, at the same time, quite similar. A lower index for sequences that begin with cores or bifacial preforms (Figure 12-26: Cb/all, Cm/all) is in accordance to our expectations, because those pieces were already decorticated and/or prepared for further reduction. Comparably low ratios for nodules that ended up as prepared nodules (Figure 12-26: Np/all) or cores (Nb/all), however, need further interpretation. To us, this is best explained by the assumption that the risk of an unsuccessful reduction was recognized early, and, therefore, the production process stopped after only a few flakes were struck.

According to our classifications, a total of 189 formal tools and 59 blanks with irregular retouch were produced and discarded on-site (Table 12-5). Among

TABLE 12-5
Calculation of imported, on-site produced, and/or exported formal tools in Buran-Kaya III Level B1

	Discarded on-site	*Exported*
Tools produced off-site, imported, and discarded		
Transformation section: Tw		
Number of RMUs: 18		
simple tools, classified as:	18	
points	4	
scrapers, simple	7	
scrapers, double	1	
scrapers, transversal	1	
scrapers, more than 2 edges	1	
retouched pieces	4	
Transformation section: Tw/surface		
Number of RMUs: 4		
surface-shaped tools	5	
Tools produced off-site, imported, resharpened or used and exported		
Indicators: isolated resharpening flakes or tool-tips, isolated tool fragments		
Transformation section: Ei		
Number of RMUs: 11		
surface-shaped tools		8
Transformation section: TT		
Number of RMUs: 3		
surface-shaped tools		3
Blanks produced off-site, imported, modified and exported or not		
Indicators: isolated chips from modification, discard of tool possible		
Transformation section: TM		
number of RMUs: 4		
simple tools	1	1
surface-shaped tools	2	
Tools produced on-site and discarded		
Transformation section: Cm, Nm, Cm/surface, Nm/surface		
Number of workpieces: 39		
simple tools	151	
surface-shaped tools	38	
Tools unquestionably produced on-site, but exported		
Indicators: flakes from flaking discarded, preform or tool is missing		
Transformation section: TM, TM/surface, Cm, Nm, Cm/surface, Nm/surface		
Number of RMUs: 56		
simple tools		6
surface-shaped blanks (preforms)		5
surface-shaped tools		21
Total (all)	215	54

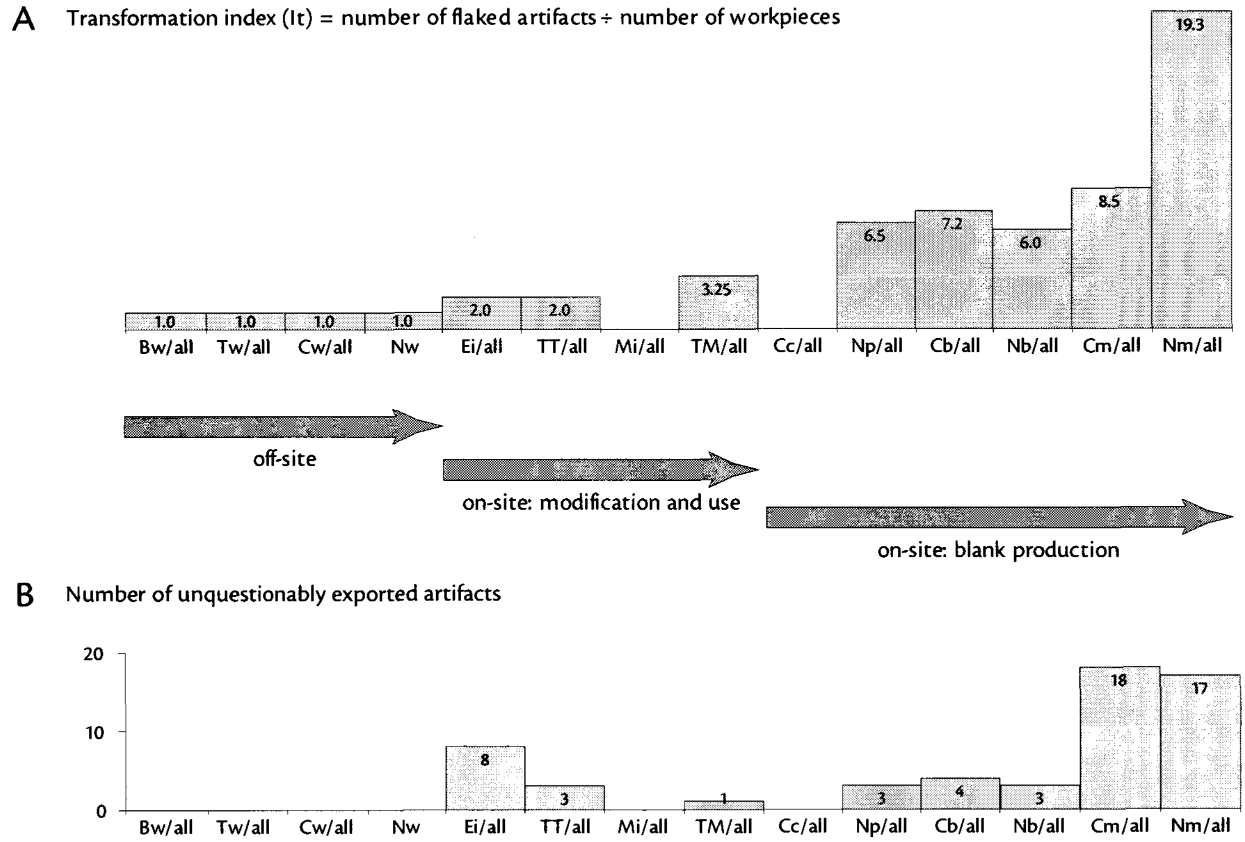


Figure 12-26—Transformation index (as artifacts per workpiece) calculated for each category of transformation sections (A) and an overview of the number of reconstructed artifacts (B).

these, 151 are simple tools dominated by points, simple sidescrapers, and convergent sidescrapers. Thirty-eight others were classified as surface-shaped tools. A detailed description of the typology and metric data of these tools are given by Demidenko in Chapter 9 of this volume.

Results of the Transformation Analysis III: Export

In theory, incomplete raw material units might not only be caused by human transport, but also by N-transforms. Because artifacts are thought to be preserved in situ, and because the analyzed sample is considered to be more or less complete, we interpret missing artifacts here as import and export of cores, preforms or formal tools.

It has already been said that the calculations of artifacts that are supposed to have been exported are biased towards cores, bifacial preforms, and bifacial tools: they are reconstructed due to by-products that were left at the site. A determination of the exported blank or tool is possible only if flakes, waste of rejuvenation, or fragments were left behind. However, these calculations generally tend to be too low, because hafted tools and other artifacts might be carried to and exported from the site without being flaked. Furthermore, without refits it is difficult to estimate if (and how many) additional flakes coming from debitage and/or *façonnage* of cores and nodules have left the site. Therefore, Figure 12-27 shows only minimal calculations for exported blanks. Fifteen of 54 exported artifacts were not produced on-site (Table 12-5). They represent 13 surface-shaped tools of unknown typological classification that were imported, and, after resharpening or intensive use, exported, as well as 2 simple tools with similar histories. Because only tool tips, rejuvenation flakes, or small fragments were discarded, the actual blank cannot be reconstructed. The same problem occurs for 21 artifacts that come from raw material units with on-site production and modification of surface-shaped blanks. Comparable to the previous category, they are represented only by surface flakes of their production and waste of their rejuvenation. The only information is that they were surface-shaped tools, yet of unknown typological classification and blank type. Among 18 cores and preforms, 5 were reconstructed as surface-shaped blanks because flakes from surface retouch occurred in the corresponding raw material units. The remaining 13 items had to be reconstructed as cores, because no flakes from surface retouch were found among the by-products. According to the *chaîne opératoire*, however, these items are better explained as initially prepared preforms for surface shaped tools.

The impression that mainly products of surface shaping were exported (within a cycle of use discard, and retooling and rehafting described by Richter in Chapter 13) is not entirely correct, because simple flakes might also have been taken to future camps without being recognized. It is still interesting, however, on the basis of minimal calculations, that from 34 nodules and 30 cores or bifacial preforms that entered the concentration (Figure 12-28), 21 surface-shaped tools, 5 surface-shaped blanks, and 13 cores or preforms were produced that left the site. Because surface-shaped tools were made from nodules and flakes, another 38 surface-shaped tools that were discarded also came from these. Altogether, these account for a minimum of 73 pieces related to surface shaping that were produced on-site.

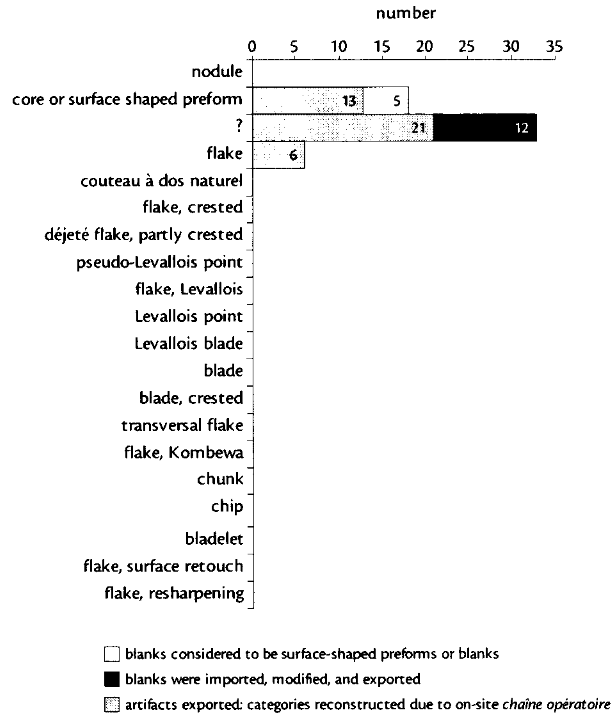


Figure 12-27—Frequencies of exported blanks based on discarded tool tips or waste from rejuvenation (black bars) and reconstructed items.

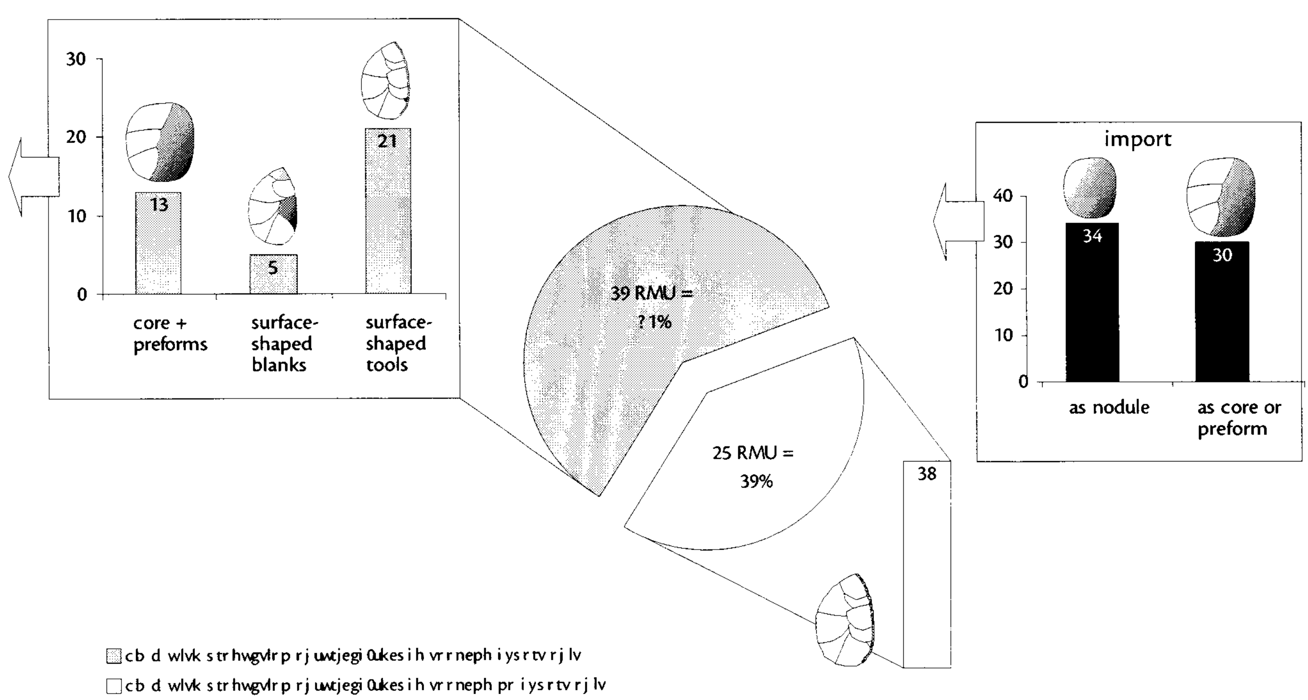


Figure 12-28—Biography of raw material units that entered the site as nodules or preforms in respect to their output of surface-shaped (bifacial) tools, preforms, or cores.

Conclusion: Distant Raw Material, Saiga Hunting, and Planning Depth

The diagrams in Figures 12-29 to 12-31 summarize the results of the transformation analysis of Level B1. Artifacts that were brought to the site of Buran-Kaya III (Figure 12-29) are dominated by raw material nodules (33%). An additional 25% were imported as cores or as bifacial preforms. This indicates primary flaking of raw material directly at the outcrops or at nearby campsites, approximately 10 to 15 km away from Buran-Kaya III. From previous campsites, surface-shaped tools, which account for 18% of all imported artifacts, were carried to Buran-Kaya III. Seventeen percent of all artifacts taken on the move were simple tools that typologically often belong to the category of simple scrapers. Only 7% were unmodified blanks.

Most artifacts that were produced and discarded on-site (Figure 12-30) were simple flakes of different shapes (41%), followed by flakes derived from surface retouch (30%) and waste of rejuvenation (13%). Some cores (1%) and surface-shaped preforms (5%) were also left behind, perhaps due to unsuccessful preparation.

Export (Figure 12-31) is characterized by high frequencies of surface-shaped tools (57%). Many cores or preforms with cortex (23%) represent raw nodules that were not consumed on-site after primary flaking.

There is no doubt that late Neandertals planned their visits to Buran-Kaya III Level B1 in advance (Figure 12-32: 4–7). Because local raw material was not available, a minimum of 4.2 kg of selected flint plaquettes, flat round flint pebbles, and preforms were carried over a distance of 10 to 15 km to the site (Figure 12-1). A distance of 10–15 km is well inside the radius of 20 km suggested for "site territory" by H. Floss (1994: 323). Although it cannot be excluded that the transport of raw material is the result of moves from previous camps to the small rockshelter at the Burulcha that belong to "residential mobility" (Binford 1980), e.g., complete (family-sized?) groups visited the site, it seems more probable that "task groups" repeatedly visited Buran-Kaya III during the time of Level B1. If it is true that mainly adult Neandertals were hunting large game, as P. Pettitt (1998) suggests, then small "task groups" of adult Neandertals came from a base camp most probably situated near the raw material sources at Tsvetochnoye or Russakovka. After some days, dedicated to special activities, they returned. The hypothesis that Neandertals of Level B1 used a "logistical" strategy for resource acquisition (Binford 1980), with "occasional camps" (Higgs and Vita-Finzi 1972: 30) near places of rich food resources, best explains why considerable amounts of raw material were transported in one move to a site where only one species was hunted. Such communities of hunter-gatherers, who live as "logistical collectors" (Binford 1980), are often expected from the Upper Paleolithic onwards, but not for the Middle Paleolithic (Floss 1994:323).

The analysis of the faunal remains showed that *Saiga tatarica* was the most important game hunted at Buran-Kaya III Level B1 (Patou-Mathis, Chapter 8). This species is known to live in large herds that are highly mobile, not only during seasonal migrations, but also during the day. Daily distances of over 100 km have been reported (Reicholf 1996:250). At the

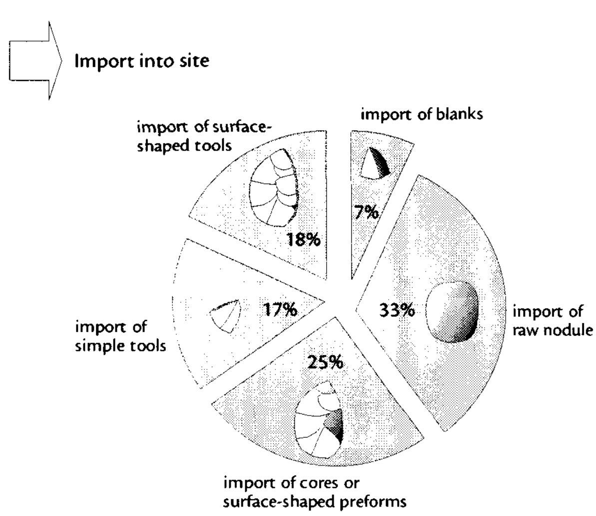


Figure 12-29—Comprehensive illustration of imported artifacts.

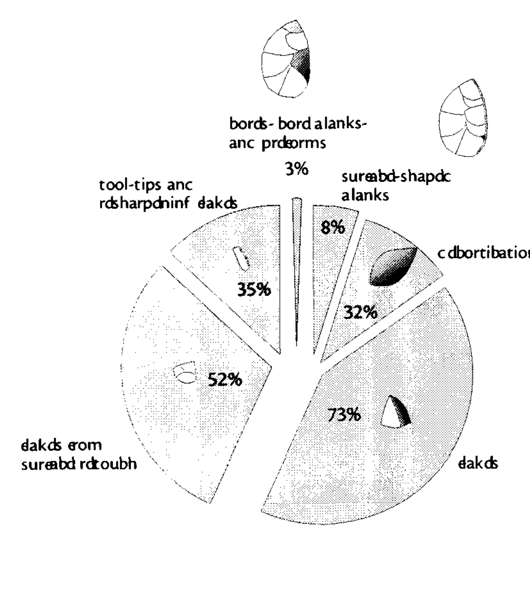


Figure 12-30—Comprehensive illustration of artifacts produced and discarded on-site.

same time, the weight of adult individuals ranges between 32 kg for females and 43 kg for males. The low individual body weight and the high mobility of the herds suggest that the hunting of *Saiga tatarica* migrating between the Crimean Mountains and the northern steppe was promising, but connected with high costs of activities other than hunting. The reconstructed scenario of a specialized hunting camp for a highly mobile species, far away from raw material sources, leads to the hypothesis that it was necessary to minimize the working hours dedicated to the procurement of raw material and the production of artifacts needed for killing and butchering. Thus, the stay at Buran-Kaya III required detailed planning.

The observation that some of the nodules were already decorticated can be interpreted as testing of the nodules to minimize the danger of fissures and cracks that might lead to unsuccessful core reduction. The transported raw material was expensive. Therefore, many by-products of the production of mainly surface-shaped preforms or tools were used as blanks for simple tools (Figure 12-32: *5*), and many formal tools underwent long reduction sequences of resharpening and rejuvenation, leading to many convergent simple tools (Demidenko, Chapter 9) and exhausted bifacial tools (Richter, Chapter 13). In a number of cases, surface-shaped preforms and broken bifacial tools were used as cores for Kombewa-like flakes before being discarded (Figure 12-32: *7*). Hafting and, therefore, re-tooling, was important, as well (Figure 12-32: *2*). The analysis of the operational steps of surface-shaped tools (Richter, Chapter 13) showed that bifacial tools were resharpened while hafted (Figure 12-32: *3*). It is

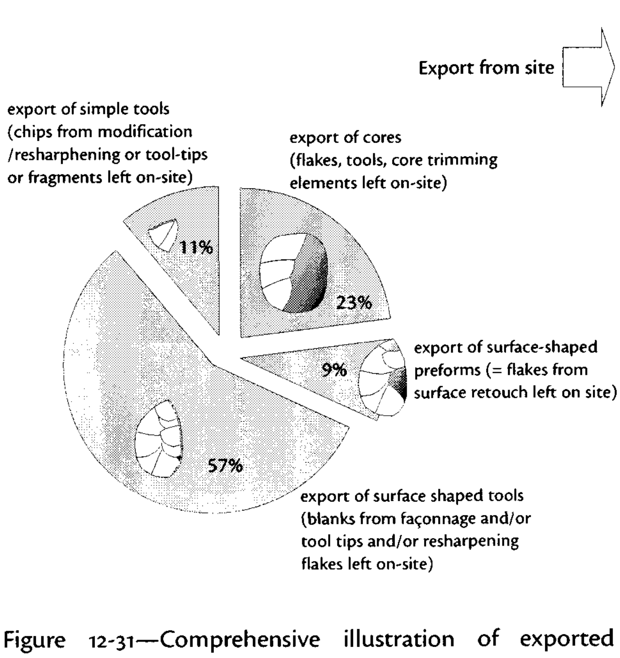


Figure 12-31—Comprehensive illustration of exported artifacts.

most likely that some of the simple formal tools, such as simple scrapers, convergent scrapers, or points, were hafted as well. Re-tooling and re-hafting most probably happened on-site. The intensive export of surface-shaped preforms and surface-shaped tools, however, suggests that this process, as well as other flaking sequences, also happened at hunting stands (Figure 12-32: 5). In addition, it is also possible that some of the tools that were imported, resharpened, and later exported are evidence for movement back and forth from Buran-Kaya III and contemporaneous ephemeral camps (Figure 12-32: *4*, *5*, *8*).

The artifacts of Buran-Kaya III Level B1 indicate that Crimean Neandertals indeed were prepared for anticipated periods. Because they were bringing all raw material to the site and chose methods of stone tool production that avoided the need for new raw material supplies, they minimized the costs of blank and tool production. The fact that raw material procurement was not embedded in other activities, with an intensive going to and coming from local or regional raw material outcrops, but a result of planned moves from one camp to another, carrying both curated tools and calculated amounts of raw nodules, indicates a high degree of planning depth (Roebroeks et al. 1988).

How long were the visits at Buran-Kaya III Level B1? Table 12-6 gives the minimal duration for the pure labor connected with the production and use of stone tools found during the 1996 excavation, calculated in reference to data from archeological experiments (Schütz et al. 1990; Kind 1987; Veil 1990). In total, 247.7 hours of pure labor were spent for blank production, retouch, and rejuvenation (51.05 hours), but mainly for the use of formal tools (196.65 hours). If a working day is calculated as 10 hours with daylight, this accounts for 24.5 working days. However, the time needed for the gathering of wood for fires, water, and other activities necessary to establish a camp is not included. The hunting of a highly mobile species such as *Saiga tatarica* should be more successful if several individuals cooperate. If it is true that Neandertals lived in family sized groups (Gamble 1999:266), then a task group numbering between two to four adult individuals seems most probable. Therefore, it can be assumed that the total amount of pure labor ranges between 12 days (two individuals), 8 days (three individuals) and 6 days (four individuals). Because fireplaces were used, it is unlikely that a visit lasted only several hours. Calculating days, it was probably some three to six visits of several days each, dedicated to the hunting of *Saiga tatarica* in the small valley of the Burulcha River, that led to the assemblage of Buran-Kaya III Level B1.

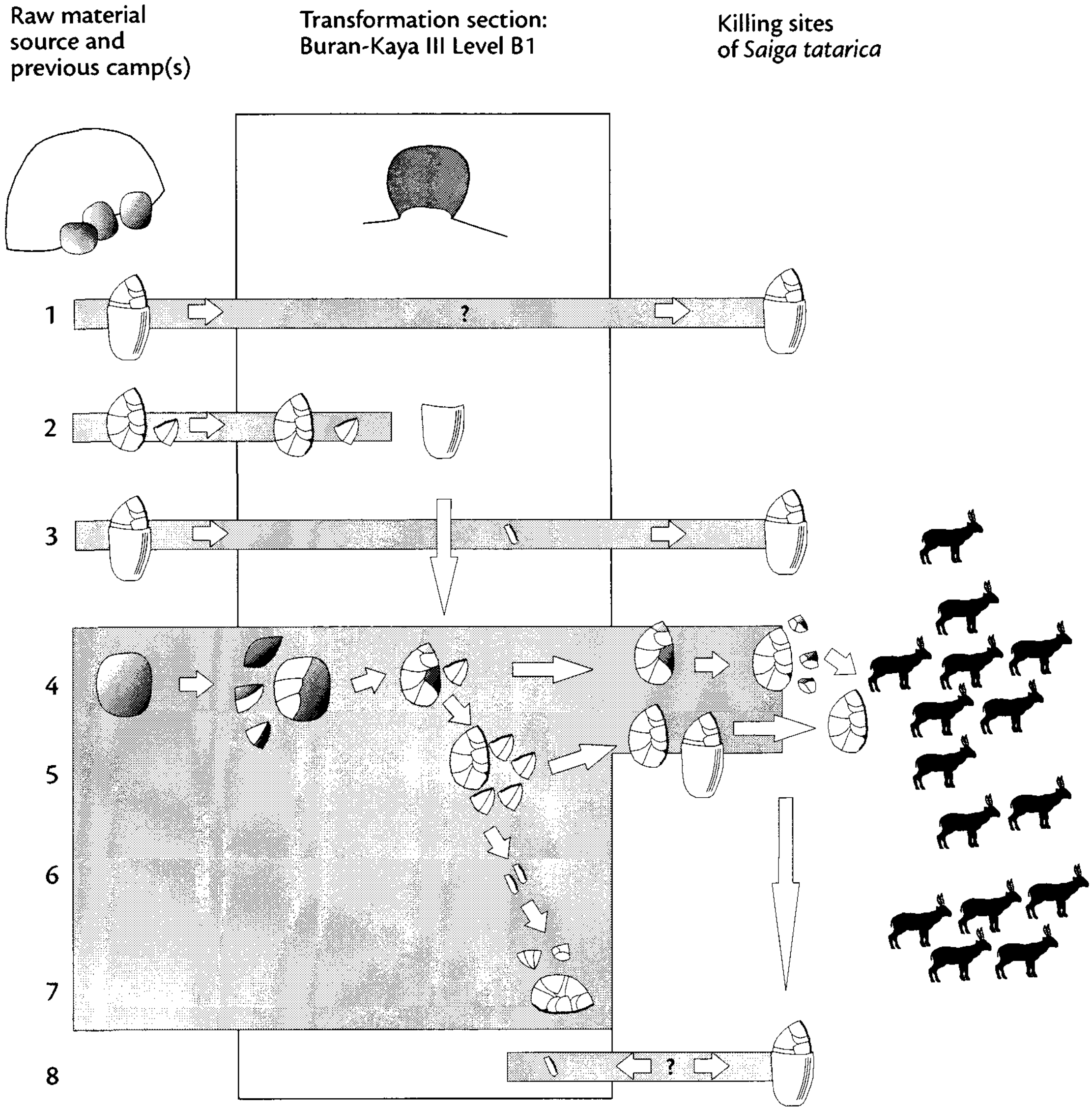


Figure 12-32—Activities in terms of import, on-site flaking and discard, and export. It is assumed that costs for raw material procurement, artifact production, and camp supplies are high during the hunting of extremely mobile *Saiga tatarica* herds. 1–hafted tools carried but not used on the site; 2–tools imported and discarded (after re-tooling?); 3–tools imported and exported after resharpening; 4 to 7–raw material units imported and reduced on-site into cores and preforms (4), surface shaped tools (5), surface shaped tools that are resharpened (6), or exhausted bifacial pieces used as cores (7); 8–tools carried from hunting stand to Buran-Kaya III Level B1.

TABLE 12-6

Calculation of pure time of labor for the production and use of all formal tools found and reconstructed. (Calculation based on experiments in Kind 1987; Schütz et al. 1990; Veil 1990.)

Activity	*Time of production or use estimated for each piece (in minutes)*	*Comment*	*Number of workpieces*	*Comment*	*Estimated time in minutes*	*Estimated time in hours*	*Estimated time in days, 10 hours of labor each*
Production of artifacts							
Reduction/ preparation of core	30		65	overall imported cores and nodules	1,950	32.5	3.2
Modification of a surface blank	9		73	40 surface shaped tools discarded on-site + 33 exported tools + 2 pieces imported, but modified on-site	657	10.95	1
Modification of a simple blank	3		152	152 simple tools discarded on-site + 2 tools imported and modified on-site	456	7.6	0.7
Use of artifacts							
Use of a simple tool, 1 working edge	18	15 min. use of modified tool + 3 min. use of simple blank	81	57 simple scrapers + 8 déjeté scrapers + 7 transversal scrapers + 9 other types	1,458	24.3	2.4
Use of a reduced simple tool, 2 working edges	33	30 min. use of modified piece + 3 min. use of simple blank	62	47 points + 3 double scrapers + 12 convergent scrapers	2,046	34.1	3.4
Use of reduced simple tool, 3 working edges	48	45 min. use of modified piece + 3 min. use of simple blank	4	scrapers with more than 2 edges	192	3.2	0.3
Use of surface shaped tool	180	4 times longer than simple tools, estimated after Richter (Chapter 13)	45	40 surface shaped tools use and discarded + 5 surface shaped tools imported and discarded	8,100	135	13.5
Total					14,859	247.65	24.5

13

Copies of Flakes: Operational Sequences of Foliate Pieces from Buran-Kaya III Level B1

Jürgen Richter

The foliate pieces of the late Middle Paleolithic were the result of complex operational sequences comprising numerous operational steps. Their analysis has proved the diversity of their production modes and the variety of their use as long-term tools. Most surprisingly, Buran-Kaya III Level B1 has foliate pieces that can be interpreted as copies of their unifacial, flake counterparts. Unifacial and foliate pieces were both produced for use as parts of composite tools. Unlike other late Middle Paleolithic foliates, the Level B1 foliate tools occupy the same place within the functional system as their counterparts made on flakes.

Definition of Foliates

Foliate pieces are made from raw material nodules or large flakes that attain their final volume and their final contour line by special overall surface shaping. Surface shaping (*façonnage* in French, *Formüberarbeitung* in German) usually affects most of the surface and is mostly carried out by a soft hammer flaking technique (Boëda 1991).

Surface shaping of foliate pieces can be either bifacial, as in handaxes, or unifacial as in typical *Halbkeil* of the Central European Micoquian. This is why the term *foliate* (*pièce foliacée* in French) is used here instead of *bifacial piece*. The special mode of surface shaping by a large number of subsequent detachments is essential to the present definition, not that it may occur on both sides or just on one side of a piece. Moreover, foliate pieces may have a functional working edge that has marginal retouch. Table 13-1 shows the technically equivalent classes.

TABLE 13-1
Technically equivalent classes of primary production and surface shaping

	Primary flake production	*Foliate surface shaping*
Support realization of shape (blank)	unretouched flake	foliate piece
Formal tool modification of edge (retouch)	scraper	scraper on foliate piece

Principles of Analysis

The present analysis focuses on the operational chains for the production of foliates (Richter 2001). The analysis of operational chains is based on the chronological sequence among the negative surfaces produced by the detachment of preceding flakes, which are seen on the surface of an artifact. The negatives of detachments are the single elements that together form (1) the upper (dorsal) face of a flake, (2) the overall flaking surface of a core, and (3) one or two surface(s) of a foliate piece.

Evaluation of Completeness of Adjacent Negatives

The attributes indicating the chronological sequence of every two succeeding detachments are shown in Figure 13-1. The initial attributes indicate the completeness of a negative. The succeeding overlapping negative reduces the completeness of the previous negative. Thus, completeness decreases from the most recent negative (fully complete) to the oldest negative (minimal completeness of this attribute).

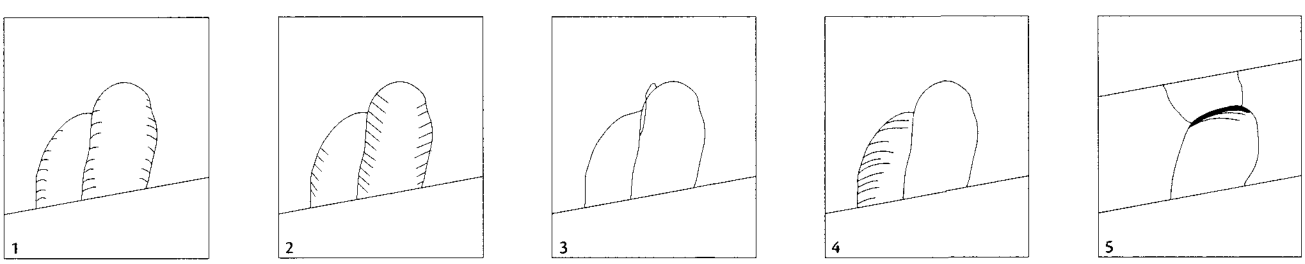
(1) The more recent negative displays more lateral convexity than its predecessor.

(2) The more recent negative displays radial scars at its periphery. These scars are missing from the preceding negative, thereby indicating the more recent negative removed the periphery and the preceding one is not complete.

(3) Small splinters, often lanceolate and scaled, usually accompany the radial scars of the most recent negative. They can also be found on the crest between two negatives.

(4) The contour line of the most recent negative follows the surface relief of the preceding negative.

(5) The distal part of the most recent negative displays a more significant concavity than does the underlying negative. At the microscopic scale, a micro-hinge can be observed where the most recent negative terminates.



the recent negative is more concave than the preceding one | *radial scars of the recent negative are more complete* | *lanceolate scars accompany the crest between two neighboring negatives* | *the waves of the recent negative follow the surface of the preceding one* | *the recent negative ends in a micro-hinge*

Figure 13-1—Time relations among operational steps.

Evaluation of the Completeness of Intersecting Negatives

A negative on the lower face and a negative on the upper face may oppose each other in the same place on the edge. The more recent one will display all attributes connected with the flaking process, such as the negative of the butt and the exploitation edge. The same attributes will be absent from the preceding negative on the other side: because its basal part served as a striking platform for the more recent flake. Thus, intersecting negatives help to establish a chronological sequence between the two different faces of a foliate piece, whereas adjacent negatives display chronological associations on one of the faces.

Definition of an Operational Step

Several negatives of adjacent detachments on the surface of a piece, displaying the same direction of percussion and belonging to the same technological unit (surface shaping, edge retouch, thinning, etc.), are regarded as related parts of the same *operational step*. As a rule, an operational step comprises more than one detachment. The individual detachments of one operational step were produced immediately after one another. As a frequent exception, it is also possible that one single detachment represents a full operational step; for example, an isolated lateral sharpening spall. The chronological sequence among operational steps results from the attributes described above. For the present analysis, the comparison of attributes is only important if the negatives compared come from two different operational steps, whereas attributes of negatives that form part of the same operational step may be ignored. Thus, the definition of the operational steps forming the surface of a piece is essential to the present analysis. Sometimes, the limits between such operational steps are not as clear as needed and definitions can be ambiguous.

Elements of the Analysis of Operational Chains

The operational steps, which are known from a huge number of data collections, can be attributed to six stages of production and modification of foliate pieces:
(0) provision of raw material
(1) initial surface shaping
(2) preparation of striking platforms
(3) final surface shaping
(4) retouch
(5) rejuvenation.

Provision of Raw Material

The forms and volumes to be found among raw material nodules are of principal importance in terms of the technical process. Raw material pieces can appear as bowl-shaped nodules, kidney-shaped nodules, slabs, and irregular pieces. The acquisition process includes the selection of the most convenient shapes and volumes.

Initial Shaping

The selected raw material pieces must be transformed in a specific manner to correct their volumes and shapes for further treatment. Large cortical flakes are initially struck off to reduce various kinds of flint nodules. The products of initial shaping are called *preforms*. In some cases, massive flakes were taken from large raw material pieces and were used directly as preforms for foliates. Breaking the flint slabs into fragments, for example, often opens them up.

Preparation of Striking Platforms

The preform needs further preparation to allow for the final surface shaping into a foliate, and this is usually carried out with a soft hammer. Therefore, special preparation of the edges results in certain essential technical conditions, such as a regular outline, a specific shape of the striking platform (for later soft hammer treatment), and a very precise determination of the angle of percussion. If large flakes are used as preforms, some of the aforementioned criteria are already present and additional preparation may not be necessary.

Surface Shaping

Boëda (1991) has identified two methods of surface shaping (*façonnage*). The first method is called *flat surface shaping* (*façonnage plan*): a crested striking platform is prepared on the edge of a piece and thin flakes are detached via very flat and orthogonal percussion with a soft hammer. The flakes are very often broken and have hinged lips. The basal parts of these flakes have a crested striking platform with dorsal reduction. Their longitudinal section is straight. The second method is called *convex surface shaping* (*façonnage convexe*). Here, a denticulated edge is produced by retouch. The protruding parts in between the small notches of the denticulation are used as striking platforms for subsequent surface shaping by soft hammer percussion. The flakes are convex and display butts *en bec*, dorsal reduction, lanceolate scars on the ventral face, and a convex longitudinal section. The combination of both methods—the flat method of surface shaping and the convex method of surface shaping—is very characteristic for the Central European Micoquian. Thus, most of the edges are plano-convex and, very often, opposed (right and left) edges are reciprocal to each other. Whereas one edge has a convex upper face and a flat lower face, the other one has a flat upper face and a convex lower face. Thus, foliate tools with a plano-convex/plano-convex surface shape are classic to the Central European Micoquian.

Retouch

After the surface shaping of one or both sides of a foliate piece, the additional retouch of one or more edges transforms it into a tool. Very often, the retouch can be found only on the convex parts of the edges of a foliate piece. At Sesselfelsgrotte, a Micoquian site in Bavaria, the retouch covers only limited parts of the edge, mostly not more than 20–30 mm. K. H. Rieder has demonstrated in the Hohle Stein at Schambach (Bavaria) that most of the foliate tools follow the functional principle of "tools with cutting edge," characterized by the following attributes: a flat lower face, pointed shape, cutting edge on the right of the convex upper face, and cutting edge adjacent to the point (Rieder 1992). At Schambach, the average length of the retouched parts of the cutting edge is 21 mm.

Rejuvenation

During their use, the edges of a tool become damaged and/or dull. Renovation of the functional parts of the tool is then required. Reworking of the tool may not only rejuvenate a worn-out edge, but may also be used to give an edge a different functional value. Usually, rejuvenation of an edge is carried out by secondary retouch. If the same edge is exploited again, a secondary final shaping or thinning might be necessary before the edge is retouched again. A particular method of sharpening an edge, quite classic to the Central European Micoquian, is the use of the lateral sharpening spall (Prondnik spall; cf. Bourguignon 1992), which occurs mostly on the upper face, but sometimes also on the lower face of a foliate. The same method may also be applied to the terminal part of a piece, as a terminal sharpening spall (*chanfrein*, or chamfered piece). A single foliate may undergo many stages of rejuvenation, such as secondary retouch, secondary surface shaping, secondary thinning, lateral and terminal sharpening spalls, etc. Whereas traces of final shaping and thinning processes are mostly preserved on the surface of a piece—at least in small remnants—secondary retouch might often be erased by further rejuvenation stages.

Final Methodological Remarks

Sometimes, foliated pieces have protracted life histories—they are used and repeatedly rejuvenated over a long period of time, from production to discard. During this time span, they may undergo several changes in their volume and outline. Formal classification of foliates is therefore a delicate process. The question arises whether a given form is a product of a typological and functional concept or a mere stage of reduction; and a reduction sequence might itself follow a regular, intended concept. The shape of a piece with its specific contour is most exposed to reduction alteration, which primarily affects the edges. At the same time, typological classification is principally based on shape. Consequently, formal classification of foliates depends on the knowledge of possible operational sequences connected with a specific concept of a tool.

E. Boëda and others have deciphered a technological grammar of foliates, which is mainly based on two methods of surface shaping (Boëda 1991): convex surface shaping and flat surface shaping. In Acheulean industries, for example, bi-convex surface shaping prevailed. In the late Middle Palaeolithic, on the other hand, plano-convex surface shaping (one face convex, the other face flat) was much more common. Within the Central European Micoquian, plano-convex/plano-convex surface shaping dominated (see above). Sometimes, the same concept can also be found among Crimean late Middle Paleolithic assemblages. The principal concept in Crimea, however, was the plano-convex concept of surface shaping.

A Database of Operational Chains

Every single operational step is described within a strict terminological framework and a special code indicates the exact place of the operational step on the surface of a foliate. To that end, a formula is needed as to how to orient the artifacts according to general rules. The rules are:

(1) all orientation is based on the longitudinal axis of the piece;

(2) pointed pieces are oriented with their point up;

(3) pieces with convergent edges are oriented with the angle of intersection up;

(4) pieces with a plano-convex section are oriented with their flat face as their lower face;

(5) pieces with a bi-convex section are oriented with their retouched edge to the right;

(6) if a piece has both a bi-convex section and retouched edges at the right and left, orientation is arbitrary.

Each operational step provides a set of data concerning such properties as place, outline, origin, order, state of edges, and logical position within a sequence of steps (micro-chronology).

The Place of an Operational Step

When the piece under analysis is oriented according to the rules specified above, the surface and the edges of a piece are represented by systematic codes (Figure 13-2). Every code represents a specific place on the piece, which is covered by the traces of an operational step. Codes for the upper face of a piece have "O" as a prefix and those for the lower face have "U" as a prefix. The subsequent number represents a part of the edge, beginning with (1) for the point, (2) for the right edge, (3) for the bottom, (4) for the left edge, and (5) for an additional left edge adjoining the point and separated from the (4) edge by an angle. If the place of an operational step is in the centre of a face without contact to one of the edges, (0) (zero) indicates this. If the same place (for example, O2) contains more than one operational step, the other steps are given secondary code numbers corresponding to their position, such as O21, O22, etc. Often, less than five parts of the edges are represented on a piece and bear traces of operational steps. Only those parts that display their own features (operational steps or primary conditions like cortex) are counted. For example, a triangular bifacial foliate has no O5/U5 code. Within an operational step located in a defined place, the five properties described below are analyzed and encoded.

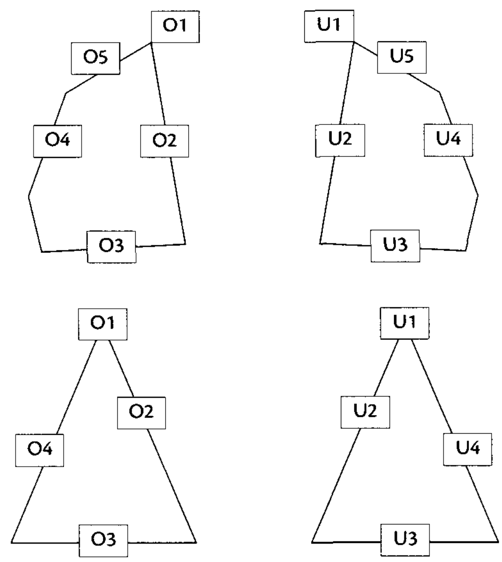


Figure 13-2—The different places of operational steps on a foliate piece (clockwise labels). The different areas on the upper face (O1–O5) and on the lower face (U1–U5) of a bifacial backed knife (*Keilmesser*) (top) and of a triangular foliate (*Dreieckiges Faustkeilblatt*) (bottom).

The Properties of an Operational Step

Contour Line

A code between 1 and 5 indicates the specific form of a contour line:
(1) concave-convex
(2) concave
(3) straight
(4) convex
(5) convex-concave.
The specific order of coding allows for intermediate estimates, such as "3.5" for an edge which is only slightly convex.

Origin

The mode of origin of the part of an edge under analysis is the most important element of the present analysis. The possible modes of origin are listed in Table 13-2.

Order

The attribute "order" describes the regularity observed among the single negatives composing an operational step:
(1) parallel order of adjoining negatives
(2) regular, but not parallel
(3) irregularly adjoining negatives
(4) isolated, disconnected negatives.

State of the Edge

This attribute describes the functional value of the edge:
(1) sharp
(2) still sharp but used
(3) heavily used or not intended for cutting.

Micro-Chronology

As a tool is worked step by step, every single operational step has an exact place within an operational sequence. The relations of adjoining negatives, which can be deduced from certain attributes, define this place within a sequence. As a rule, not all attributes related to the micro-chronology are preserved, since succeeding steps often remove them. Thus, it is most important to document all relations that can be observed on the surface of a piece. To this end, place codes of operational steps are given and their "stratigraphic" relations are indicated by the logical functions > (older than) and < (younger than), such as O21 > O22 and O22 < U2.

All observed stratigraphic relations may be transmitted to a Harris-Matrix program that computes all relations and produces an integrative scheme (WinBASP). It is not yet possible to compare a large number of such Harris diagrams to extract real chronological sequences of the working processes. Presently, Harris diagrams can only deliver those stratigraphic relations that have been observed in actuality. Since some relations have disappeared during the working process, the diagram is always incomplete. This often leads to unclear relations among single steps, which are then indicated as if they were contemporaneous. By contrast, contemporaneity among working steps principally can be excluded because within the real production process of a foliate piece, one operational step always followed another. For the present research, this problem has been solved graphically (Figures 13-3, 13-4, 13-6). The stratigraphic diagrams that are presented below show all operational steps of a foliate piece (indicated as boxes with address labels). The graph displays two different levels of empirical quality. The first level represents the stratigraphic relations between pairs of operational steps that were actually observed on the surface of the piece. This level is indicated by lines connecting the boxes. The second level represents an additional hypothesis of this author concerning the position of some operational steps that still remained ambiguous. This hypothetical level is indicated by the vertical position of the boxes.

Table 13-2
Foliate production: modes of origin of operational steps

Original state	11 cortical surface 12 broken part 13 exploitation edge of core (non-Levallois) 14 exploitation edge of core (Levallois)
Surface shaping	21 flat surface shaping 22 convex surface shaping
Retouch of edges	31 flat retouch 22 semi-steep retouch 23 steep retouch 34 Quina retouch
Preparation	40 preparation of exploitation face for thinning or for sharpening spall
Thinning	51 lateral thinning 52 distal thinning
Sharpening spall	61 lateral sharpening spall 62 terminal sharpening spall
Use wear traces	71 traces of utilisation 72 splintered edge 73 small Clactonian notch 74 irregular denticulation
Fragmentation	81 latitudinal 82 diagonal 83 longitudinal
Thermic alteration	90 crackled

Three Examples from Buran-Kaya III Level B1-2

The late Middle Paleolithic Layer B of Buran-Kaya III is very rich in foliate pieces. During the analysis of the lithic inventory from this layer, it became clear that a specific relation existed between unifacial points and some foliate pieces that had very similar dimensions. The question arose as to whether an analysis of operational chains would be able to yield more detailed information on the obvious similarity observed between those technically distant tool classes. Thus, two examples of foliate points were selected for analysis, as well as one example of a foliate scraper that had some intriguing parallels among unifacial tools.

A Distal Fragment of a Triangular Plano-Convex Foliate Point

The operational sequence for the distal fragment of a triangular plano-convex foliate point from square Д7 (Table 13-3; Figure 13-3) has a unilinear structure; surprisingly, without any hint of secondary reshaping. The principal operational stages follow each other: surface shaping, retouch, utilization, fracture, and discard. As secondary reshaping is absent, the long-life option was not used, as it was in many other Middle Paleolithic assemblages elsewhere with bifacial components. The flat lower face was shaped only once. Like a ventral face on tools made on flakes, the lower face was never reshaped. After finishing the lower face, all intentional alteration of the piece concentrated on the upper face, which underwent convex shaping and convergent retouching. This might have happened only once, as only one stage of convex surface shaping and one stage of retouch are still visible. Obviously, accidental breakage of the tool prevented further reduction and this distal fragment has preserved attributes of initial use only.

Forgoing the long-life option of foliates, increasing convexity of the upper face and steep edges were tolerated instead. Bifacial reduction would have reduced the thickness of the tool and also the general width. This was obviously not desired, and any alteration of the latitudinal section—at least in the proximal part—seems to have been inconvenient. If this is true, it probably can be explained by some form of hafting that did not allow for changes in the dimensions of those parts in contact with the haft.

Use was not bifacial. Only the upper, convex face displays use wear (O22 and O42), except two lamellar spalls (U1) near the distal end of the lower face caused by pressure impact on the tip. On the upper face, the right edge (O21) is more heavily utilized than the left one. If the user was right-handed, the principal cutting

TABLE 13-3
Operational sequence of a distal fragment of a triangular plano-convex foliate point from square Д7

Place	*Origin*	*Contour line*	*Order of operational steps*	*State of the edge*	*Micro-Chronology*
O2	22 convex surface shaping	0 –	2 regular	0 –	O2>O21>O22; O2<O4
O21	32 semi-abrupt retouch	3 straight	2 regular	0 –	O21<O4
O22	71 utilized	3,5 straight-convex	2 regular	1 sharp	O22<O21
O3	81 latitudinal fragmentation	3 straight	4 isolated	3 blunt	O3>O31; O3>U3
O31	72 splintered	0 –	4 isolated	0 –	O31>O4; O31<O2
O4	22 convex surface shaping	0 –	2 regular	0 –	O4>O2; O4>O41>O42
O41	32 semi-abrupt retouch	3 straight	2 regular	0 –	O41<O4
O42	71 utilized	3,5 straight-convex	2 regular	2 still sharp	O42<O41
U01	21 flat surface shaping	0 –	3 irregular	1 sharp	U01>U1; U01>U3
U1	72 splintered	3 straight	1 parallel	1 sharp	U1<O42; U1<O22
U2	11 cortex	3 straight	0 –	1 sharp	U2>U01
U3	72 splintered edge	0 –	4 isolated	3 blunt	U3<O3

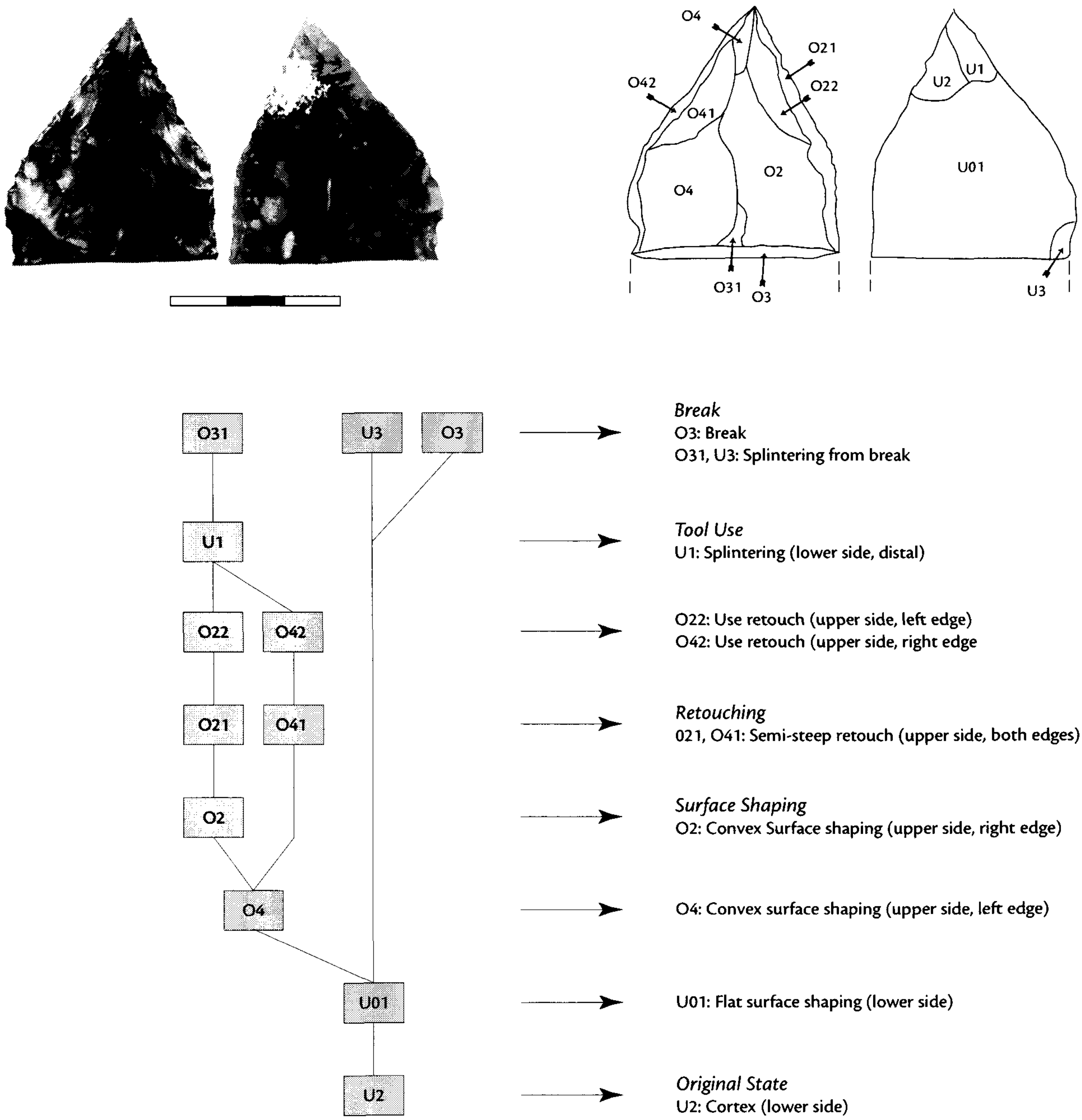


Figure 13-3—Result of the analysis of operational steps for the distal fragment of a triangular plano-convex foliate point. (Level B1, square Д7, no. 3, depth –215.) Raw material from RMU 4 (see Kurbjuhn, Chapter 14).

edge (right edge) of the tool was away from the user's body during use, with the tip pointed to the user's left side. The tool was held in a flat angle on, or nearly parallel to, the object's surface. Thus, sharp scraping was the principal task of this foliate point. The sharp tip of the point was also important. The splintered tip argues for lever-like use of the tool with frequent up-and-down movements, directing powerful pressure to the tip, which eventually caused medial fragmentation (O3). At that very moment, pressure came from the upper, convex side, as shown by reflected splintering (O31) of the adjacent upper surface. Most probably, this pressure was transmitted by the end of a handle or shaft protruding onto the convex face of the piece.

In this piece, surface shaping fulfilled a very particular task: the modification of the tool for hafting. The permissible dimensional tolerance was very low for hafting, and later alteration of those dimensions had to be kept at a minimum. The lower face was totally excluded from any intentional alteration. Traces of use—so often seen on long-life tools with multiple functions—are not ubiquitous. The specific pattern of use argues for a short-life tool with a very specific function, which required sharp, convergent edges and a stabile tip.

A Triangular Plano-Convex Foliate Point

A triangular plano-convex foliate point from square B8 belongs to a series of bifacial tools all having similar contours. Uthmeier (Chapters 11 and 12) has shown that the size and contour of these tools are

Table 13-4
Operational sequence of a triangular plano-convex foliate point from square B8

Place	*Origin*	*Contour line*	*Order of operational steps*	*State of the edge*	*Micro-Chronology*
O2	22 convex surface shaping	0 –	0 –	0 –	O2> O21; O2>O3; O2>O4; O2<O5
O21	31 flat retouch	3 straight	2 regular	2 still sharp	O21>O3
O22	71 utilized	3 straight	2 regular	2 still sharp	O22<O21<O2
O3	52 terminal thinning	2 concave	2 regular	2 still sharp	O3>O4
O4	31 flat retouch	4 convex	2 regular	2 still sharp	O4>O51
O5	82 diagonal fracture	3 straight	1 parallel	3 blunt	O5>O51; O5<U1; O5<U51
O51	51 lateral thinning	2 concave	1 parallel	3 blunt	O51<O4; O51<O2; O51<O21; O51<O5
U1	72 splintered	0 –	3 irregular	3 blunt	U1<O5
U2	21 flat surface shaping	3 straight	4 isolated	1 sharp	U2>U5; U2>U21
U21	21 flat surface shaping	5 convex-concave	3 irregular	2 still sharp	U21>O21
U3	40 striking plat. preparation	1 concave-convex	2 regular	3 blunt	U3<U21; U3<U4
U4	31 flat retouch	4 convex	3 irregular	2 still sharp	U4>U41
U41	71 utilized	4 convex	2 regular	2 still sharp	U41<O4
U5	21 flat surface shaping	0 –	3 irregular	0 –	U5<U2; U5>U4
U51	31 flat retouch	3 straight	3 irregular	3 blunt	U51>O5

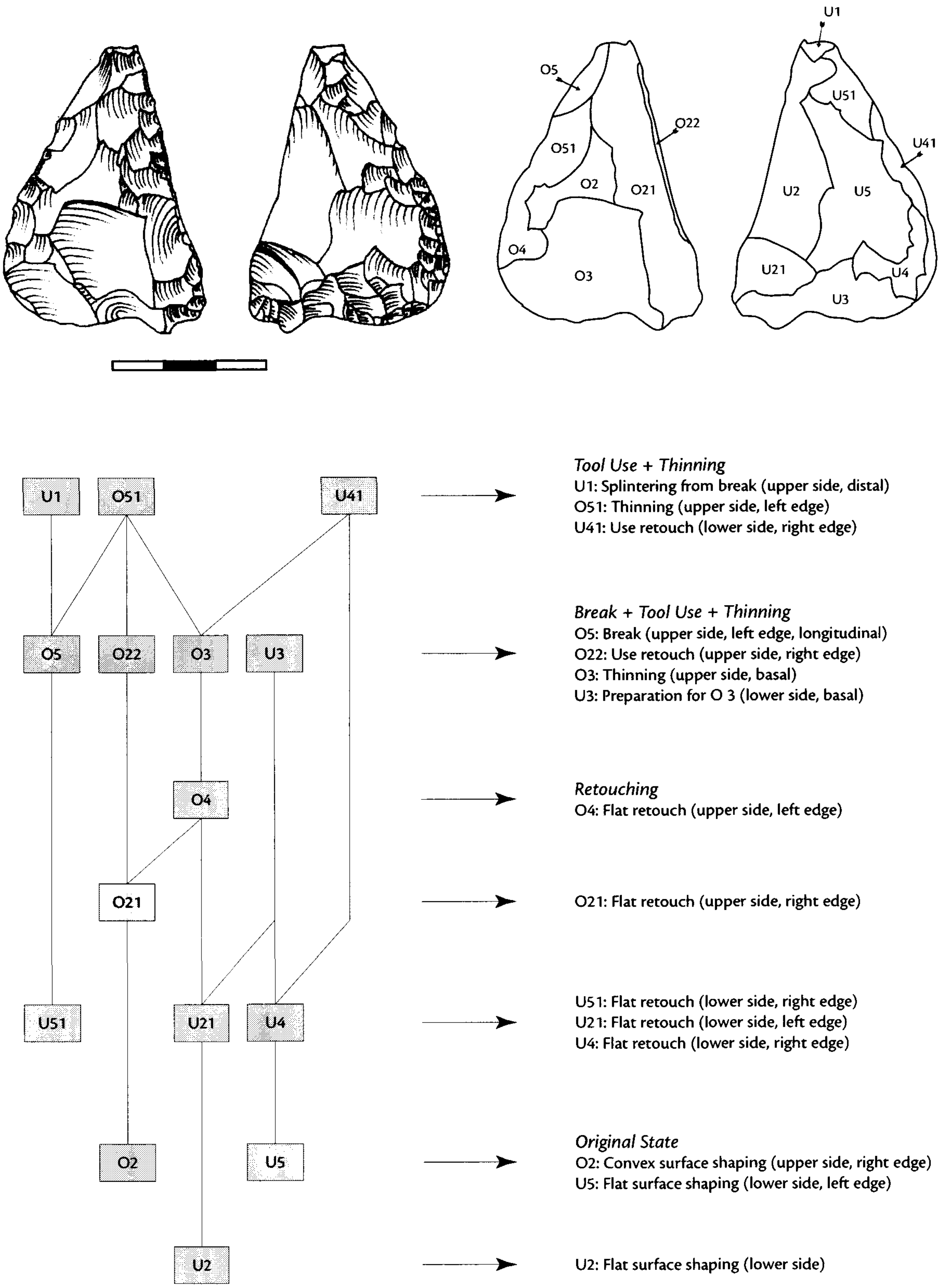
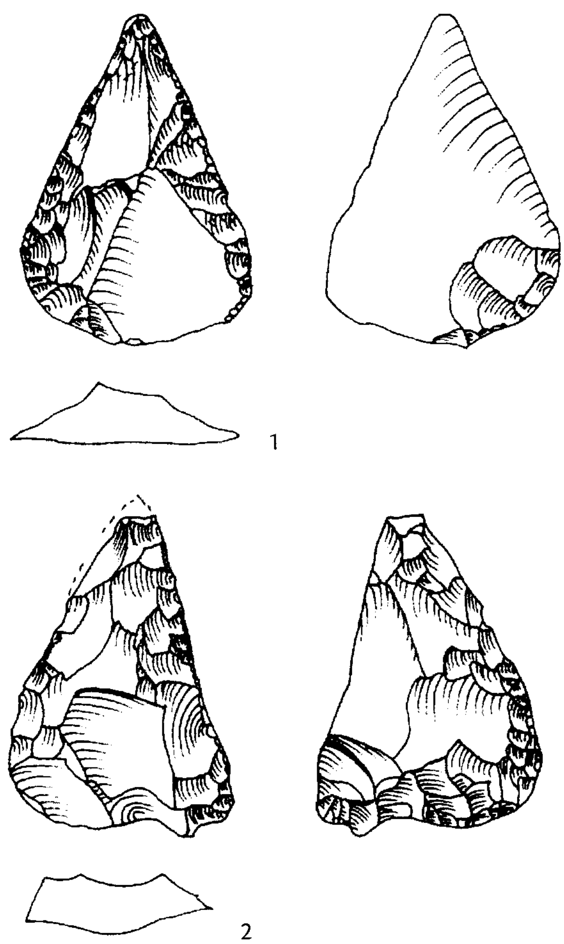


Figure 13-4—Result of the analysis of operational steps for a triangular plano-convex foliate point. (Level B1-2, square B8, no. 12, depth –2.13.) Raw material from RMU 68 (see Kurbjuhn, Chapter 14).



1

2

Figure 13-5—Two realizations of the same functional tool concept: an off-axis point made on a flake (1) and the triangular plano-convex foliate point discussed in the text (2), which is a copy of its flaked counterpart.

standardized and parallel the shape and dimensions of unifacial convergent scrapers or points made on flakes, all of which are abundant in the same Buran-Kaya III assemblage. These bifacial tools are copies of unifacial tools! This particular foliate point (Figure 13-4) may be interpreted as a bifacial copy of a convergent scraper or point made on an off-axis flake. It is identical in shape, size, and contour line to another unifacial piece from the same assemblage (Figure 13-5). The shape standardization probably allowed for hafting within a specific composite system. This must have included an organic haft, which was repeatedly equipped with new stone inserts of an exactly defined dimension. Thus, this bifacial tool may have been produced as an equivalent of the unifacial tools that were not available to the extent needed. Indeed, Level B1 is exclusively characterized by such foliate tools, which have unifacial counterparts within the same assemblage.

The result of the analysis of operational steps matches the "copy-hypothesis." A linear sequence of surface shaping—retouch—use—discard can be observed, and surface shaping occurs only at the beginning, without any repetition of the sequence by rejuvenation. The foliate piece was produced once and, consequently, underwent exactly the same processes as its unifacial counterparts.

The first operational step for this piece was a flat surface shaping of the lower face, followed by convex surface shaping of the upper face (Table 13-4). From U51 onwards, a flat retouch around the edge of the lower face followed, in order to correct its contour. Retouch of the principal working edge (O22) was then done with some additional retouch on the left side. Thinning (U3; O3) made the piece suitable for hafting. It was then ready for use, which produced traces on the upper face, right edge, and on the lower face, opposite edge. The tip broke (O5), and a part of the left contour was corrected by retouching the upper face. At the same time—or later—the present tip incurred an impact and splintered (U1).

A Foliate Scraper

A foliate scraper from square Γ7 (Table 13-5) has some relationships to other foliate pieces from Buran-Kaya III Level B1. First, a resharpening spall has been found in the same raw material unit (RMU 7), which indicates on-site reduction of the piece. Second, the operational sequence (Figure 13-6) resembles that of the triangular plano-convex point described above (cf. Figure 13-4), thus indicating that this point seems to represent an earlier stage of reduction of the same hafted composite tool as this foliate scraper.

The operational sequence of the present piece began with a flat surface shaping of the lower face (U2), followed by convex surface shaping of the upper face (Oo). Then, the thickness of the base was reduced

Table 13-5
Operational sequence of a foliate scraper from square Γ7

Place	*Origin*	*Contour line*	*Order of operational steps*	*State of the edge*	*Micro-Chronology*
Oo	22 convex surface shaping	0 –	0 –	0 –	Remnant of old surface shaping
O1	72 splintered	0 –	4 isolated	2 still sharp	O1>O41
O2	32 semi-abrupt retouch	3 straight	2 regular	2 still sharp	O2>O1; O2>O22; O2>O3
O21	31 flat retouch	4 convex	2 regular	2 still sharp	O21<U3
O22	74 irregular denticulation	3 straight	2 regular	3 blunt	O2>O22
O3	52 terminal thinning	4 convex	3 irregular	3 blunt	O3<O2; O3>O4
O31	40 striking plat. preparation	4 convex	2 regular	3 blunt	O3>O31
O4	22 convex surface shaping	0 –	2 regular	0 –	O4>O41>O1; O3>O4
O41	31 flat retouch	3 straight	2 regular	1 sharp	O41<O4; U41>O41
U1	72 splintered	0 –	4 isolated	2 still sharp	U1<U41; U4>U1
U2	21 flat surface shaping	3 straight	3 irregular	2 still sharp	U4<U2; U2>U3; U2>O22; U2>O2
U3	40 striking plat. preparation	1 concave-convex	2 regular	3 blunt	U3>O3; U3>U4; U3<U2
U31	52 terminal thinning	4 convex	4 isolated	3 blunt	U4<U31; U31>O31
U4	21 plane surface shaping	0 –	2 regular	0 –	U4<U3; U4>U41; U4<O4
U41	31 flat retouch	3 straight	2 regular	2 still sharp	

by thinning on both sides (U3/O3), obviously for later hafting. Now, a second phase of flat and convex surface shaping took place (U4/O4), again followed by some thinning (U31/O31), probably in order to optimize the foliate's dimensions for hafting. Then, the right edge was intensively used as a scraper. The same edge underwent heavy reduction and had to be reshaped several times, which was carried out exclusively on the upper face. Only the last sequence of repeated edge retouch is preserved (O2).

At the same time, the left edge was used, but as a knife. The same edge was retouched on the upper and lower face.

Throughout the whole reduction process (Figure 13-6), the pointed tip was also heavily used and splintered (U1/O1).

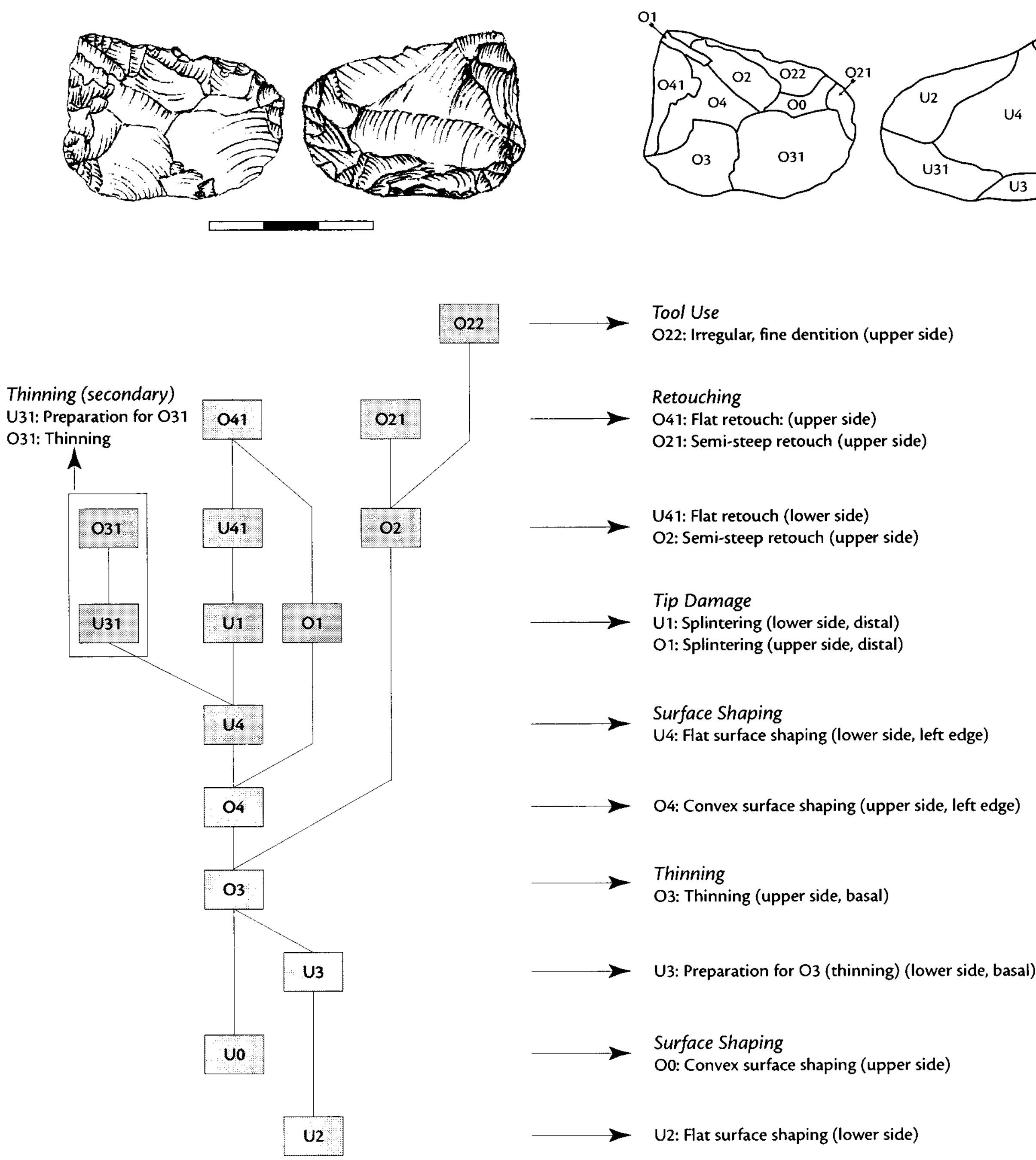


Figure 13-6— Result of the analysis of operational steps for a foliate scraper. (Level B1-2, square Γ7, no. 18, depth −2.17.) Raw material from RMU 7 (see Kurbjuhn, Chapter 14).

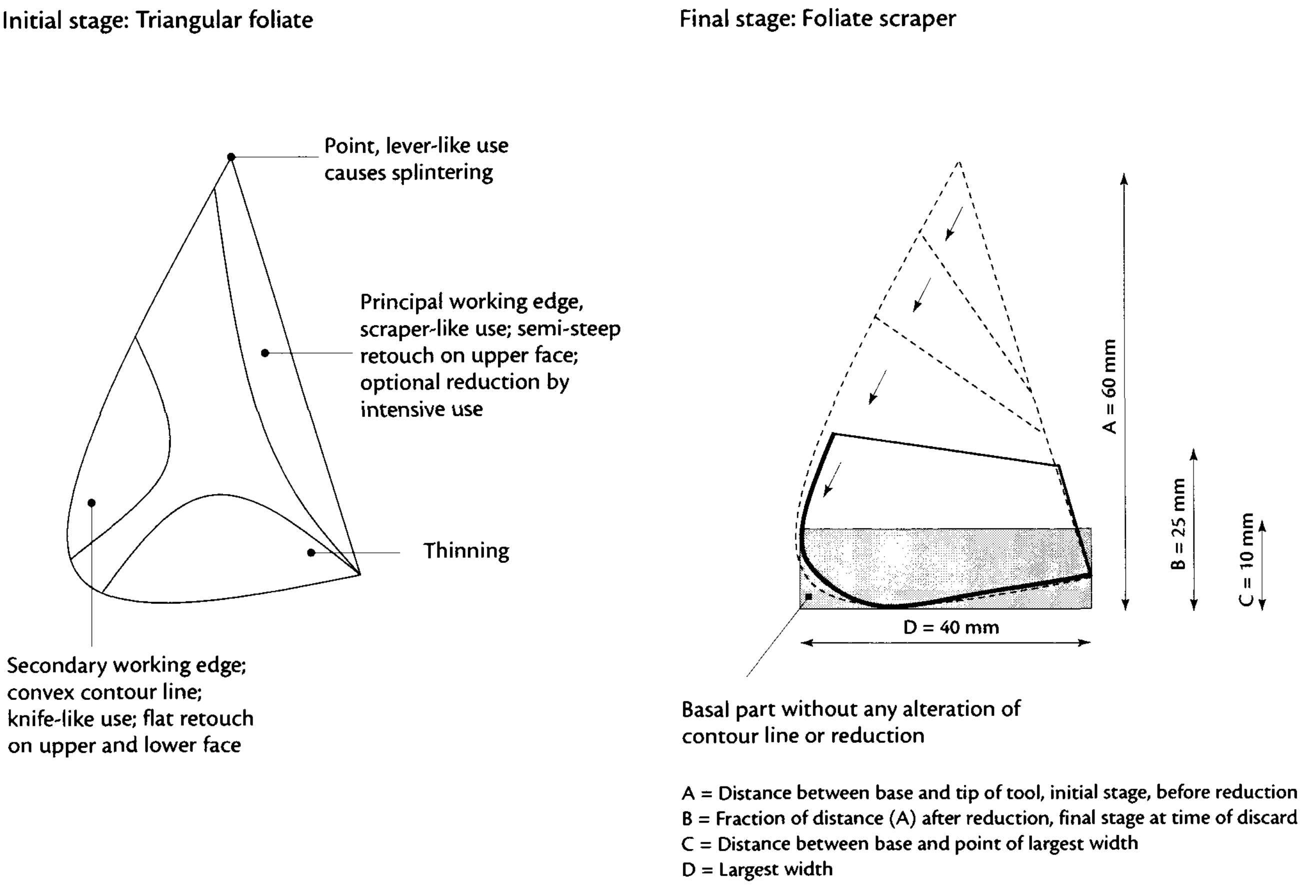


Figure 13-7—Reduction sequence of the principal formal tool from Buran-Kaya III Level B1. The distances A and B indicate the beginning and end of the reduction process. Distances C and D both remain constant throughout the whole reduction process. Values C and D are both identical among all foliate pieces, which belong to the "Triangular Foliate–Foliate Scraper" reduction sequence, whether they come from initial or final stages.

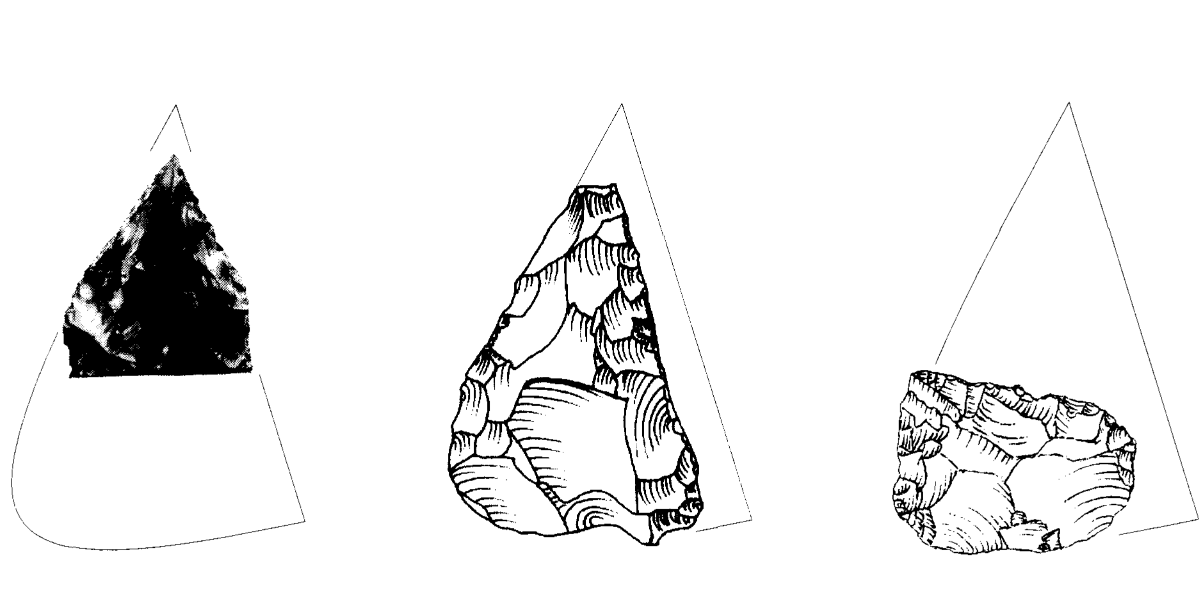


Figure 13-8—The position of the three analyzed pieces from Buran-Kaya III Level B1 within the principal functional concept of an elongated point.

Conclusions

What is most surprising in the Buran-Kaya III Level B1 assemblage is the foliate pieces that occur as copies of their unifacial flake counterparts (Figure 13-5). Each type was produced to be used in the same composite tools. Unlike other late Middle Paleolithic foliates, the foliate tools in this analysis occupy the same place within the functional system as their flake-based counterparts.

The foliate pieces from the late Middle Paleolithic Level B1 of Buran-Kaya III reflect a single preeminent functional concept, which was carried out through both flake production and foliate production: an elongated triangular point was the principal tool. The point was hafted, probably in a handle, and it had a straight right working edge, which was used as a scraper. Resharpening was only on the upper face, which led to the quick reduction of the right edge. As a result, the shape of the tool became more and more asymmetrical and its contour lines approached that of an off-axis convergent scraper (*racloir déjeté*).

The reduction sequence (Figure 13-7), was anticipated by the makers of the tool and was carried out several times in a consistent way. One may conclude that the reduction sequence followed a specific concept of reduction (ending up with off-axis scrapers), which accomplished the concept of production (ending up with elongated points) and the concept of function (ending up with a right-hand scraper edge) of the tool.

The three tool examples presented above represent remnants of the same, superimposed concept of shape. The first piece is a distal part of the same elongated type of point, mirrored by the more complete second piece. Both mark an initial stage of reduction. The third piece, a scraper, represents the final stage of the same reduction sequence (Figure 13-8).

In sum, the Buran-Kaya III Level B1 assemblage provides a case study of three interwoven concepts, all aimed at the same superimposed functional pattern (Figure 13-9).

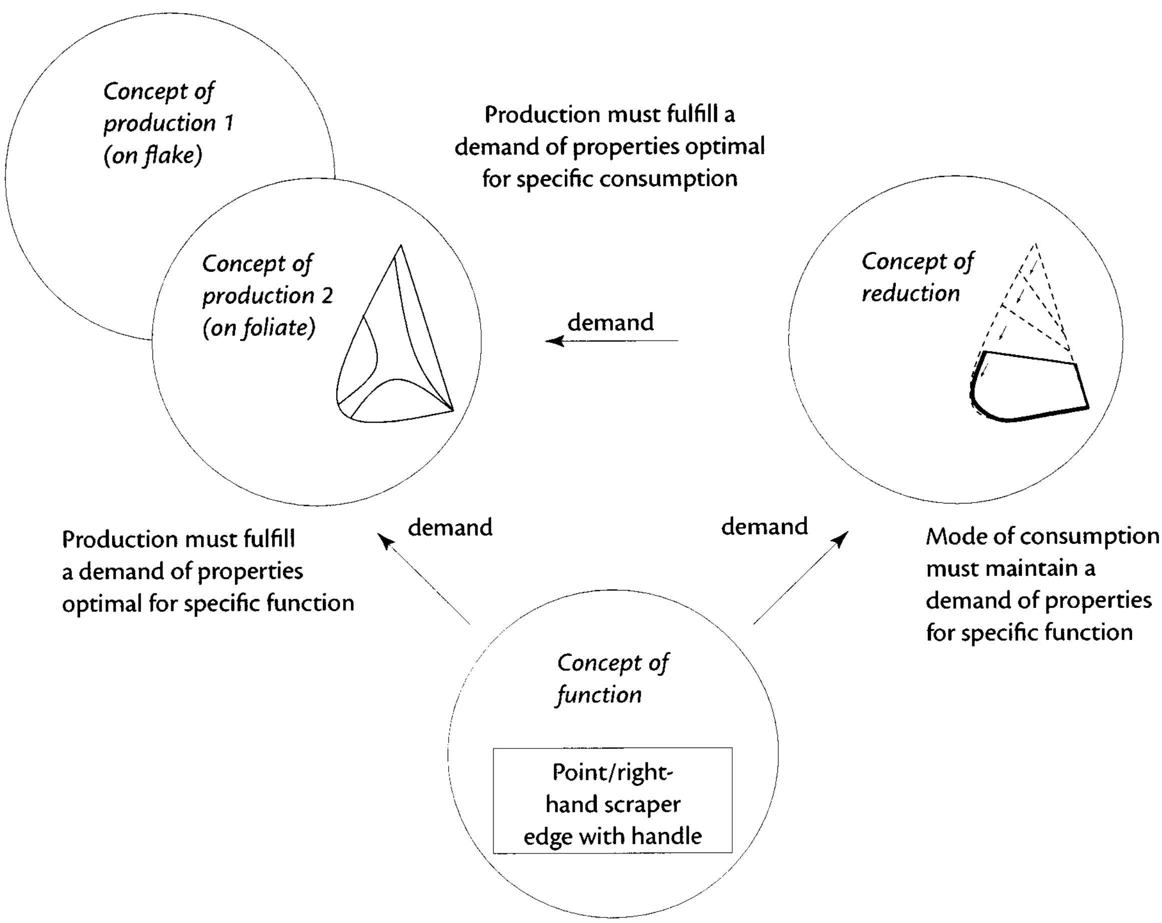


Figure 13-9—Buran-Kaya III Level B1. Two concepts of production and one concept of reduction delivered the properties that were defined by the superimposed concept of function.

14

Catalogue of Raw Material Units in Level B1 of Buran-Kaya III

Martin Kurbjuhn

This chapter provides a detailed accounting of each raw material unit (RMU) identified in Buran-Kaya III Level B1 of the 1996 excavation sample (see Uthmeier, Chapters 11 and 12). All raw material units (RMU 1–115) were catalogued in the order of their on-site transformation section. The catalogue starts with the summary of single artifacts (Table 14-1), which were imported to the site and discarded without being transformed (classes: Tw, Bw, Nw, or Ei). This is followed by descriptions of the individual workpieces (RMUs), which are presented according to the section length of their on-site transformation.

The catalogue is arranged in the following order:

(1) Single artifacts of transformation section *Tw, Bw, Nw, Cw*, or *Ei* (imported object with no transformation on-site).

(2) Workpieces of transformation section *TM* and *TM/surface* (import of a blank and on-site modification).

(3) Workpieces of transformation section *Np* and *Np/surface* (import of a nodule and on-site decortication).

(4) Workpieces of transformation section *Cb* (import of a core and on-site blank production).

(5) Workpieces of transformation section *Cb/surface* (import of a preform or a big blank and on-site production of a bifacial tool).

(6) Workpieces of transformation section *Nb/surface* (import of a nodule and on-site decortication with subsequent production of a bifacial tool).

(7) Workpieces of transformation section *Cm* (import of a core and on-site blank production followed by the production of one or more simple tools).

(8) Workpieces of transformation section *Cm/surface* (import of a big blank or preform and on-site blank production with modification to simple and bifacial tools).

(9) Workpieces of transformation section *Nm* (import of a nodule and on-site decortication, core reduction, and simple tool production).

(10) Workpieces of transformation section *Nm/surface* (import of a nodule and on-site decortication followed by bifacial tool production).

The descriptions for each workpiece contain the following data:

RMU: number of the raw material unit,

Transformation section: class of transformation (Tw, Cb, etc.),

Number of artifacts: the number of artifacts included in the workpiece,

Weight of artifacts: the weight (in grams) of all artifacts from the workpiece,

Flint source: the source of the raw material (primary, secondary),

Shape: the shape of the nodule,

Flint color: short description of the color,

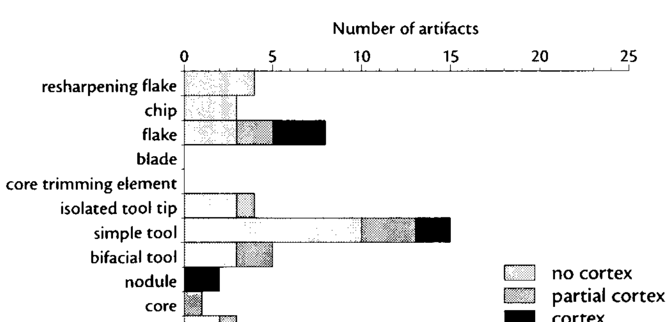
Tools: number and type of tools,

Activity: short description of the on-site activity.

In addition, there is a graphical representation of every workpiece, displaying the number of each type of artifact class it contains, subdivided by cortical coverage. The spatial distribution of the artifacts making up the workpiece is plotted on a simplified plan of the Buran-Kaya III excavations.

TABLE 14-1
RMUs with single artifacts: descriptions, types, and spatial distribution of artifacts

RMU	*Transformation section*	*Artifact*	*Raw material source*	*Color*	*Weight (g)*
42	Tw	scraper	not recognizable	grey/blue	18
69	Tw	scraper	primary	grey/beige	46
70	Tw	scraper	not recognizable	grey	21
71	Tw	biface	not recognizable	grey	13
72	Bw	flake	primary	grey/beige	8
73	Nw	chunk	primary	dark grey	16
74	Tw	scraper	primary	dark brown/grey	20
75	Tw	biface	not recognizable	grey	12
76	Tw	scraper	primary	dark grey, patinated	10
77	Tw	scraper	primary	brown, patinated	12
78	Tw	scraper	not recognizable	dark grey	3
79	Nw	nodule	primary	beige	19
80	Tw	scraper	not recognizable	dark grey	5
81	Tw	biface	primary	grey	11
82	Ei	tool tip	not recognizable	light grey	4
83	Tw	scraper	not recognizable	light grey	4
84	Bw	flake	primary	dark brown	7
86	Tw	point	secondary	light grey	5
87	Bw	chip	not recognizable	dark grey	2
88	Bw	flake	not recognizable	dark grey	5
90	Tw	biface	secondary	grey/brown	2
91	Tw	biface	not recognizable	dark grey	12
92	Bw	flake	not recognizable	dark brown	3
93	Bw	flake	primary	dark brown	2
95	Tw	point	primary	dark grey	3
96	Tw	scraper	not recognizable	beige	5
97	Tw	point	not recognizable	grey	18
98	Ei	resharpening flake	not recognizable	grey/brown	2
99	Tw	scraper	not recognizable	light brown	2
100	Bw	flake	not recognizable	honey-colored	24
101	No	nodule	secondary	grey/brown	8
102	Ei	tool tip	not recognizable	light grey	11
103	Ei	resharpening flake	not recognizable	grey	2
104	Ei	resharpening flake	not recognizable	light grey	2
105	Cw	core	primary	brown/beige	10
106	Ei	tool tip	not recognizable	dark grey	2
107	Bw	flake	primary	dark brown	2
108	Bw	flake	not recognizable	light brown/beige	5
109	Bw	chunk	not recognizable	light grey	1
110	Tw	point	not recognizable	grey	2
111	Bw	chunk	primary	dark grey/brown	1
112	Bw	chip	not recognizable	grey	1
113	Ei	resharpening flake	not recognizable	light grey	1
114	Bw	chip	not recognizable	grey/brown	1
115	Ei	tool tip	primary	dark grey	1



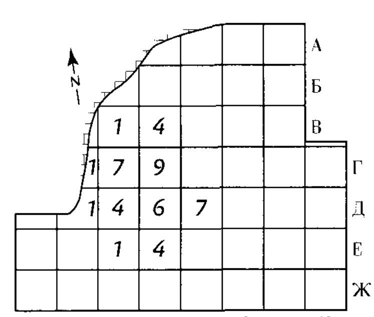


TABLE 14-2

Numerical order and page numbers for workpieces. Descriptions of individual workpieces are arranged in the catalogue according to their transformation section length, as noted above.

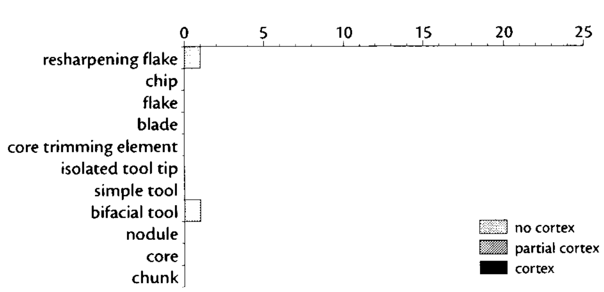
Workpiece	*Page*	*Workpiece*	*Page*
RMU 01	253	RMU 36	257
RMU 02	266	RMU 37	262
RMU 03	266	RMU 38	256
RMU 04	267	RMU 39	257
RMU 05	258	RMU 40	271
RMU 06	258	RMU 41	262
RMU 07	251	RMU 43	262
RMU 08	267	RMU 45	271
RMU 09	259	RMU 46	271
RMU 10	267	RMU 47	263
RMU 11	268	RMU 48	272
RMU 12	268	RMU 49	272
RMU 13	259	RMU 50	272
RMU 14	268	RMU 51	273
RMU 15	254	RMU 52	263
RMU 16	269	RMU 53	273
RMU 17	269	RMU 54	263
RMU 18	269	RMU 55	273
RMU 19	270	RMU 56	264
RMU 20	266	RMU 57	256
RMU 21	270	RMU 58	255
RMU 22	259	RMU 59	264
RMU 23	254	RMU 60	264
RMU 24	260	RMU 61	265
RMU 25	270	RMU 62	253
RMU 26	255	RMU 63	274
RMU 27	260	RMU 64	274
RMU 28	260	RMU 65	252
RMU 29	261	RMU 66	254
RMU 30	252	RMU 67	253
RMU 31	261	RMU 68	265
RMU 32	255	RMU 85	265
RMU 33	256	RMU 89	252
RMU 34	261	RMU 94	258
RMU 35	257		

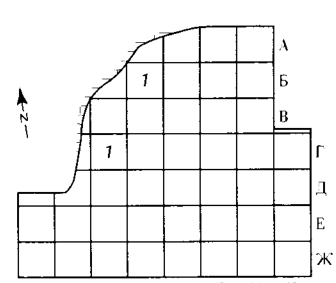
RMU 07

Transformation section: TM
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 16 g
Number of artifacts: 2
Flint color: Grey

Tools: 1 bifacial tool

Activity: Import of a bifacial tool » Resharpening.



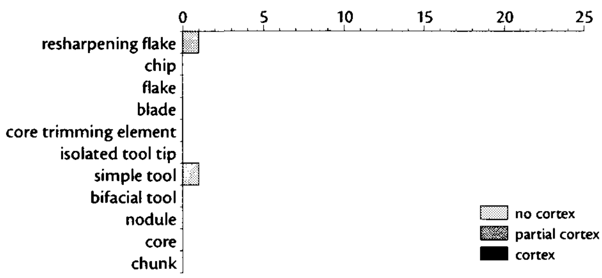


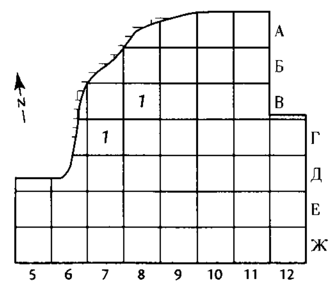
RMU 89

Transformation section: TM
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 10 g
Number of artifacts: 2
Flint color: Light grey

Tools: 1 scraper

Activity: Import of a scraper » Resharpening.



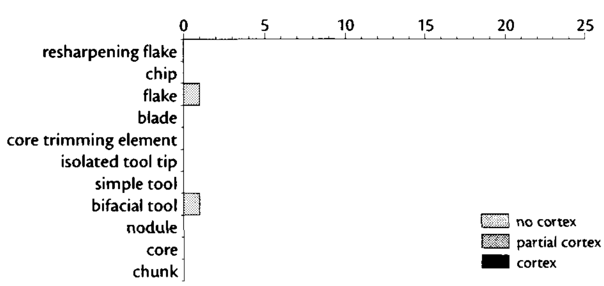


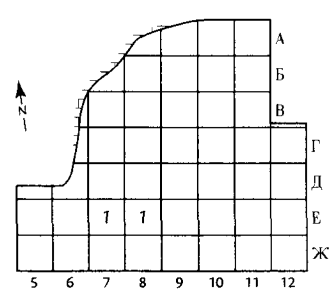
RMU 30

Transformation section: TM/surface
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 14 g
Number of artifacts: 2
Flint color: Black

Tools: 1 bifacial point

Activity: Import of a bifacial point » Thinning of the tool.



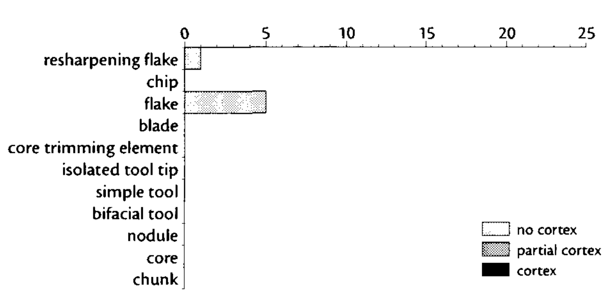


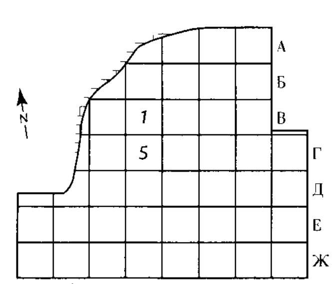
RMU 65

Transformation section: TM/surface
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 21 g
Number of artifacts: 6
Flint color: Grey, partly patinated

Tools: No tools

Activity: Import of a bifacial tool or preform » Tool use » Resharpening » Secondary blank production (Tool used as a core) » Export of the core.



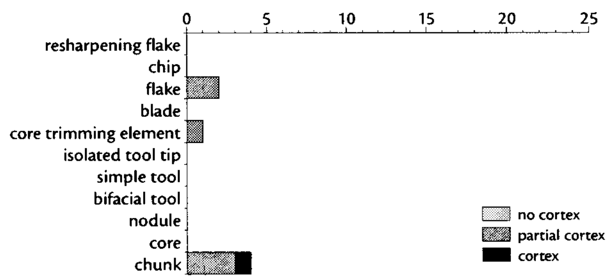


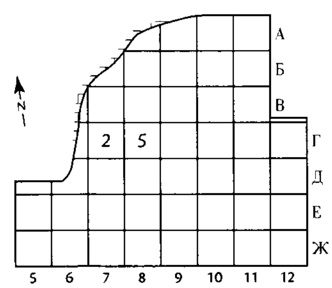
RMU 01

Transformation section: Np
Nodule form: Round
Flint source: Primary
Weight of artifacts: 66 g
Number of artifacts: 7
Flint color: Light beige, white speckled

Tools: No tools

Activity: Import of a nodule » Decortication » Export of the preform/core.



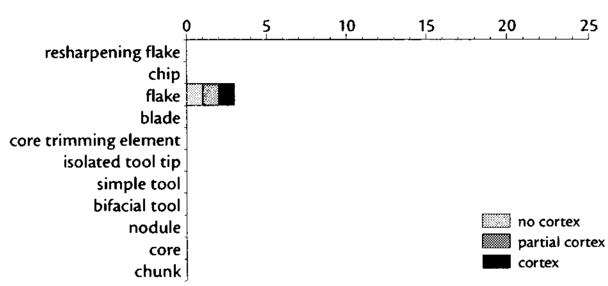


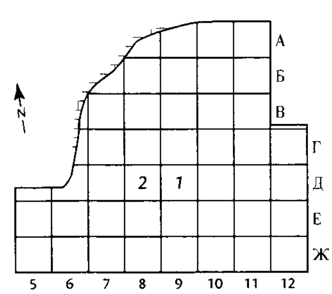
RMU 62

Transformation section: Np
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 17 g
Number of artifacts: 3
Flint color: Dark grey

Tools: No tools

Activity: Import of a nodule » Decortication » Export of the preform/core.



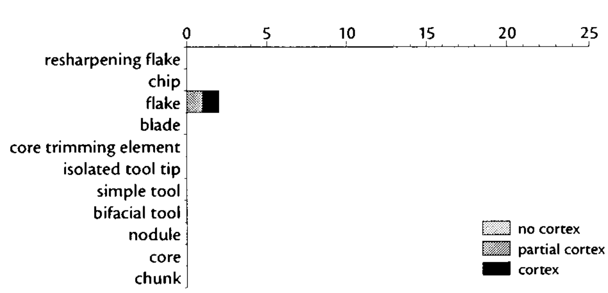


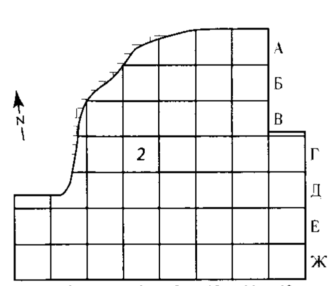
RMU 67

Transformation section: Np
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 21 g
Number of artifacts: 2
Flint color: Grey, white speckled

Tools: No tools

Activity: Import of a nodule » Decortication » Export of the preform/core.



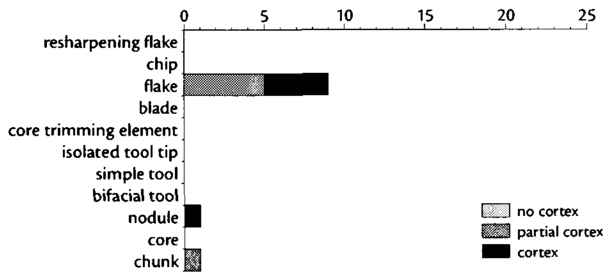


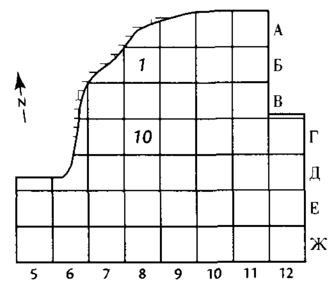
RMU 15

Transformation section: Np/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 41 g
Number of artifacts: 11
Flint color: Light beige/grey

Tools: No tools

Activity: Import of a nodule » Decortication » Preform production.



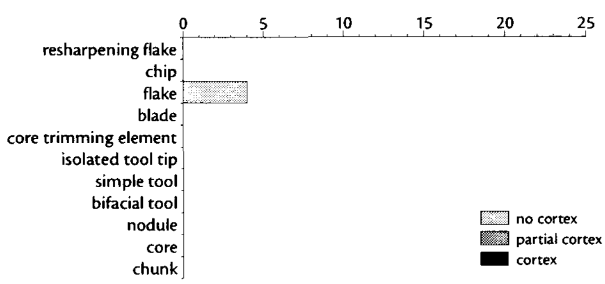


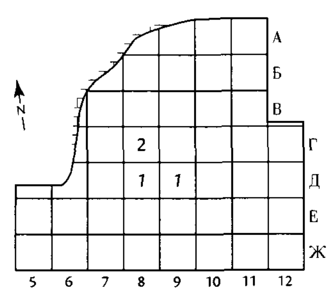
RMU 23

Transformation section: Cb
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 9 g
Number of artifacts: 4
Flint color: Dark grey, white, grey speckled

Tools: No tools

Activity: Import of a big flake » Flake used as a core (Kombewa) » Export of the core.



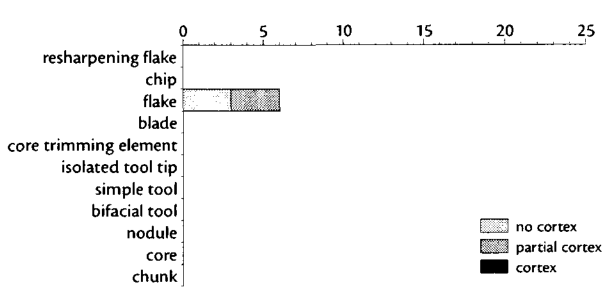


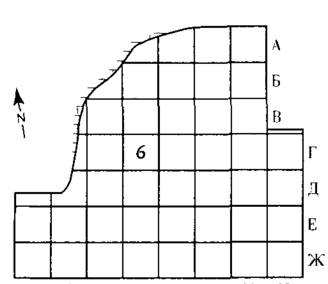
RMU 66

Transformation section: Cb
Nodule form: Round
Flint source: Primary
Weight of artifacts: 34 g
Number of artifacts: 6
Flint color: Grey

Tools: No tools

Activity: Import of a core » Blank production » Export of the core.



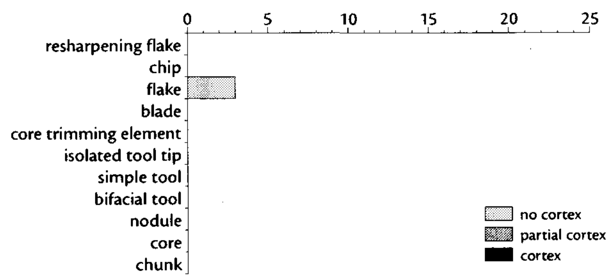


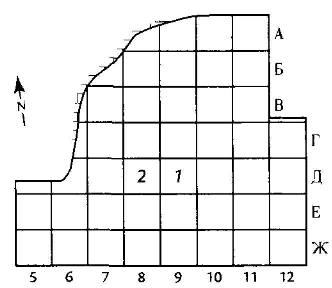
RMU 26

Transformation section: Cb/surface
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 14 g
Number of artifacts: 3
Flint color: Grey

Tools: No tools

Activity: Import of a preform » Bifacial tool production » Export of the bifacial tool.



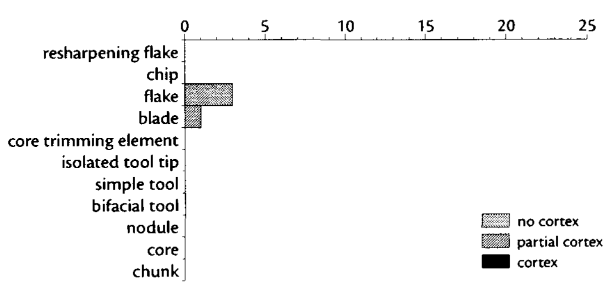


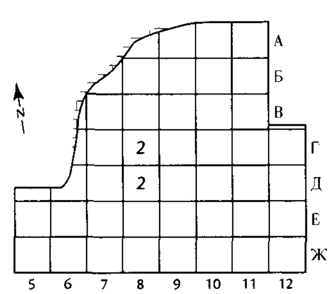
RMU 58

Transformation section: Cb/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 27 g
Number of artifacts: 4
Flint color: Dark grey

Tools: No tools

Activity: Import of a blank or preform » Bifacial tool production » Export of the bifacial tool.



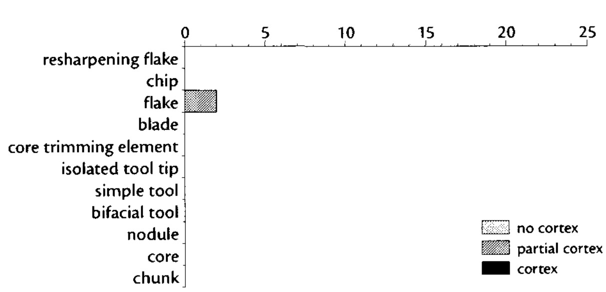


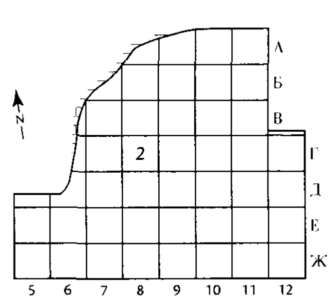
RMU 32

Transformation section: Nb/surface
Nodule form: Plaquette
Flint source: Secondary
Weight of artifacts: 7 g
Number of artifacts: 2
Flint color: Dark brown

Tools: No tools

Activity: Import of a nodule » Decortication » Preform production » Export of the preform.



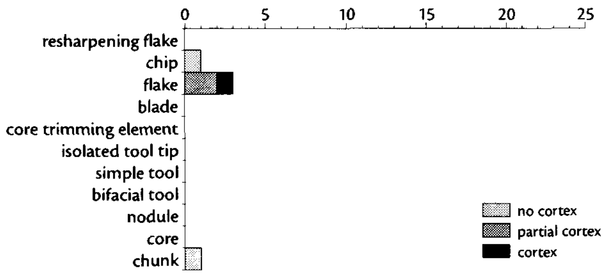


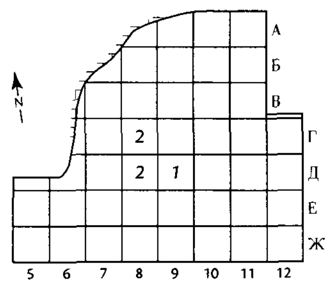
RMU 38

Transformation section: Nb/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 11 g
Number of artifacts: 5
Flint color: Grey

Tools: No tools

Activity: Import of a nodule » Decortication » Preform production » Export of the preform.



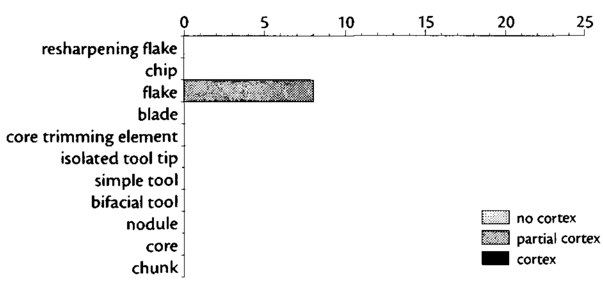


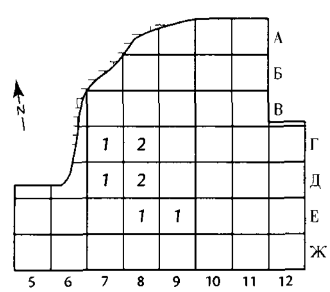
RMU 57

Transformation section: Nb/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 45 g
Number of artifacts: 8
Flint color: Beige

Tools: No tools

Activity: Import of a nodule » Decortication » Preform production » Export of the preform.





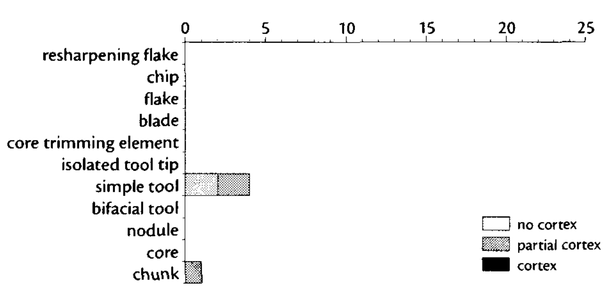
RMU 33

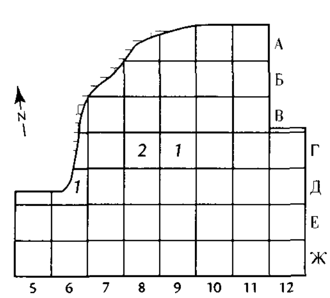
Transformation section: Cm
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 30 g
Number of artifacts: 5
Flint color: Dark grey/black

Tools: 4 scrapers

Activity: Import of a core » Blank production » Tool production » Export of the core.

(1 tool is not shown on plan)



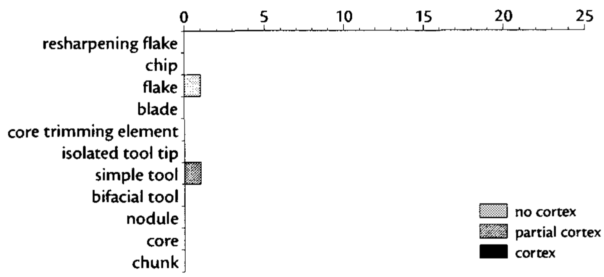


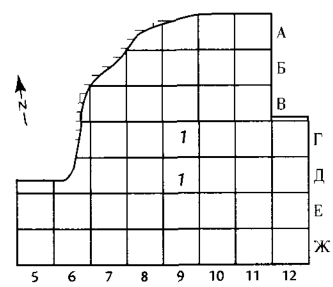
RMU 35

Transformation section: Cm
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 15 g
Number of artifacts: 2
Flint color: Grey/brown

Tools: 1 scraper

Activity: Import of a core » Blank production » Tool production » Export of the core.



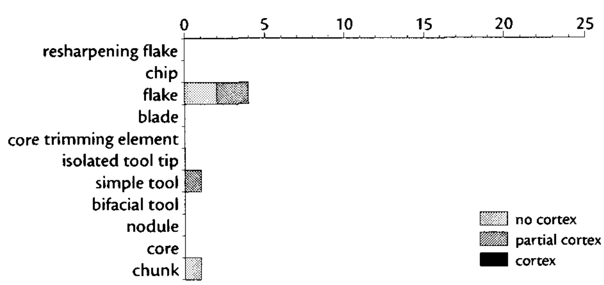


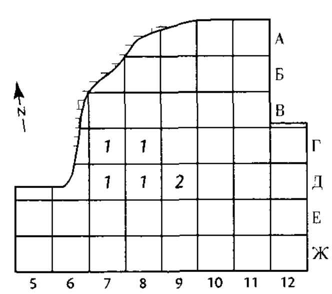
RMU 36

Transformation section: Cm
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 38 g
Number of artifacts: 6
Flint color: Light grey

Tools: 1 point

Activity: Import of a core » Blank production » Tool production » Export of the core.



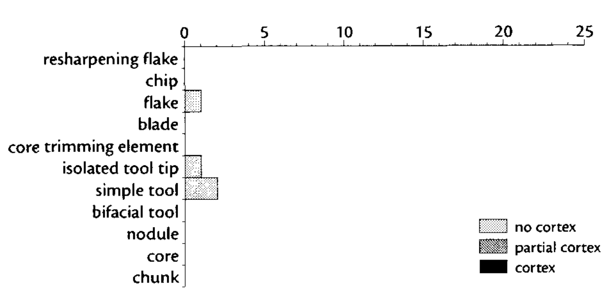


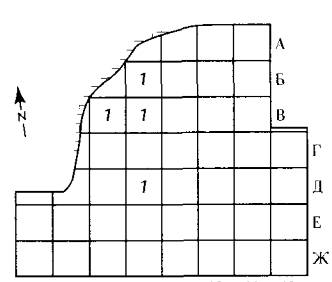
RMU 39

Transformation section: Cm
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 16 g
Number of artifacts: 4
Flint color: Grey

Tools: 2 scrapers, 1 tool tip

Activity: Import of a core » Blank production » Tool production » Tool use » Export of the core.





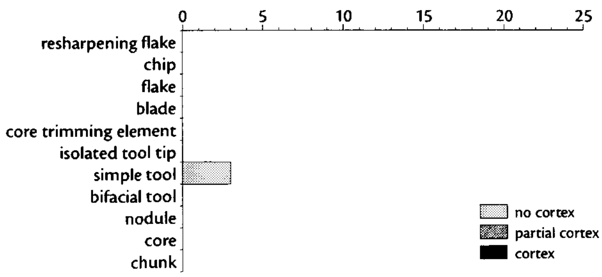
RMU 94

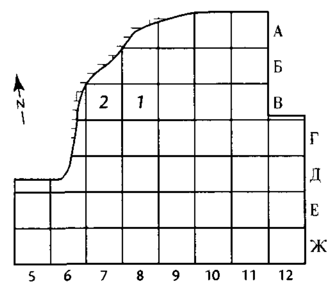
Transformation section: Cm
Flint source: Not recognizable
Number of artifacts: 3
Nodule form: Not recognizable
Weight of artifacts: 29 g
Flint color: Grey

Tools: 3 scrapers

Activity: Import of a core » Blank production » Tool production » Export of the core.

(Maybe there was no tool production on-site (flakes & chips are missing) and the 3 scrapers were all imported.)



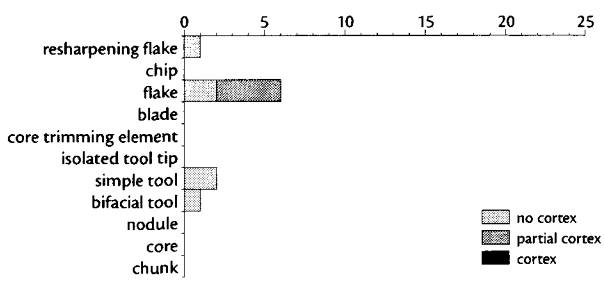


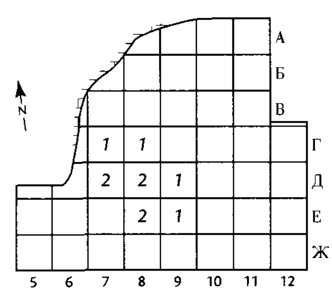
RMU 05

Transformation section: Cm/surface
Flint source: Secondary
Number of artifacts: 10
Nodule form: Flat
Weight of artifacts: 32 g
Flint color: Dark brown

Tools: 1 scraper, 1 notched tool, 1 bifacial tool (fragment)

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production » Tool use » Resharpening » Damage of the bifacial tool.



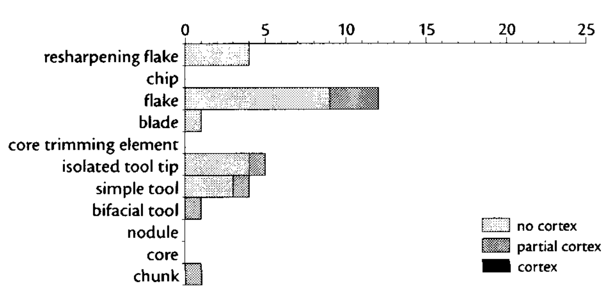


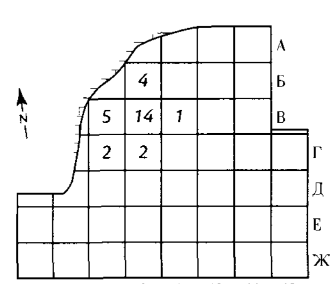
RMU 06

Transformation section: Cm/surface
Flint source: Secondary
Number of artifacts: 28
Nodule form: Round
Weight of artifacts: 32 g
Flint color: Brown

Tools: 2 scrapers, 2 simple tools (undefined), 5 tool tips

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production » Tool use » Secondary blank production.



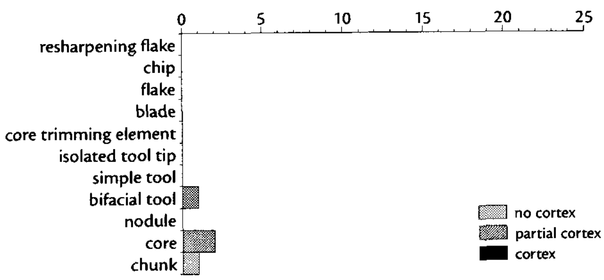


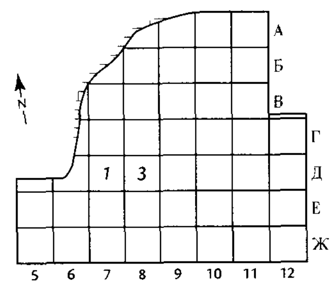
RMU 09

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 88 g
Number of artifacts: 4
Flint color: Dark brown

Tools: 1 bifacial point

Activity: Import of core » Bifacial tool production » 1 flake (bifacial by-product) used as a core.



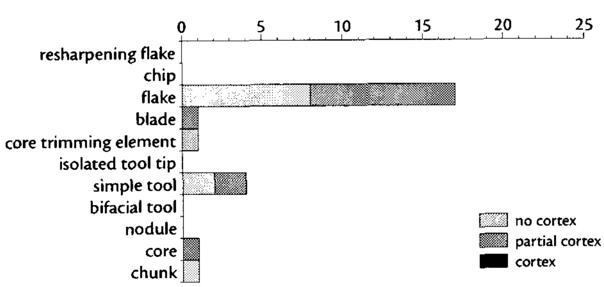


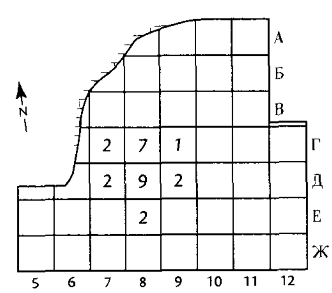
RMU 13

Transformation section: Cm/surface
Nodule form: Plaquette
Flint source: Primary
Weight of artifacts: 112 g
Number of artifacts: 25
Flint color: Brown

Tools: 4 points

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Damage of the bifacial tool.



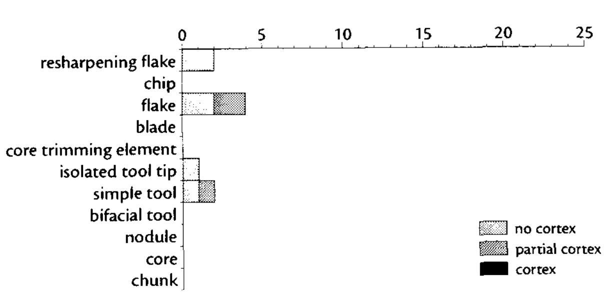


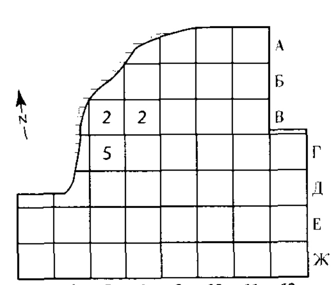
RMU 22

Transformation section: Cm/surface
Nodule form: Round
Flint source: Secondary
Weight of artifacts: 30 g
Number of artifacts: 9
Flint color: Dark grey

Tools: 2 scrapers, 1 bifacial tool tip

Activity: Import of a bifacial tool » Tool use » Resharpening » Broken tool used as core » Simple tool production » Export of the core.



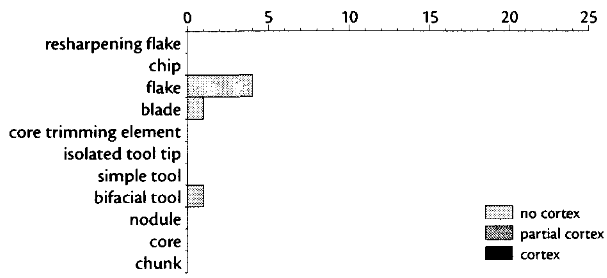


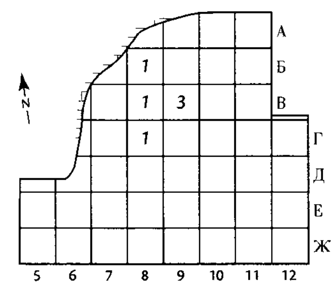
RMU 24

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 28 g
Number of artifacts: 6
Flint color: Light grey

Tools: 1 bifacial tool

Activity: Import of a big flake » Bifacial tool production.



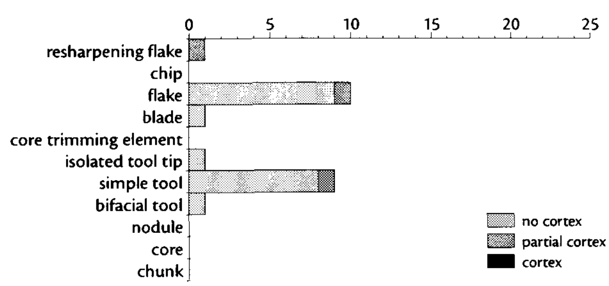


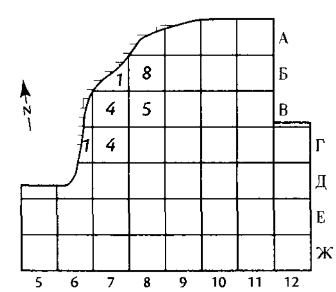
RMU 27

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 92 g
Number of artifacts: 23
Flint color: Light grey, patinated

Tools: 7 points, 2 scrapers, 1 bifacial tool tip

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



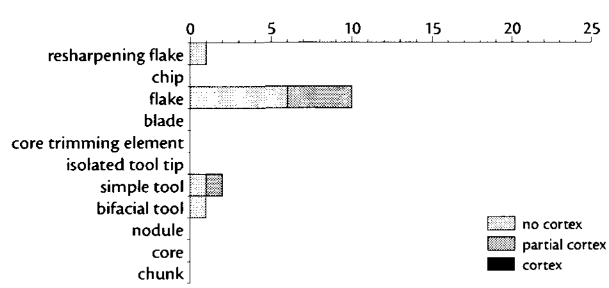


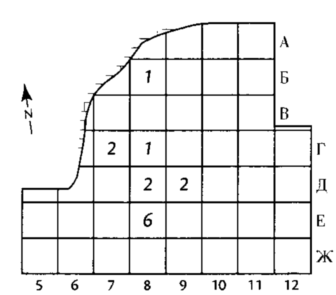
RMU 28

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 53 g
Number of artifacts: 14
Flint color: Grey

Tools: 2 scrapers, 1 bifacial tool

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



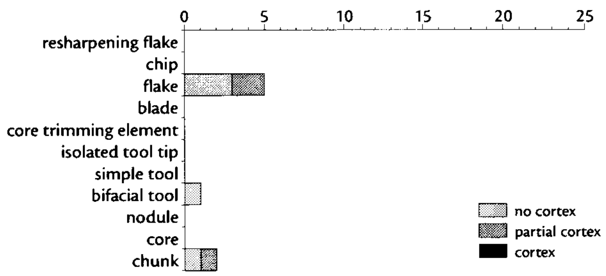


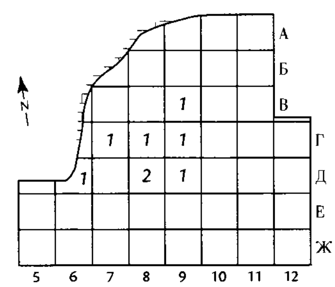
RMU 29

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 30 g
Number of artifacts: 8
Flint color: Dark brown

Tools: 1 bifacial tool

Activity: Import of a preform » Bifacial tool production.



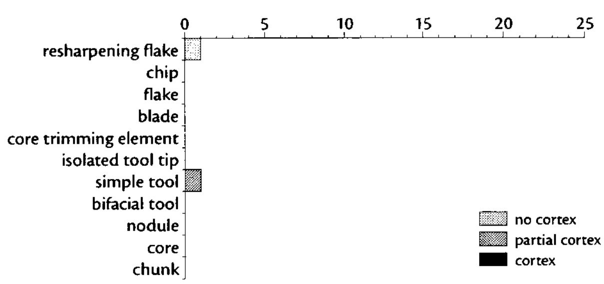


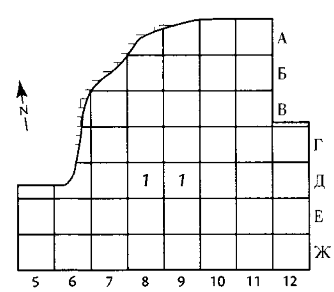
RMU 31

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 11 g
Number of artifacts: 2
Flint color: Dark grey

Tools: 1 scraper

Activity: Import of a preform » Bifacial tool production » Simple tool production » Tool use » Resharpening of the bifacial tool » Export of the bifacial tool.



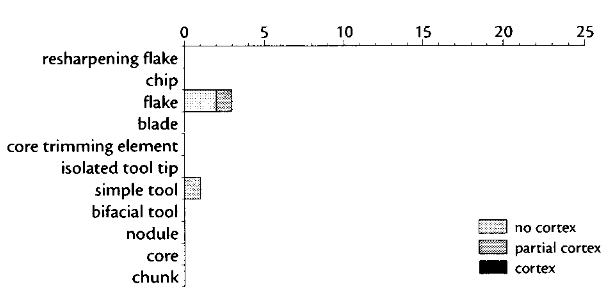


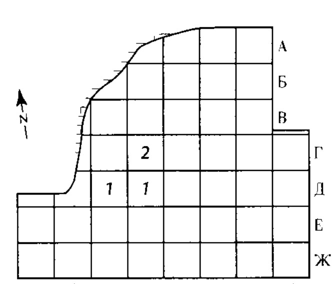
RMU 34

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 13 g
Number of artifacts: 4
Flint color: Grey/brown

Tools: 1 scraper

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Export of the bifacial tool.



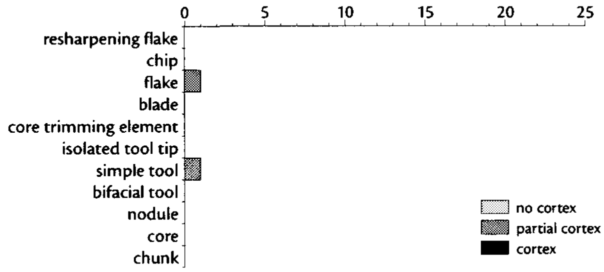


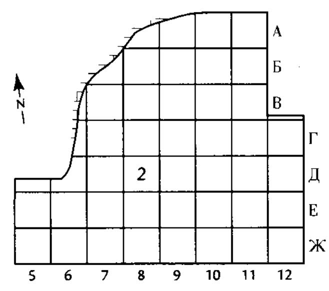
RMU 37

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 7 g
Number of artifacts: 2
Flint color: Grey/brown

Tools: 1 scraper

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Export of the bifacial tool.



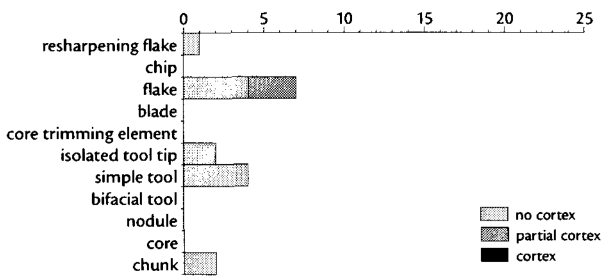


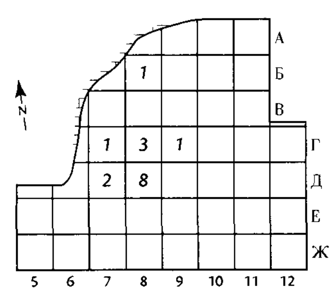
RMU 41

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 58 g
Number of artifacts: 16
Flint color: Light grey

Tools: 1 point, 2 scrapers, 1 denticulate, 2 undefined tool tips

Activity: Import of a preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



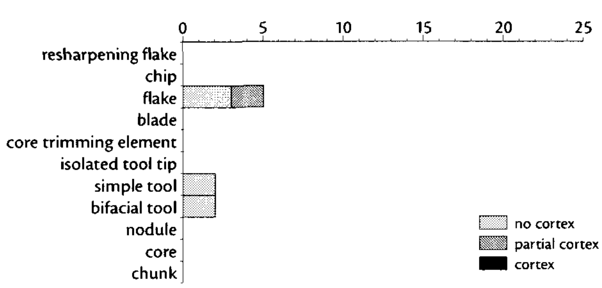


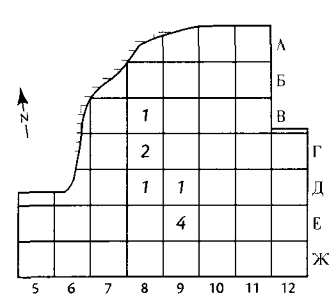
RMU 43

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Secondary
Weight of artifacts: 35 g
Number of artifacts: 9
Flint color: Light grey/brown

Tools: 2 scrapers, 2 bifacial tools

Activity: Import of a preform » Bifacial tool production » Simple tool production from bifacial by-products » secondary bifacial tool production » Export of the initial bifacial tool.





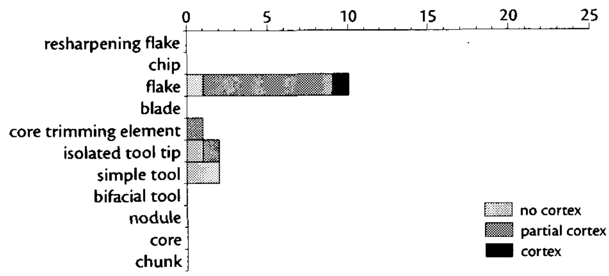
RMU 47

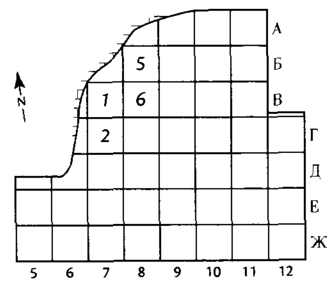
Transformation section: Cm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 86 g
Number of artifacts: 15
Flint color: Grey/blue

Tools: 2 scrapers, 2 tool tips (including 1 from a point)

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Secondary blank production (broken bifacial used as a core).

(1 unlabeled flake is not shown on plan.)



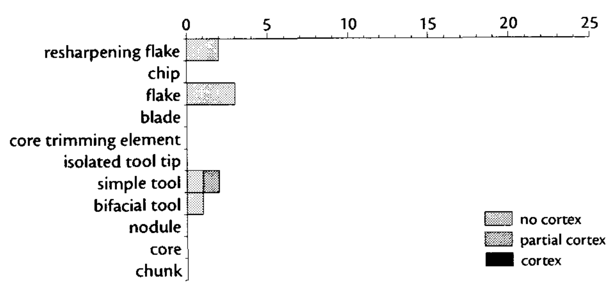


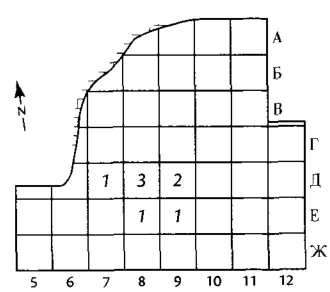
RMU 52

Transformation section: Cm/surface
Nodule form: Round
Flint source: Primary
Weight of artifacts: 39 g
Number of artifacts: 8
Flint color: Black

Tools: 2 scrapers, 1 bifacial (used up)

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.





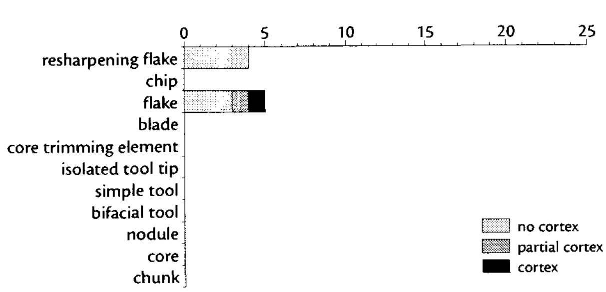
RMU 54

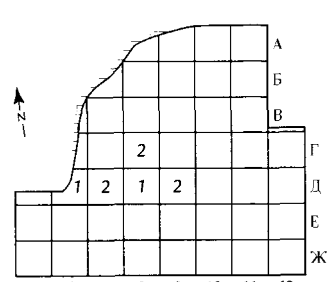
Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Primary
Weight of artifacts: 21 g
Number of artifacts: 9
Flint color: Dark grey

Tools: No tools

Activity: Import of a blank or preform » Bifacial tool production » Tool use » Resharpening » Export of the bifacial tool.

(1 flake is not shown on plan.)



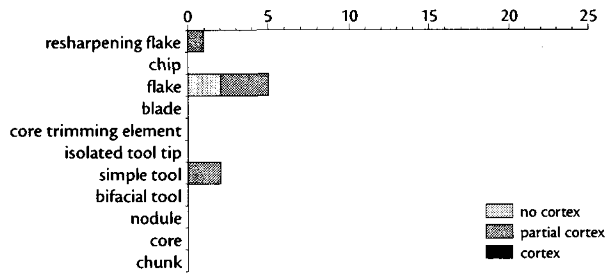


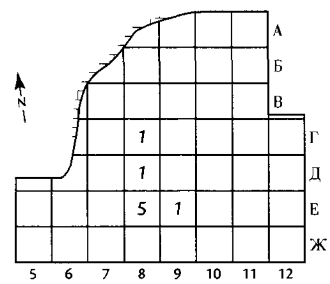
RMU 56

Transformation section: Cm/surface
Nodule form: Round
Flint source: Secondary
Weight of artifacts: 26 g
Number of artifacts: 8
Flint color: Grey

Tools: 2 scrapers

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Re-sharpening » Export of the bifacial tool.





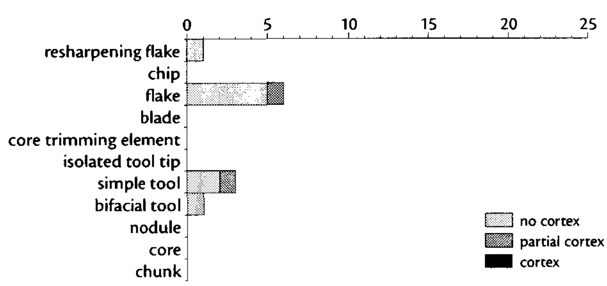
RMU 59

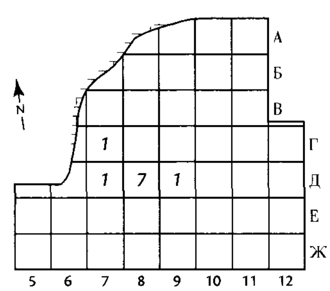
Transformation section: Cm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 57 g
Number of artifacts: 11
Flint color: Grey/black

Tools: 1 point, 2 scrapers, 1 bifacial tool

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Re-sharpening.

(Bifacial tool is unlabeled and not shown on plan.)



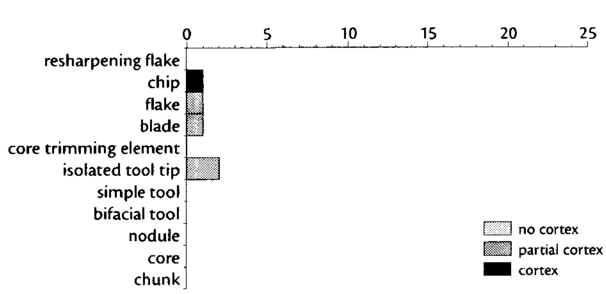


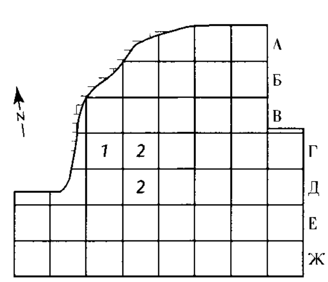
RMU 60

Transformation section: Cm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 12 g
Number of artifacts: 5
Flint color: Grey/brown

Tools: 2 tool tips (undefined)

Activity: Import of an initial retouched nodule » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Export of the bifacial tool or preform.



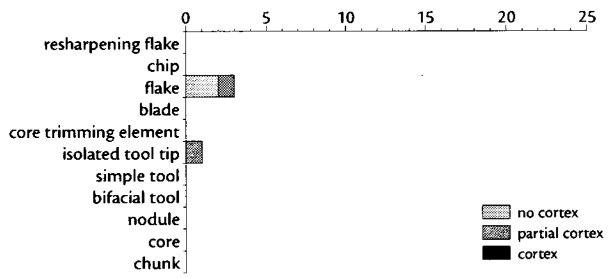


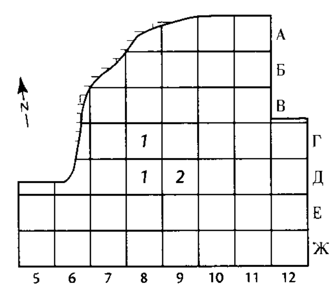
RMU 61

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Secondary
Weight of artifacts: 17 g
Number of artifacts: 4
Flint color: Grey/brown

Tools: 1 bifacial tool tip

Activity: Import of a blank or preform » Bifacial tool production » Tool use » Export of the bifacial tool.





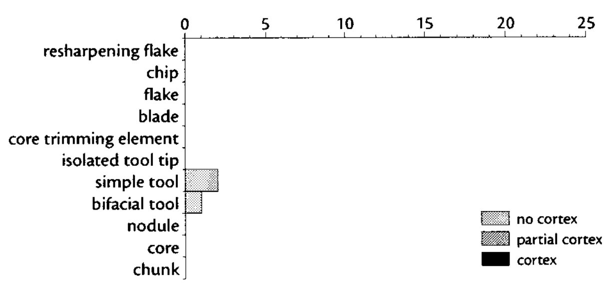
RMU 68

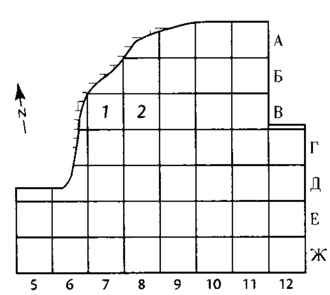
Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 31
Number of artifacts: 3
Flint color: Grey, light grey patinated

Tools: 2 scrapers, 1 bifacial tool

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products.

(Because flakes and chips are absent, maybe all tools were imported to the site.)



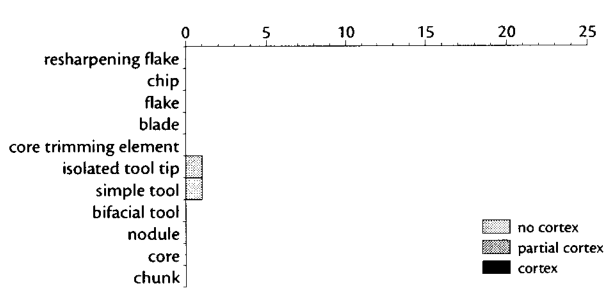


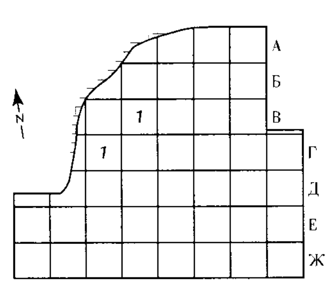
RMU 85

Transformation section: Cm/surface
Nodule form: Not recognizable
Flint source: Not recognizable
Weight of artifacts: 10 g
Number of artifacts: 2
Flint color: Dark grey, white patinated

Tools: 1 scraper, 1 bifacial point

Activity: Import of a blank or preform » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Export of the bifacial tool.



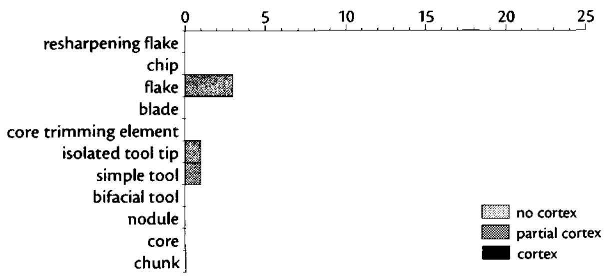


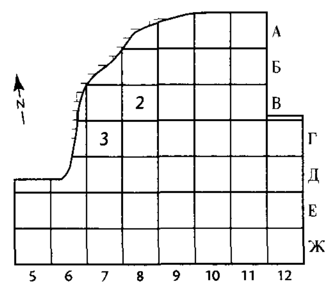
RMU 20

Transformation section: Nm | Flint source: Secondary | Number of artifacts: 5
Nodule form: Not recognizable | Weight of artifacts: 31 g | Flint color: Dark grey, white patinated

Tools: 1 scraper, 1 tool tip (undefined)

Activity: Import of a nodule » Decortication » Initial blank production » Tool production » Export of the core.



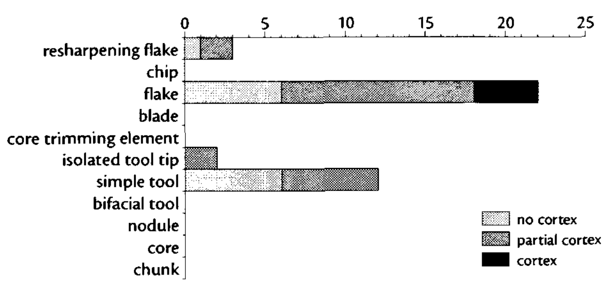


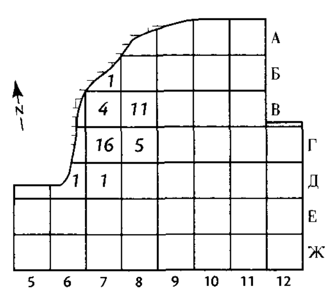
RMU 02

Transformation section: Nm/surface | Flint source: Secondary | Number of artifacts: 39
Nodule form: Flat | Weight of artifacts: 150 g | Flint color: Light grey

Tools: 5 points, 5 scrapers, 2 fragments from simple tools (undefined), 2 tool tips (undefined)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



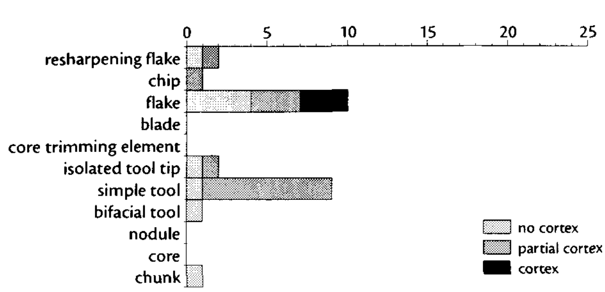


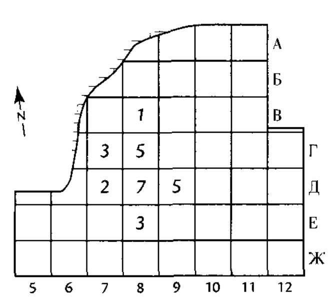
RMU 03

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 26
Nodule form: Flat | Weight of artifacts: 119 g | Flint color: Grey

Tools: 3 points, 6 scrapers, 1 bifacial tool, 2 tool tips (1 from a simple tool, 1 from a bifacial tool)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



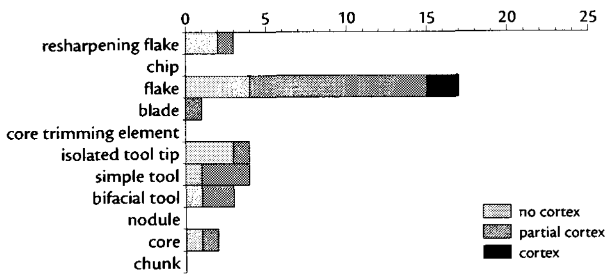


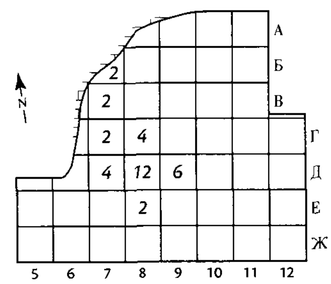
RMU 04

Transformation section: Nm/surface
Nodule form: Round
Flint source: Primary
Weight of artifacts: 218 g
Number of artifacts: 34
Flint color: Dark grey, brownish

Tools: 4 scrapers, 3 bifacial tools, 4 tool tips (1 from a simple tool, 3 from bifacial tools)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Broken biface used as a core.



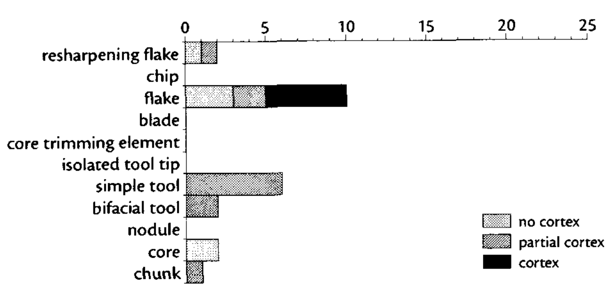


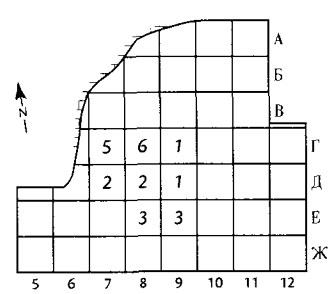
RMU 08

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 115 g
Number of artifacts: 23
Flint color: Grey/brown

Tools: 1 point, 5 scrapers, 2 fragments of 1 bifacial tool

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



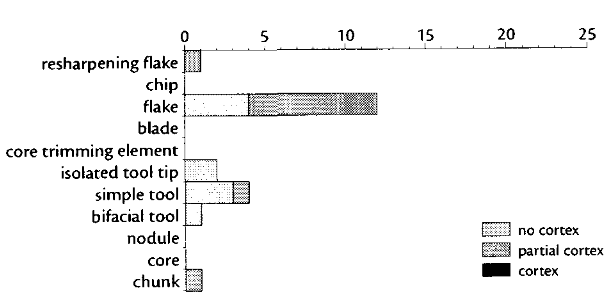


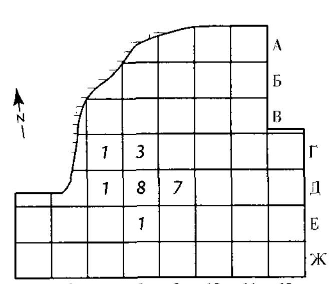
RMU 10

Transformation section: Nm/surface
Nodule form: Round
Flint source: Secondary
Weight of artifacts: 114 g
Number of artifacts: 21
Flint color: Grey

Tools: 4 scrapers, 1 bifacial tool, 2 tool tips (bifacial)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



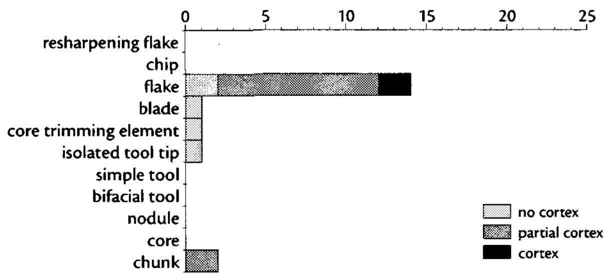


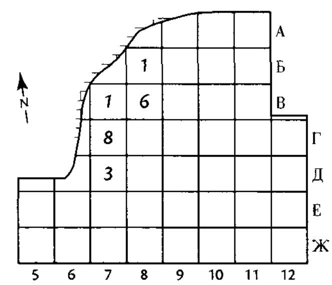
RMU 11

Transformation section: Nm/surface
Nodule form: Round
Flint source: Secondary
Weight of artifacts: 80 g
Number of artifacts: 19
Flint color: Grey, brownish

Tools: 1 tool tip (undefined)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Secondary blank production.



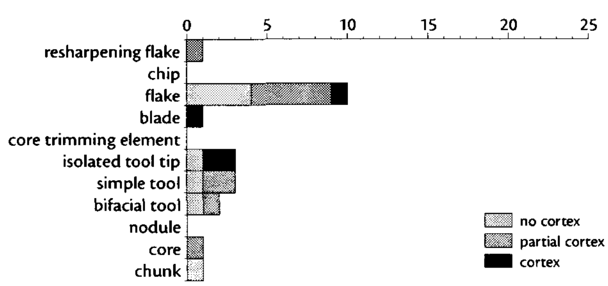


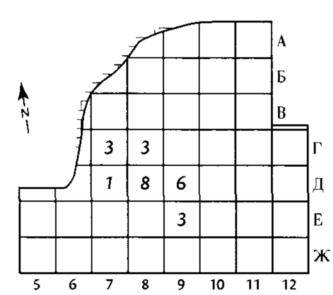
RMU 12

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 106 g
Number of artifacts: 22
Flint color: Grey/brown

Tools: 1 point, 2 scrapers, 2 bifacial tools, 3 tool tips from simple tools

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Broken bifacial tool used as a core.



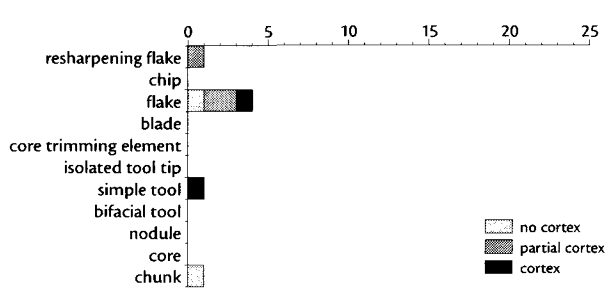


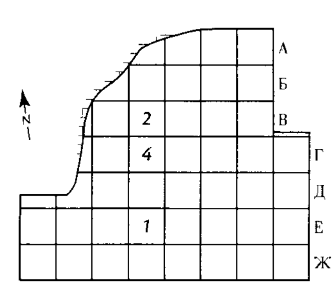
RMU 14

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 34 g
Number of artifacts: 7
Flint color: Grey, partial white patinated

Tools: 1 scraper

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



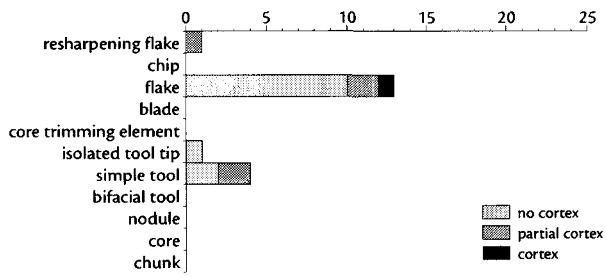


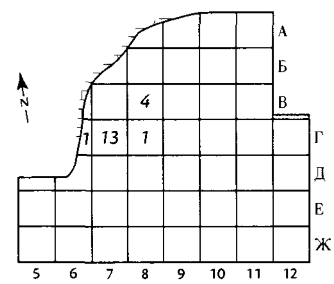
RMU 16

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 127 g
Number of artifacts: 19
Flint color: Light grey, white patinated

Tools: 1 point, 3 scrapers, 1 tool tip (from simple tool)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



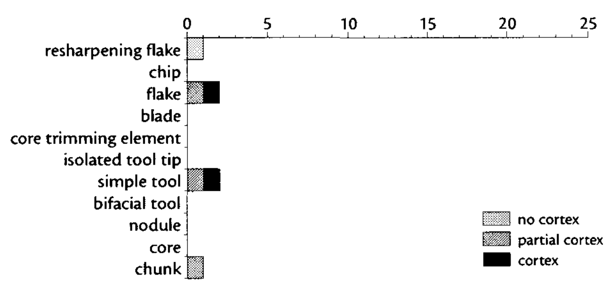


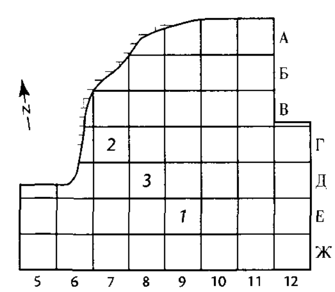
RMU 17

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 31 g
Number of artifacts: 6
Flint color: Grey/beige

Tools: 2 scrapers

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



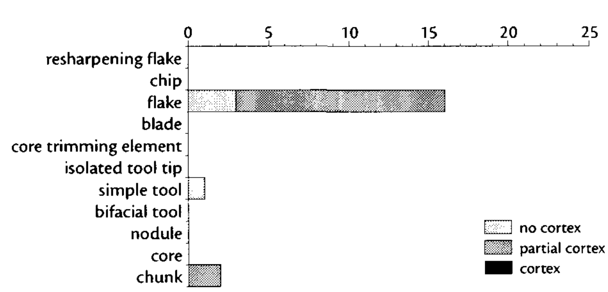


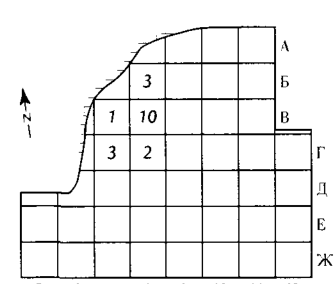
RMU 18

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 115 g
Number of artifacts: 19
Flint color: Brown, light grey patinated

Tools: 1 scraper

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Demolition of the bifacial tool.



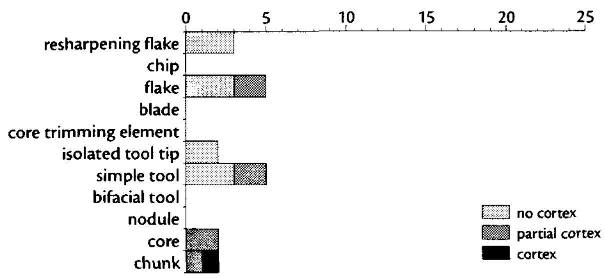


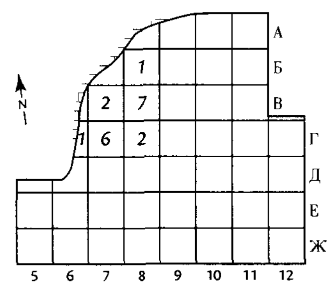
RMU 19

Transformation section: Nm/surface
Nodule form: Round
Flint source: Secondary
Weight of artifacts: 94 g
Number of artifacts: 19
Flint color: Dark grey

Tools: 2 points, 3 scrapers

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Preform fragments used as cores for secondary blank production.



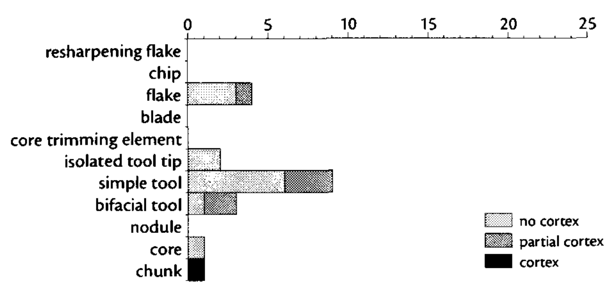


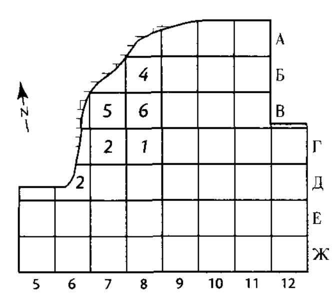
RMU 21

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 148 g
Number of artifacts: 20
Flint color: Light grey

Tools: 5 points, 4 scrapers, 3 bifacial tools (including preform fragments)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Secondary blank production.



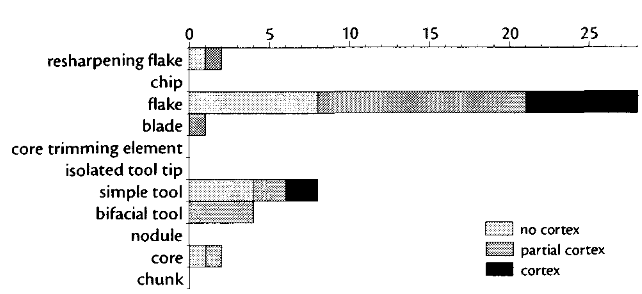


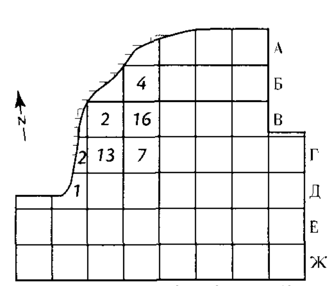
RMU 25

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Secondary
Weight of artifacts: 198 g
Number of artifacts: 45
Flint color: Grey

Tools: 3 points, 5 scrapers, 4 bifacial tools

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Preform fragment and a flake used as cores for secondary blank production.



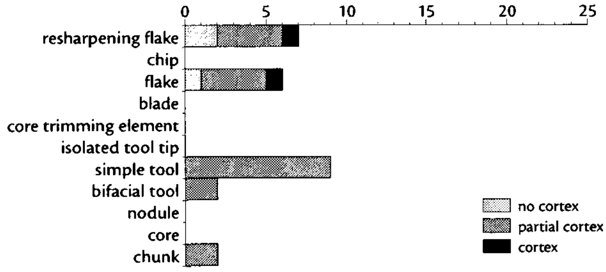


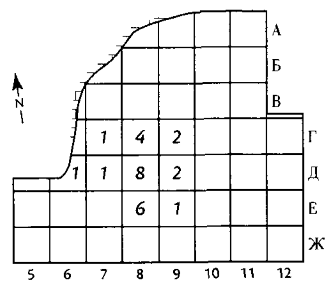
RMU 40

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 26
Nodule form: Not recognizable | Weight of artifacts: 115 g | Flint color: Black

Tools: 9 scrapers, 2 bifacial tools

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



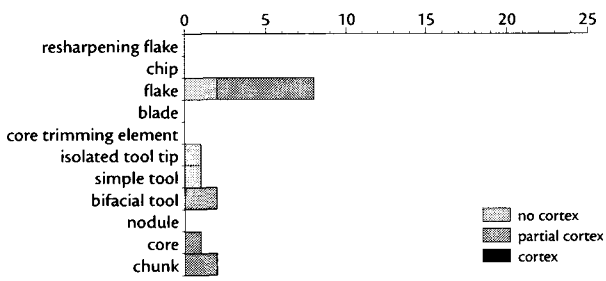


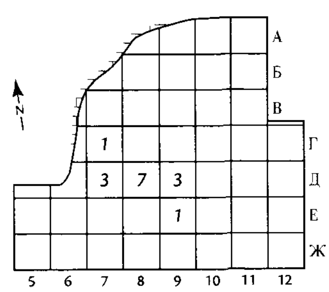
RMU 45

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 15
Nodule form: Round | Weight of artifacts: 111 g | Flint color: Beige/grey

Tools: 1 scraper, 2 bifacial tools, 1 tool tip (bifacial)

Activity: Import of a nodule » Decortication » Bifacial tool production » Tool use » Secondary blank production » Simple tool production.



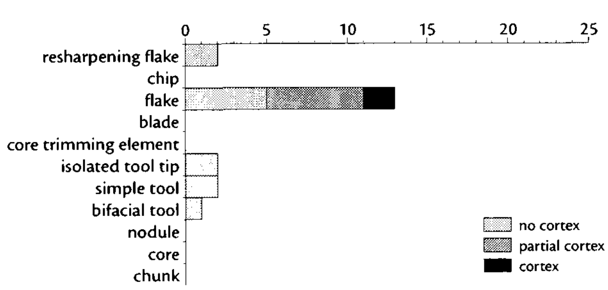


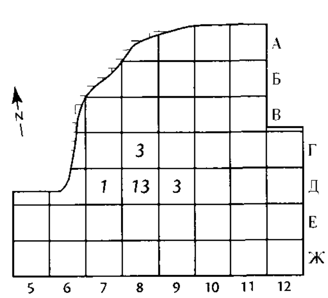
RMU 46

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 20
Nodule form: Flat | Weight of artifacts: 75 g | Flint color: Beige/grey

Tools: 1 point, 1 scraper, 1 bifacial tool, 1 tool tip (bifacial)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening.



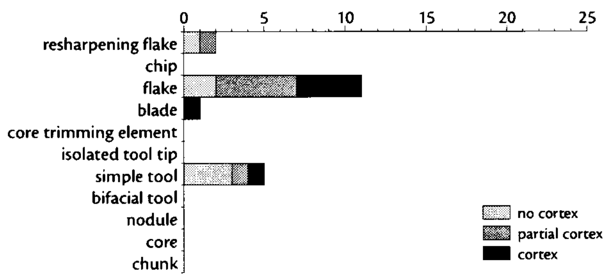


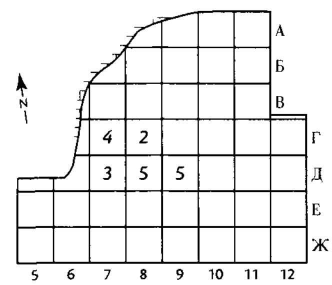
RMU 48

Transformation section: Nm/surface | Flint source: Secondary | Number of artifacts: 19
Nodule form: Flat | Weight of artifacts: 48 g | Flint color: Light beige

Tools: 2 scrapers, 3 fragments from simple tools

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



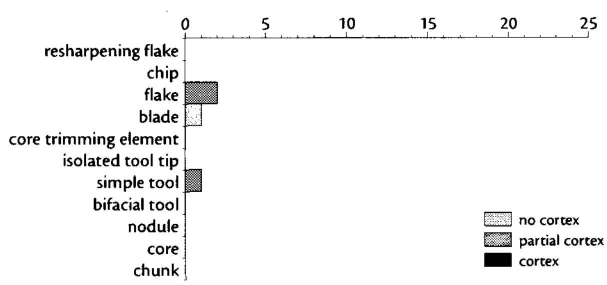


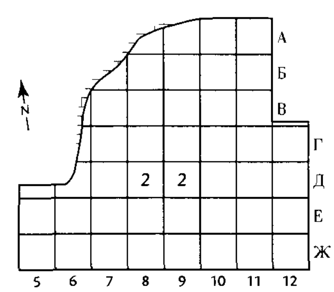
RMU 49

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 4
Nodule form: Not recognizable | Weight of artifacts: 12 g | Flint color: Brown/honey colored

Tools: 1 scraper

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Export of the bifacial tool.



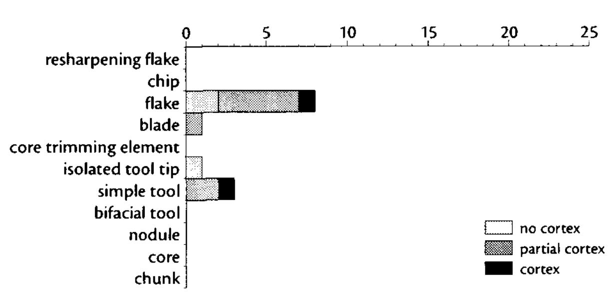


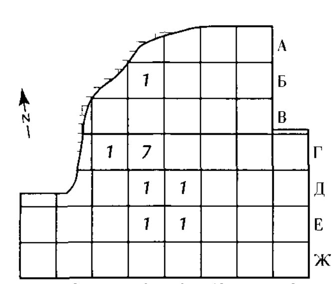
RMU 50

Transformation section: Nm/surface | Flint source: Primary | Number of artifacts: 13
Nodule form: Plaquette | Weight of artifacts: 59 g | Flint color: Dark brown

Tools: 1 point, 2 scrapers

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Export of the bifacial tool.



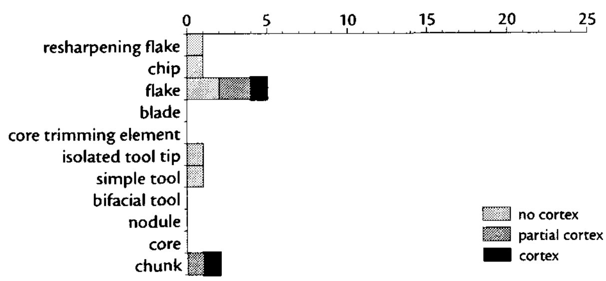


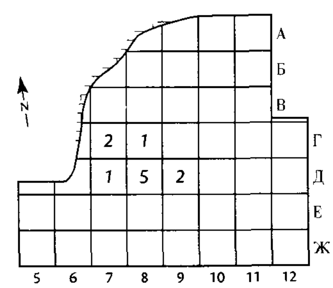
RMU 51

Transformation section: Nm/surface
Nodule form: Plaquette
Flint source: Secondary
Weight of artifacts: 38 g
Number of artifacts: 11
Flint color: Light grey

Tools: 1 scraper, 1 tool tip (simple tool)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



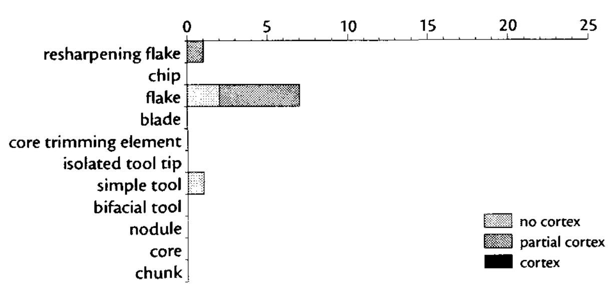


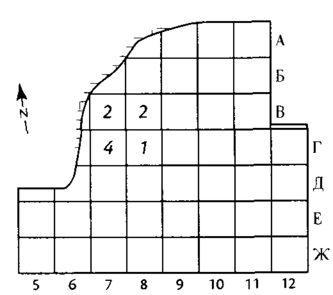
RMU 53

Transformation section: Nm/surface
Nodule form: Plaquette
Flint source: Secondary
Weight of artifacts: 17 g
Number of artifacts: 9
Flint color: Grey

Tools: 1 denticulate

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.



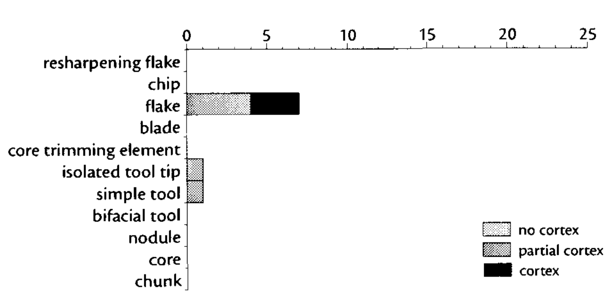


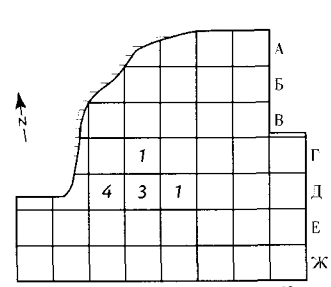
RMU 55

Transformation section: Nm/surface
Nodule form: Plaquette
Flint source: Secondary
Weight of artifacts: 26 g
Number of artifacts: 9
Flint color: Brown

Tools: 1 scraper

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Export of the bifacial tool.



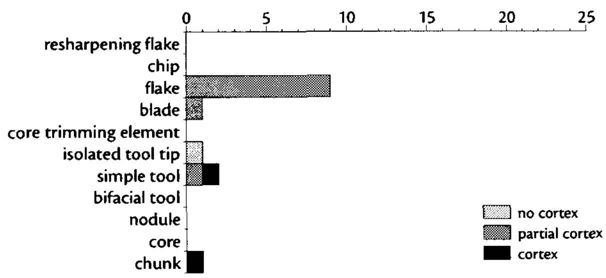


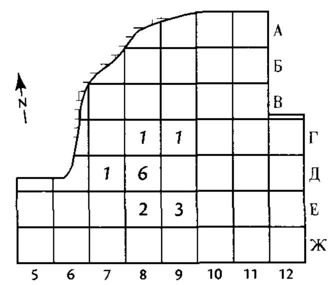
RMU 63

Transformation section: Nm/surface
Nodule form: Plaquette
Flint source: Primary
Weight of artifacts: 30 g
Number of artifacts: 14
Flint color: Beige

Tools: 1 point, 1 scraper

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Export of the bifacial tool.



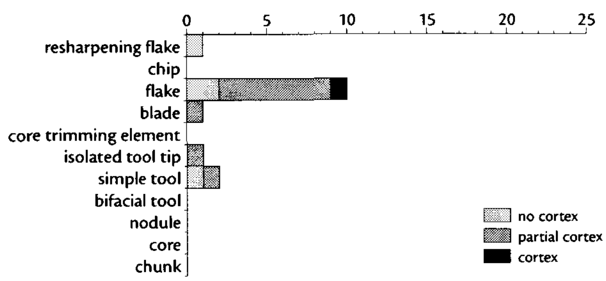


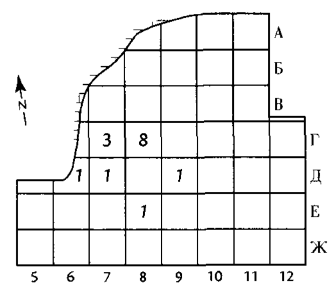
RMU 64

Transformation section: Nm/surface
Nodule form: Flat
Flint source: Primary
Weight of artifacts: 78 g
Number of artifacts: 15
Flint color: Dark grey, some artifacts blue/grey patinated

Tools: 2 scrapers, 1 tool tip (from simple tool)

Activity: Import of a nodule » Decortication » Bifacial tool production » Simple tool production from bifacial by-products » Tool use » Resharpening » Export of the bifacial tool.





Part II:
Karabi Tamchin

15

The Site of Karabi Tamchin: Introduction

Alexander I. Yevtushenko, Ariane Burke, & C. Reid Ferring

The site of Karabi Tamchin is a recently discovered, stratified Middle Paleolithic locality situated in the Crimean highlands. Its location provides an unusual opportunity for the investigation of Middle Paleolithic human adaptation to highland conditions in Crimea, as well as the effects on technology and typology by the absence of good-quality lithic raw material.

The Crimean Mountains extend for about 180 km along the southern tip of the peninsula, from Sevastopol to Feodosia. The Mountain Massif consists of three parallel ridges (Main, Internal, and External) running in a northeasterly direction. Each ridge terminates abruptly towards the south in a series of cliffs or steep escarpments and slopes away gently towards the north. Formed of Triassic and Jurassic limestone, the Main Ridge is the highest, reaching heights of up to 1500 meters above mean sea level (msl). The Main Ridge dominates the southern coastline, its limestone cliffs forming a dramatic headland. Several highland plateaus, called *Yailas*, Turkic for "summer pastures," lie along the Main Ridge at elevations ranging from 700 to 1000 m msl. The Main Ridge is bordered on the northwest by the Internal Ridge, which lies between 400 and 500 m msl, followed by the External Ridge, which ranges from 200 to 300 m msl. The Internal and External Mountain ridges form typical cuestas, their Cretaceous and/or Paleogene (Eocene) limestone bases incised by river valleys. The rivers take their source in the mountains and run north towards the plains before bifurcating either west or east, depending upon where they lie relative to the nummulitic crest on which the city of Simferopol is built.

The history of investigation of the Crimean Paleolithic goes back over a century. Today, several dozen Middle Paleolithic locations are known (Kolosov et al. 1993). Most are located in the foothills of the Internal and External Ridges of the Crimean Mountains, and are associated with good flint sources, predictable water supplies, numerous natural rockshelters, and temperate climatic conditions. In the past, only a few rockshelter localities and several open-air find-spots were known in the highlands of the Main Ridge. Aside from Karabi Tamchin, there is only a single highland site, Adji-Koba Cave, containing Paleolithic artifacts in mixed stratigraphic context. All other known highland locations are open air find-spots near the meteorological station on Karabi Yaila, and on the Yaltinskaya Yaila (Kolosov et al. 1993). The distribution of known Middle Paleolithic sites is explainable on the one hand by a relative lack of archeological research in the highlands compared to other areas, and on the other hand, by an absence of good raw materials for stone tool production. In addition, climatic conditions in highland regions of the Main Ridge are more severe than along the Internal or External Ridges: summer is shorter, and winter is longer and harsher, accompanied by strong winds and snowstorms. Although the Main Ridge gets the most rainfall in Crimea, most of the local streams and springs become dry by the middle of the summer. These factors will likely have affected the manner in which highland regions were exploited during prehistoric times.

Setting and Excavations

The site of Karabi Tamchin is situated at an elevation of about 740 meters msl, on the northwest edge of Karabi Yaila, the largest plateau of the Main Ridge of the Crimean Mountains. The site is located at the foot of the limestone escarpment that forms the edge of the plateau, above the wooded, steep slope of the deep Audjikli Ravine, at the bottom of which flows Tamchin Creek. This creek flows into the shallow Suat River, which is the eastern tributary of the Burulcha River.

The geological context of the site is linked with the local foothills of Upper Jurassic (J3) limestone that have been intensively eroded by karstic activity. There are more than two hundred caves, grottos, funnels, gaps, and others karstic formations within the Karabi Plateau (Dublyansky and Lomaev 1980). Several relatively deep karstic caves are situated in the same abrupt limestone cliff not far from Karabi Tamchin. One of these, the famous Adji-Koba Cave, is located only 70 m to the southeast of Karabi Tamchin.

Karabi Tamchin was discovered during the summer of 1996 by A.I. Yevtushenko and V.P. Chabai in a big, semi-circular fluting opening to the southwest. The surface of this area (18 m x 6 m) was covered by huge limestone slabs and blocks, which were interpreted as the remains of a destroyed rockshelter chamber, and the density of stones suggested a collapsed roof.

A test pit was dug at the edge of the discovered area. The deposits consisted of a sequence of loamy sediments, enriched by plate and angular gravel. These sediments were subdivided into five lithological strata. Four horizons of Middle Paleolithic flint artifacts and faunal remains were also recognized in the test pit. The upper horizons of the sequence were partially disturbed and contain few diagnostic artifacts.

Based on the initial test results, excavations were continued from 1999 through 2001 during summer field seasons. The main excavation area, of about 27 m^2, was made in the central part of the site, in order to discover both the whole stratigraphic sequence, as well as a full sequence of prehistoric occupations (Figure 15-1).

Since the archeological materials were in relatively soft sediments, the method of excavation followed that used during previous investigations at western Crimean Paleolithic sites (Chabai 1998b:177-181; Yevtushenko 1998a:280).

Heavily brecciated sediments were broken up prior to excavation using electric jackhammers. A one square meter, alphanumeric grid system was placed over the whole site area and excavations were carried out within these units. Elevation measurements used a single datum. The artifacts and bone from each level were mapped at a scale of 1:10, using a conventional sign system (typology of artifacts, bones, teeth, etc.). Elevations were recorded for the most important finds in each level of each square (tools, flakes, blades, large bones, special samples, etc.) on the maps. All excavated sediments were sieved through nested 5 mm and 1.5 mm screens. Samples for dating were selected from each undisturbed archeological level.

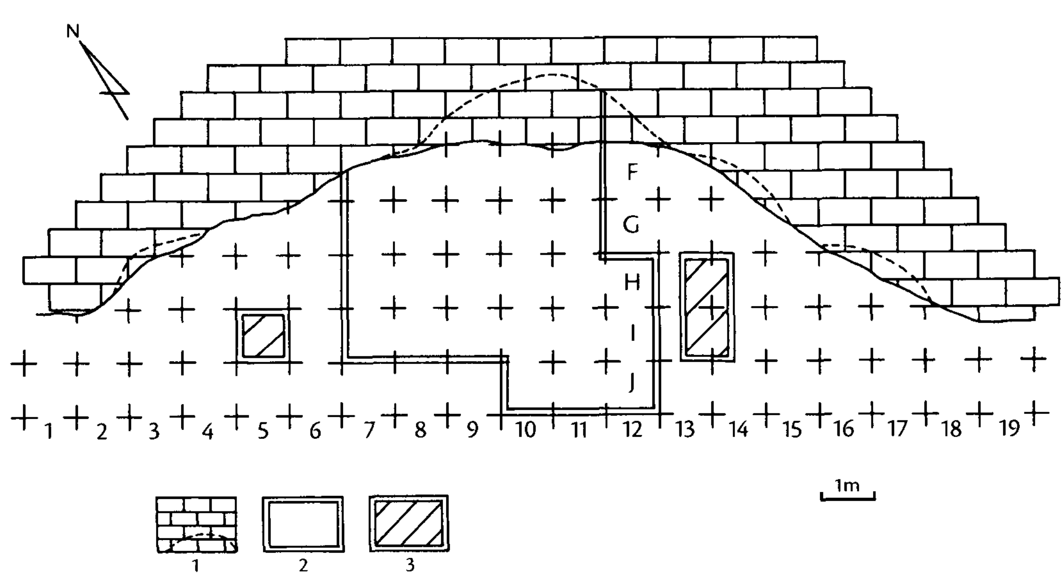


Figure 15-1—Plan of excavated area at Karabi Tamchin: 1–bedrock with karstic flutings; 2–main excavation area; 3–sondages.

Geology

Karabi Tamchin preserves a sedimentary record of rockshelter evolution, beginning with erosion/weathering of the initial shelter into the bedrock cliff. The bedrock is a thickly bedded, hard, micritic limestone, which strikes roughly north–south, and dips ca. 25° east. Over the course of infilling, concurrent with the episodic occupations, sedimentation was dominated by spalling of platy, angular *éboulis* from the roof and walls, interspersed with periods of geochemical weathering (dissolution), pedogenesis, and possible introduction of silt and clay from outside the shelter.

The sedimentary-pedogenic history of the shelter's infilling is registered in three main parts of the stratigraphic sequence (Figure 15-2). The lowermost deposits, resting on bedrock, of strata 7–4 are dominated by platy, angular *éboulis*, intercalated with thin finer-grained units that may reflect eolian or colluvial introduction of sediment during periods of slow *éboulis* accumulation. These deposits, and perhaps some overlying deposits now removed by erosion, were deeply weathered, resulting in the carbonate cementation of the lowermost units, and leaching of the overlying *éboulis*. The zone of cementation did not follow the stratigraphy of the existing sediments, but because it was essentially a pedogenic process conditioned in part by the topography of the bedrock base of the shelter, the zone of cementation cross-cut the buried deposits. As a result, strata are differentially cemented over the excavated area (Table 15-1). Thus,, the condition of the lowest deposits, those having the highest concentration of archeological materials, varies according to the topography of the base of the shelter just prior to deposition and according to the relative post-depositional cementation. Thicker deposits occur in the central part of the excavated area, and this is also where the greatest thickness of the cemented zone is found. Archeological Levels V and IV are concentrated there, with greater numbers of artifacts and bones apparently associated with thin silty beds on bedrock and between the lower platy *éboulis* layers of geologic strata 7 and 6. All of these deposits appear to have been laid down when the backwall of the shelter was forward of its present position, especially in the northwestern part of the shelter, and during the time that the roof of the shelter was the apparent source for most of the *éboulis*.

After those initial occupations, the back-wall of the shelter began to retreat, expanding the area of the shelter towards the cliff, and supplying new volumes of platy *éboulis* that were deposited as part of geologic stratum 4 and most of stratum 3. The line of the former backwall is clearly demarcated in the exposed area of the excavations. It trends from the center of the back part of the shelter to the west–northwest, and delineates the possible extent of the oldest occupation surfaces. Although the shelter became larger as the backwall retreated, increasing rates of *éboulis* deposition may have resulted in lower artifact densities for archeological Levels I-A and I, and also contributed to the disturbance of the shallowly buried materials associated with archeological Levels II/1 and II/2.

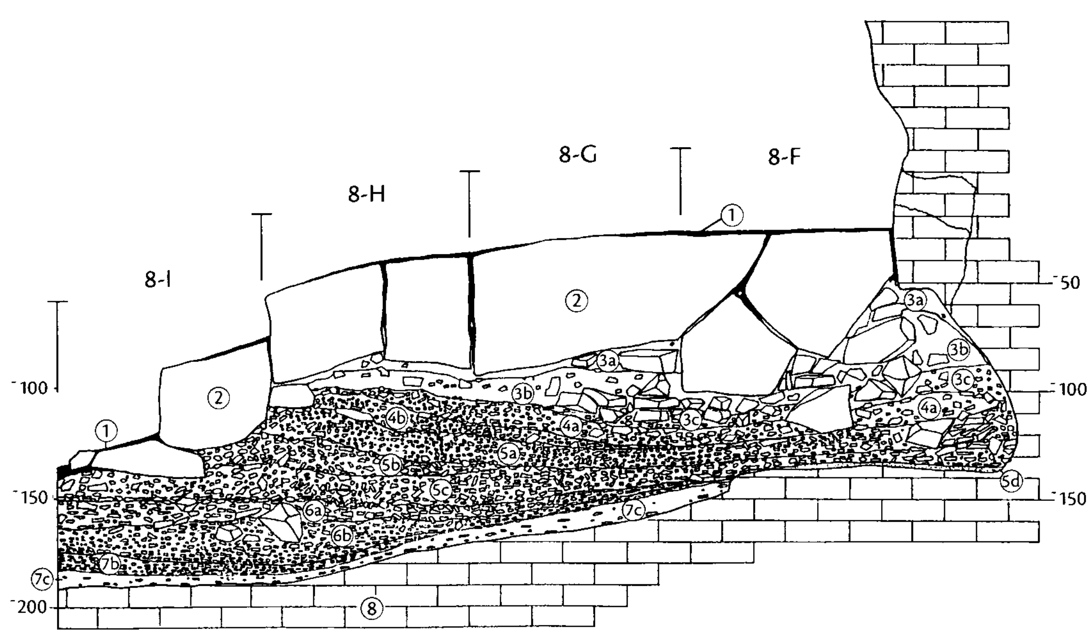


Figure 15-2—Karabi Tamchin: stratigraphic profile of line 8/9 F–I.

TABLE 15-1

Granulometry of Karabi Tamchin; shaded areas indicate the carbonate cemented sediments

Eboulis size fraction (mm)	*Sample depth (cm-bs)*	*Fines % (<2mm)*	*Eboulis wt % (mm)*		*Eboulis roundness*						*Small bone*		*Large bone*	*Bones/ kg*	*Artifacts*	
			2–4	*16–64*	*N*	*v w rnd*	*rnd*	*sub-rnd*	*sub-ang*	*ang*	*N*	*burn %*	*N*		*flakes*	*chips*
	19	21.3	13.8	48.9	174	0.03	0.13	0.16	0.28	0.41	33	0.03	8	43.6	0	0
	32	14.6	10.1	46.1	148	0.01	0.07	0.09	0.18	0.65	75	0.00	24	111.2	1	0
4–16	41	27.4	11.0	45.2	115	0.05	0.18	0.24	0.36	0.17	16	0.00	0	21.9	1	0
	48	21.3	9.8	52.5	71	0.17	0.18	0.20	0.32	0.13	20	0.05	10	49.2	0	1
	55	28.8	13.8	37.5	140	0.13	0.28	0.20	0.25	0.14	215	0.05	18	291.3	3	7
	62	27.6	6.6	46.1	89	0.11	0.19	0.28	0.21	0.20	133	0.06	5	181.6	1	14
	66	Limestone bedrock														
	19				36	0.00	0.06	0.11	0.36	0.47						
	32				39	0.00	0.08	0.13	0.44	0.36						
16–64	41				30	0.07	0.10	0.37	0.43	0.03						
	48				30	0.03	0.07	0.17	0.53	0.20						
	55				32	0.13	0.22	0.19	0.25	0.22						
	62				31	0.06	0.13	0.32	0.45	0.03						

After deposition of geological stratum 3c, *éboulis* deposition essentially ceased, and fine, loamy sediment filled the remainder of the back of the shelter, and an apparently long period of weathering commenced, resulting in the formation of the red soil B horizon that characterizes the upper part of the profile. Minor additional precipitation of pedogenic carbonates probably accompanied this, but with little apparent effect on the deeper buried materials that were already enveloped in the earlier carbonates. Note that the *éboulis* above the cemented zone is considerably more angular than in the cemented zone (Table 15-1). This scenario implies that there were two periods of weathering in the geologic history of the shelter, characterized by different climatic and/or temporal parameters. The earlier period of weathering occurred after the main Middle Paleolithic occupations, and is registered prominently by the rounded *éboulis* and the very strong cementation by pedogenic carbonates. The second weathering took place after the shelter was enlarged by spalling of the backwall. That weathering resulted in formation of a soil with prominent rubified argillic horizons, but little evidence of dissolution-rounding of the limestone *éboulis*. It is possible that this soil may include some colluvial parent material, derived from the surfaces above cliff, which included reddened clay/silt derived from erosion of older soils on the surface of the plateau; this can be investigated by micromorphological study of the soil in the shelter. The sequence of sedimentary and weathering (pedogenesis and dissolution) processes bears on the regional paleoclimatic sequence, as well as on site formation processes. The details of those paleoenvironments have yet to be defined. It is apparent, however, that Karabi Tamchin contains an important geologic framework for continued analyses of past environments and cultural use of the locality in the Upper Pleistocene.

Archeological Stratigraphy

As a rule, the different archeological occupations were separated from each other by thin sterile lenses of *éboulis*. The primary numbering of the archeological levels was based on the several cultural levels seen in stratigraphic sequence in the 1996 test pit. This general archeological sequence was adopted for all of the excavation area, but new levels were defined as needed during the 1999–2001 field seasons.

Level 0 consists of disturbed materials in modern humus (stratum 1).

Level I-A is disturbed materials in stratum 3c.

Level I is artifacts and bones material associated with geologic strata 4a and 4b. The materials of Level I are probably disturbed and were naturally mixed.

Level II/1 comprises the artifacts in disturbed sediments within stratum 5a.

Level II/2 is the compactly deposited artifacts and bones in the middle part of stratum 5c.

Level III occurs at the bottom of stratum 6b, and is separated from Level II/2 by both thick lenses of gravel at the base of stratum 5 and by sterile sediments of the upper part of stratum 6a. In squares 7-F/G, the lower part of these sediments contained strongly cemented *éboulis* of archeological Level III (in stratum 7a). Evidently, the artifacts and faunal remains of Level III are in situ, with little evidence of disturbance.

Level IV/1 is in the upper part of stratum 6b only along lines 7 and 8, while those deposits are archeologically sterile in others part of excavation area. In squares 7/8–H/I, the sediments containing Level IV were thicker than in other excavation areas.

Level IV/2 is associated mainly with the deposits of middle part of stratum 6b. The lower part of these sediments contained cemented deposits ascribed to stratum 7b.

Level IV-A was defined as the artifacts from greyish sediments of the upper part of geologic layer 6b, which filled the small depression into the surface of the cemented *éboulis* (about 1.5 m^2) in the central part of the excavations. Also, small numbers of artifacts (Level IV-A-BR) were found in thin greyish lenses of the lower part of the cemented sediments of stratum 7b.

Level V is heavily cemented sediments of geologic layer 7c, resting on the bedrock surface.

Finds in Level 0, deriving from the modern humus, consist of a mixture of artifacts and faunal remains from the Paleolithic, late Medieval, and, probably, Bronze Ages. The artifacts from the upper deposits, i.e., Levels I-A, I, and II/1, were recovered from disturbed lithological contexts. The materials from these levels are mostly pieces of mammal bones, with a few flint artifacts: too few for any technological and typological study. The cultural horizons of Level IV/1 contain too few artifacts for qualitative typological and technological description. In addition, the materials from Level IV-A were found in natural pits in the surface of the breccia and their origin is, as yet, unclear.

Thus, this preliminary report utilizes only artifacts from the four main in situ cultural levels, all excavated during 1999–2001: Level II/2, Level III, Level IV/2, and Level V. Artifacts are described by A.I. Yevtushenko in Chapter 20 under the same system used to analyze the Middle Paleolithic assemblages of Western Crimea (Chabai and Demidenko 1998), with some modifications.

Chronology and Absolute Dating

Dating the archeological levels Karabi Tamchin has proven difficult. ESR and Uranium-series dates could not be obtained because of the limited thickness of the deposits, their heterogeneous nature, and the presence of standing water in the excavation area. As a result, only AMS dates, obtained from four bone samples, are available.

Four long bone fragments were selected from cultural Levels III and IV for AMS dating after the 1999/2000 field season. Dating was carried out at the Radiocarbon Accelerator Unit, Oxford University (Great Britain).

Two samples from Levels III and IV/2 failed to produce dates because of low collagen yield. The other two provided the following dates:

Level III, square 8-I: OXA-10883, $\delta^{13}C$ = −19.8%, age: > 42,400 uncalibrated years BP.

Level IV/2, square 10-G: OXA-10884, $\delta^{13}C$= −20.1%, age: > 41,200 uncalibrated years BP.

Level V, square 12-I: OXA-11387, $\delta^{13}C$=−21.2%, age: > 29,800 uncalibrated years BP.

Thus, available absolute dates of Karabi Tamchin Level III and Level IV/2 can only indicate that Levels III, IV, and V are older than ca. 41,000 uncalibrated years BP. It is important to note that materials of Level III and Level IV/2 are represented by typologically and technologically distinct lithic industries: the Western Crimean Mousterian (Level III) and the Crimean Micoquian (Level IV/2). Also, materials from Level IV-A, which were deposited between Level IV/2 and Level V, are characterized by Levallois cores and blanks that occur commonly in Western Crimean Mousterian (WCM) industries, while Level V exhibits features of the Crimean Micoquian. WCM occupations at Kabazi II were present for about 20,000 years, from the first Middle Glacial Stadial (pre-Hengelo Interstadial) to the second Middle Glacial Stadial (post-Les Cottés Interphasial), inclusively (Chabai 2000b). Taking into account that the earliest WCM assemblages at Kabazi II Level IIA-2 correspond with the first Middle Glacial Stadial, between Moershoofd and Hengelo (or Vytachiv vt b2-b1, according to the Ukrainian geochronological scheme) (Gerasimenko 1999), the WCM occupations of Level III and Level IV-A at Karabi Tamchin must be as old or older than any of the occupations at Kabazi II.

The oldest Crimean Micoquian assemblages (Kabazi II Units IV-VI) date to the Eemian (Pryluky -Kaydaky) Interglacial (Chabai in press). On other hand, the available AMS dates for Buran-Kaya III Level B1, (28,520 ± 460; 28,840 ± 840460), show that the Crimean Micoquian industries could date as late as the Arcy (Denekamp) Interstadial (Chabai et al. 1998). Thus, the Crimean Micoquian of Karabi Tamchin

Level IV/2 dates well before the end of the Micoquian, but, given the paleoenvironmental data, it certainly does not date to its earliest Interglacial occurrence.

The microfaunal remains from Level II/2, Level III, and Level IV/2 (Markova, Chapter 17) are characteristic of open, steppe-like landscapes, but the sediments comprising the matrix of Level II/2 accumulated during a relatively warm phase, possibly the Bryansk Interstadial (between 33,000 and 24,000 BP). The assemblage of Level V is characterized by the presence of a relatively primitive species of *Ellobius talpinus* and thus, this level may be significantly older than the others, possibly even dating to the Last Interglacial.

Malacological remains at Karabi Tamchin (Mikhailesku, Chapter 19) indicate that Level II/2, III, and IV/2 deposits accumulated during relatively warm interstadial conditions. There is a possibility that Levels III and IV/2 accumulated during different interstadials, while Level II/2 accumulated under more clement conditions, transitional between Level III and modern conditions.

The large mammal taxa identified at Karabi Tamchin are typical of Late Pleistocene, Eurasian steppe biocoenoses (Burke, Chapter 16). The presence of reindeer (*Rangifer tarandus*) in all levels at Karabi Tamchin does not contradict evidence for interstadial conditions cited above. Reindeer are widespread in Crimea throughout the Late Pleistocene and are clearly adapted to mosaic environments (Markova et al. 1995).

The geological data suggest the possible existence of a weathered surface between the brecciated sediments of stratum 7c, which contains cultural Level V, and the overlying sediments. This might constitute evidence of a relatively long period between the accumulations of Level V and Level IV-A–Level IV/2. On other hand, there is no clear evidence for a long sedimentary hiatus between the accumulations of strata 6a and 6b, which contained the assemblages of Level IV/2 and Level III. The sediments containing the assemblage of Level II/2 (stratum 5) might have been deposited a long time after the accumulation of the Level III deposits.

The available chronological information for Karabi Tamchin is still poor. The AMS dates only provide minimal values and the cultural levels might be considerably older than 41,000 BP. The paleoenvironmental data, however, does provide reasonable grounds for stating that the different levels accumulated under interstadial, rather than stadial conditions. Thus, the chronology of Karabi Tamchin might be represented as follows:

Level V – Last Interglacial, or one of the Early Glacial Interstadials (Amersfoort, Brörup, Odderade);

Levels IV/2 and III – no later than the Hengelo Interstadial;

Level II/2 – no later than the Arcy (Denekamp) Interstadial.

Conclusions

Karabi Tamchin is the first known multi-level, stratified Middle Paleolithic site in the Crimean highlands. The archeological sequence includes typologically and technologically distinct assemblages belonging to the Western Crimean Mousterian and Crimean Micoquian industries.

The environment of Karabi Yaila, where plateau/steppe landscapes with a wide variety of grasses abut thickly forested valleys and ravines, was rich in both steppe and forest mammalian species. The faunal remains from the Karabi Tamchin occupations demonstrate the use of a diverse mix of prey species. Human occupants of Karabi Tamchin hunted wild ass (*Equus hydruntinus*) preferentially, while red deer, reindeer, and saiga were also exploited. The remains of other predators, including cave bear, wolf, fox, and cave hyæna, have also been identified (Burke, Chapter 16).

The Main Ridge of the Crimean Mountains receives the most precipitation of any district in Crimea. This climatic feature is responsible for much longer periods of active grass growth in the highlands, which stay fresh until late summer, when the steppes in the foothills to the north become very dry by July. Most herbivores are able to go without a source of fresh water for several days if fresh grasses are available, unless they are lactating. Seasonal migrations of steppe species onto the highland plateaux may have been connected with a search for fresh pastures at the end of summer. Karabi Yaila may have provided relatively fresh fodder through late autumn. Lithic and faunal analyses of Karabi Tamchin suggest that the site was occupied on a short-term basis only, perhaps seasonally during the late summer or fall, as a hunting camp, although there is some disagreement in the time of occupations (Burke, Chapter 16).

Karabi Tamchin provides an important archeological, geological, and paleogeographic framework for continued analyses of the Middle Paleolithic exploitation of highland regions, as well as opportunities for reconstructing past environments.

16

Karabi Tamchin: Faunal Remains

Ariane Burke

This research represents a preliminary analysis of the faunal assemblages from four occupation levels at Karabi Tamchin. The total number of faunal remains recovered from Levels II/2, III, IV, and V, which were excavated during three successive field seasons from 1999 to 2001, is 52,820 pieces (Table 16-1). Faunal identifications were made in the field in 2000 and 2001, a small selection of diagnostic faunal material was identified using reference collections at the Museum National d'Histoire Naturelle, Paris. Unidentifiable bone fragments were sorted to standard size categories and counted with the help of graduate students from the University of Manitoba.

Taxonomic Representation

The faunal assemblages excavated from the four main occupation levels at Karabi Tamchin (Levels II/2, III, IV, and V) indicate the presence of taxa typical of Late Pleistocene, Eurasian steppe biocoenoses including: *Equus hydruntinus, Rangifer tarandus, Cervus elaphus, Saiga tatarica, Bos/Bison* sp., *Hyena crocuta, Vulpes vulpes, Ursus spelaeus*, and *Rupicapra rupicapra* (Table 16-2). These taxa tend to co-occur in upland regions of Eastern Europe, particularly in the Crimean Peninsula and neighboring Caucasus region, during the Late Pleistocene (Markova et al. 1995; Markova, Simakova, Puzachenko, and Kitaev 2002).

The "wild ass" (*Equus hydruntinus*) dominates all levels in terms of the total number of identifiable bone fragments (NISP) (Table 16-2) and in terms of the minimum number of individuals (MNI) (Table 16-3). Reindeer (*Rangifer tarandus*) and red deer (*Cervus elaphus*) are present in smaller quantities but are ubiquitous (Tables 16-2, 16-3). Large artiodactyls include fragments of bone attributable to either red deer or reindeer. Other herbivores present include saiga antelope (*Saiga tatarica*), which is ubiquitous and probably under-represented due to the fragmentary nature of the assemblage (Table 16-4). The small artiodactyl class likely incorporates numerous saiga remains rendered non-diagnostic (to taxon) due to fragmentation. The same might be said of chamois (*Rupicapra rupicapra*), although diagnostic material for this taxon is only encountered in Level IV (Table 16-2). A large bovid (*Bos/Bison*) occurs in Levels II/2 and V. Among the carnivores, the common fox (*Vulpes vulpes*) and hyæna (*Hyena crocuta*) are present in most levels; cave bear (*Ursus spelaeus*) occurs once in Level III. The distribution of bone fragments into size classes appears to confirm the dominance of equids (LM class) while highlighting the continued presence of smaller, saiga-sized prey (S/MM class).

The small MNI values for herbivores in all levels at Karabi Tamchin (Table 16-3) are indicative of short stays and/or small hominid group sizes. The assemblage from Level III is relatively larger than the other assemblages in terms of the total number of individuals present (five *Equus hydruntinus* and two reindeer have been identified). The carnivores are also repre-

TABLE 16-1
Karabi Tamchin: assemblage size and percentage of unidentified bone

	Total	*Unidentifiable*	*% Unidentifiable*
Level II/2	6,998	6,494	92.8
Level III	11,832	10,629	89.8
Level IV	9,392	8,938	95.2
Level V	24,598	24,046	97.8
Total	52,820	50,107	94.9

TABLE 16-2
Karabi Tamchin: taxonomic representation (NISP)

	Level II/2	*Level III*	*Level IV*	*Level V*
E. hydruntinus	51	40	37	18
Cervus	7	3	1	6
Rangifer	5	35	6	1
Saiga	2	5	6	3
Rupicapra	–	–	2	–
Bos/bison	2	0	1	2
Hyena	1	6	–	–
Ursus	–	1	–	–
Vulpes	10	5	3	3
Panthera sp.	–	2	–	–
Lepus sp.	–	1	–	–
Equid	57	126	89	116
Carnivore	4	19	4	1
Large artiodactyl	43	74	23	44
Small artiodactyl	113	263	77	73
MF	–	22	2	–
LM	166	516	132	144
S/MM	21	66	54	14
SM	8	13	6	6

TABLE 16-3
Karabi Tamchin: taxonomic representation (MNI)

	Level II/2	*Level III*	*Level IV*	*Level V*
E. hydruntinus	3	5	3	3
Cervus	1	1	1	1
Rangifer	1	2	1	1
Saiga	1	1	1	1
Rupicapra	–	–	1	–
Bos/bison	1	–	1	1
Hyena	1	1	(1?)	(1?)
Ursus	–	1	–	–
Vulpes	1	1	1	1
Panthera sp.	–	1	–	–

Numbers in parentheses indicate Carnivore cf. *Hyena* only identified in these levels.

TABLE 16-4
Karabi Tamchin: allocation of unidentified bone to size classes (percent of sample)

	<2 cm	*2–5 cm*	*5–10 cm*	*N*
Level II/2	59.0	40.3	0.7	6,494
Level III	62.4	36.9	0.7	10,629
Level IV	57.9	41.2	1.0	8,938
Level V	82.7	16.9	0.4	24,046

sented by very few bones and it is unlikely that the site functioned as a den for either hyæna or bear during the time of deposition of the levels studied here.

Age Classes

Teeth provide a basis for analyzing the mortality patterns for equids in all four of the occupation levels. Remains consist mostly of single (isolated) teeth. Unfortunately, wear stages on isolated teeth can only provide broad age estimates that sometimes overlap two age categories. In this study, equid teeth were assigned a dental wear stage (following Levine 1983) and sorted (where possible) to the following age categories: foal, juvenile, prime adult, and old adult. Age categories were established following significant developmental stages. Foals (birth to 2 years of age) are dependent on their mothers and rarely encountered on their own. Juveniles (between 2 and 5 years of age) are entering their reproductive years and may still be present in mixed mare and stallion herds (especially if female) or may be solitary or living in small bachelor groups (if male). Prime adults are in their peak reproductive years (5–17 years of age for the sexes combined, based on peak reproduction ages in males: 7–11 years; and females: 5–17 years). Old adults (aged over 17 years) are past their reproductive prime and males are unlikely to maintain territories.

In Level II/2 a minimum of three equids are present, including one juvenile, one prime, and one old adult. Level III includes one foal, one juvenile, and three prime aged adults. The presence of three fœtal individuals in this level indicates that the prime adults were female. The probable age of the fœtuses (15–23 weeks of age, see discussion below) indicates that the females, though pregnant, would not have been hindered in their movements. Level IV contains three individuals including one foal and two prime adults. Level V contains a minimum of three individuals, including one juvenile and two prime adults. The age profiles indicate that the exploitation of *E. hydruntinus* was focused on the acquisition of prime adults, specifically mares accompanied by juveniles or traveling in mixed social groups. A prime adult focus, combined with the presence of skeletal elements from all portions of the carcass (see discussion below) indicates hunting rather than scavenging as the mode of acquisition.

Seasonality

Seasonal information for Level III is available on the basis of fœtal equid remains. Three fœtal equids are present in this level. On the basis of data published by Prummel (1987) for fœtal horse, the ages of the three fœtuses in Level III are estimated between 15 and 23 weeks. Given normal reproduction and gestation patterns for wild ass, this means that the mares were probably killed in the fall or early winter. Fœtal bone is also present in Levels II/2 and V but cannot be identified to taxon with any confidence.

Taphonomic Patterning

The faunal assemblages analyzed here are heavily fragmented (Table 16-4). Most of the bone fragments measure less than 2 cm in length and have not been identified to either taxon or size class. The Level V assemblage is the most heavily fragmented, at least partially as a result of brecciation. The effects of brecciaing (and archeological recovery from brecciated levels) are not the only factors affecting bone fragmentation, however. Most bone fragments show a pattern of green-bone fracture and dynamic loading (spiral fractures, impact scars) attributable to human and/or carnivore processing of fresh bone.

Taphonomic patterning indicates that Levels II/2 and III are more likely to have been affected by carnivores than Levels IV and V, and that these latter reflect more direct signs of hominid use of bone (Table 16-5). Gnawing is present to some extent in all levels but is relatively more common in Levels II/2 and III, indicating that carnivores potentially played a greater role in creating the taphonomic signatures for these levels. Gnawed bone, digested bone, end-flaked bone, bone flakes (detached flakes, sometimes digested), and flake scars tend to co-occur. Levels II/2 and III also contain a larger number of carnivore remains by NISP (Table 16-2) and greater diversity of carnivore species. The presence of fœtal bone in these levels indicates that the assemblages were not heavily damaged by carnivore activity, however.

Burned bone is present in Levels III, IV, and V (Table 16-5). Most of the burned bone scored is completely burned, indicating direct exposure to flames; burned bone fragments are generally under 2 cm in length. Fragmentation (Table 16-4) and taphonomic patterns indicate that bone was probably heavily processed in Level V, likely for marrow judging by the number of long bone shaft fragments. The pattern of burning also indicates that bone may also have been burned as a source of fuel (Thery-Parisot 2002). Bone may also have served as a fuel source in Level IV. Burned bone will have been much less attractive to scavengers visiting the site after its human occupants had left (Outram 2001), which could explain the relative lack of carnivore damage in these levels.

TABLE 16-5
Karabi Tamchin: taphonomic patterns

	Level II/2	*Level III*	*Level IV*	*Level V*
Burned	–	20	252	752
Butchered	9	14	9	10
End flaked	11	10	4	6
Gnawed/digested	54	58	23	5
Bone flake	51	77	42	30
Flake scars	3	13	9	5

Human Modifications to Bone

Cut marks or other butchering marks are relatively infrequent (Table 16-5). The lack of butchering data is partly attributable to the poor surface condition of the bone and to post-depositional damage, especially in the lower (brecciated) Levels IV and V. Two bone shaft fragments from Level V showed a pattern of damage consistent with their use as retouchers, but surficial damage to the fragments prevents definitive identification. Similarly, one shaft fragment from Level II/2 showed a small number of repeated, localized impact scars but without additional preparation (striations) and the bone was weathered. Lack of evidence for the use of bone retouchers may be a result of lithic reduction patterns at the site, discussed elsewhere in this volume, which indicate little primary tool production or extensive tool reworking on site.

Element Representation: Equids

Element representation patterns are analyzed for the best-represented taxon—the equids (Figure 16-1). The ratio of lower to upper teeth (per level) indicates that whole skulls (including mandibles) were transported to the site in Levels II/2, III, and IV (the ratio approaches 1 in each case), whereas in Level V, a ratio of 1.55 indicates that mandibles were either transported or have preserved preferentially. Figure 16-1 also indicates that entire carcasses were likely processed at the site in Levels II/2, III, and IV. The kill sites, therefore, must have been a relatively short distance from the shelter and hominids had preferential access to the kills. The same figure (Figure 16-1) indicates that podial and axial elements are under-represented in Level V, which may indicate that fragmentation and burning has removed these smaller (podial) and more fragile (axial) elements. It could also indicate that elements of greater utility were being preferentially transported to the site, which would explain the ratio of lower to upper teeth. In the latter case, the distance to kill-sites may have been greater but preferential access is still indicated. The highly fragmented nature of bone in Level V (Table 16-4) makes any further conclusions tenuous.

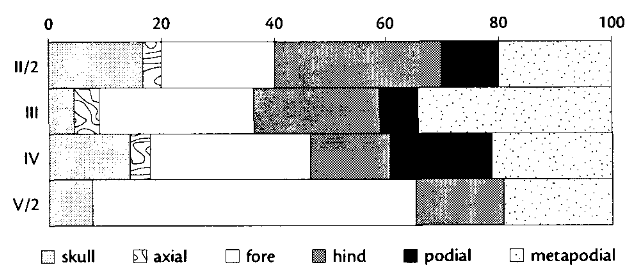


Figure 16-1—Karabi Tamchin: element representation for Equids (cumulative percentages).

Epiphyseal portions of equid limb bones are distinctly under-represented; the processing of limb bones for marrow and the use of bone for fuel likely resulted in an over-representation of shaft fragments and the destruction of spongy bone. Equid long bones are a relatively important source of bone grease (Lam 1999) and this is probably reflected in the degree of shaft fragmentation seen in the assemblages.

Spatial Distribution of Bone

The spatial distribution of bone material in Levels II/2 and IV is not very focused (Figure 16-2). The lack of spatial focus may indicate a lack of spatial organization or the presence of palimpsests, but this remains to be tested. In Levels III and V, faunal remains are more spatially focused, despite the fact that these are numerically larger assemblages. Bone tends to concentrate in the central part of the shelter in Level III, and towards the front of the shelter and centrally in Level V (Figure 16-2). The presence of burned bone concentrations in Level IV, in squares 9I and 10G, and in squares 10H and 11H in Level V, may indicate the presence of hearths inside the shelter or hearth-cleaning episodes.

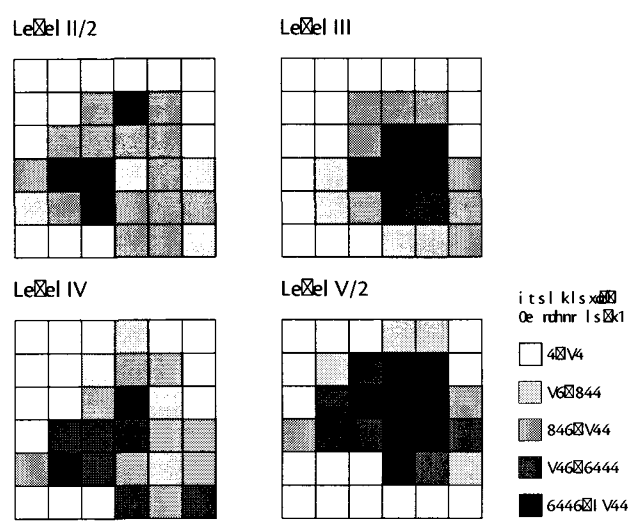


Figure 16-2—Karabi Tamchin: spatial distribution of bone.

Environmental Reconstruction

The presence of *E. hydruntinus* and *S. tatarica* at the site is consistent with broad plateaux and open grassland or steppe communities, while also reflecting a regional (Crimean) focus on the acquisition of these species, for example at sites like Starosele, Kabazi II, and Kabazi V (Burke 1999a, 1999b; Patou-Mathis 1999). The presence of reindeer at Karabi Tamchin is indicative of tundra-like landscapes or wooded (coniferous) tundra (Kahlke 1999). Reindeer were widespread in Crimea throughout the Late Pleistocene and clearly adapted to mosaic environments (Markova et al. 1995).

Red deer (*Cervus elaphus*) tolerate a wide range of habitats including open, mountainous country (Skovlin 1982), but prefer forested belts in elevated regions (Markova et al. 1995). Although red deer are distributed in open, mountainous terrain today (e.g., in the British Isles), these are managed herds in highly anthropogenic landscapes and it seems more likely that the occupants of Karabi Tamchin were exploiting smaller groups of red deer on wooded or partially wooded slopes below the site.

Chamois (*Rupicapra rupicapra*) is often used as an indicator of mountain environments, but this species is also known to frequent karst features in mid to low altitudes (Miracle and Sturdy 1991) where its surefootedness comes into play. The presence of chamois in Level IV at Karabi Tamchin is a reflection of the karstic nature of Karabi plateau, which lies above the site, rather than the proximity of the first Crimean Mountain range.

The environment that can be reconstructed around Karabi Tamchin on the basis of malacological and microfaunal analyses reflects the local setting of the shelter at the foot of a rocky escarpment, above a river valley. The microfauna indicate generally open conditions around the site (Markova, Chapter 17). Rocky and forest-steppe species dominate the snail assemblages in Levels II/2 and IV, while Level III contains relatively more steppic elements (Mikhailesku, Chapter 19). Conditions in Level IV were relatively humid, while Level III appears to have accumulated under temperate conditions, but relatively colder than today (Mikhailesku, Chapter 19). The malacological data reflect probable interstadial conditions, while both the malacological and microfaunal data indicate that Level II/2 was deposited during a warm phase.

Regardless of the apparent shifts in climate indicated by the microfauna and malacofauna, the large mammal fauna indicate a continuing focus on animal resources from the more open landscapes on the plateau above the site. The steep sloped ravine below the site probably excluded wild ass and saiga, since these species tend to prefer even, hard and unbroken terrain. The dominance of wild ass in all assemblages, and the ubiquity of saiga and reindeer, indicates that the plateau above the site was probably accessible during each of the occupation phases and remained a focus of animal procurement.

Discussion

The minimum number of individual prey present in each level (Table 16-3) indicates that Karabi Tamchin was probably only used for short periods of time by small numbers of people. This is consistent with evidence that carnivores also used the site, particularly in Levels II/2 and III. The relatively large assemblages from Levels III and V (Table 16-1) may indicate either longer periods of occupation, more than one period of occupation per level, or the presence of larger groups. In Level V, assemblage size is probably inflated by the degree of fragmentation, however.

Taphonomic patterns indicate that whole equid carcasses were intensively processed on site. Element representation patterns for Level V, where upper teeth, axial, and podial elements are under-represented (Figure 16-1), could be due either to selective transportation of bone for marrow processing, or to destructive processes such as burning of bone, combined with depositional and post-depositional breakage. In general, mortality and element representation patterns indicate that equids were hunted, with a focus on the acquisition of prime-aged adults. The killing of both adult mares and juveniles (e.g., in Level III) indicates that hominids were probably stalking mixed herds of mares and young—though whether the assemblages reflect single hunting episodes or successive hunting events is unclear.

The environmental information that has been obtained for the site based on large mammal remains is consistent with what is known for the Late Pleistocene of Crimea, while microfaunal and malacological data indicate interstadial conditions. Evidence for fall/winter occupations at a relatively high altitude (the site is situated slightly less than 800 meters above mean sea level) near the first Crimean Mountain chain is more understandable given this evidence.

Taphonomic signatures for levels containing Crimean Micoquian lithic assemblages (Levels V and IV) and levels containing Western Crimean Mousterian lithic assemblages (II/2 and III) are somewhat different, particularly with respect to the possible use of bone as fuel. However, the site appears to have had essentially the same function during successive occupations. The plateau above the site seems to have provided the occupants of Karabi Tamchin with most of their faunal resources, while the presence of red deer, combined with the use of flint cobbles from the riverbed below the site (Yevtushenko, Chapter 20) indicates that hominids were also exploiting resources from the valley below the site. Hominids likely occupied Karabi Tamchin for brief periods of time; the small lithic assemblages (Yevtushenko, Chapter 20) and the faunal evidence presented above indicate that hunting and the processing carcasses were the main activities carried out at the site.

17

Rodent Fauna from the Middle Paleolithic Site of Karabi Tamchin

Anastasia K. Markova

The sample of small mammal remains that is the focus of this study was obtained during excavations at the site of Karabi Tamchin conducted in 1999 and 2000 by Dr. A. Yevtushenko and Dr. A. Burke. Karabi Tamchin is located in the first range of the Crimean Mountains, on the Karabi Tamchin plateau, in the Tamchin River basin (44°55'N; 34°27'E). The altitude of the Karabi Tamchin rockshelter is about 800 m, and the elevation of the site above the Tamchin River water level is about 100 m. The site includes five cultural levels: Levels II/2 and III are Western Crimean Mousterian, while Levels IV and V are Crimean Micoquian. The available ^{14}C dates indicate only the minimum ages of Level III and Level IV. They are OXA-10883 (2000-L3-8/1), bone, $\delta^{13}C$ = −19.8%, age > 42,400 uncalibrated years BP and OXA-10884 (2000-L4-10/6), bone, $\delta^{13}C$ = −20.1%, age > 41,200 uncalibrated years BP.

Material and Taphonomy

Small mammal bones were collected during the screening and washing of sediments from the cultural levels. The bone remains from the 1999 and 2000 field seasons were given to the author in 2001 for identification.

Microfaunal bones in Karabi Tamchin are rather well preserved, but their concentrations in all of the cultural levels are very low, which may be the result of the deposits' coarse composition. Bone accumulations in sites of this type are connected to the hunting activities of owls, which nest on crags above sites and in rockshelters (Gromov 1955, 1961). These birds tend to hunt small mammals found mainly in open areas. The small mammal composition of the Karabi Tamchin fauna represents this kind of owl activity. Since the hunting ranges of owls can encompass several kilometers, the microfauna identified in the site of Karabi Tamchin reflects the natural conditions of a wide area around the site, not just the local environs inside the rockshelter.

The small mammal fauna in Karabi Tamchin is limited to rodent species (Rodentia). Remains of Insectivora, Chiroptera, and Lagomorpha were not found in this site.

Species Composition and Ecology of the Fauna

The sample sizes and contents of the small mammal material from this analysis of Karabi Tamchin is presented in Table 17-1.

Level V

The oldest fauna was found in cultural Level V. Two species were identified in this level: the northern mole-vole *Ellobius* and the "obscurus" vole *Microtus obscurus* (Table 17-1).

Microtus lower first molars from Level V have a complicated structure with additional angles on the posterior loop of the anteroconid complex (Figure 17-1: *1, 2*). Such morphology is characteristic of *Microtus obscurus* (Markova 1999).

The morphology of the first lower molar of *Ellobius* from Level V of Karabi Tamchin has one primitive feature (Figure 17-1: *3, 4*): the so-called "prismatic" fold located on the anteroconid complex, which is rarely found in modern and Late Valdai-age *Ellobius talpinus* teeth. In addition, *Ellobius* remains that have been analyzed from other Crimean Paleolithic sites do not have this particular feature (Markova 1999). This feature is also not characteristic for the modern mole-vole *Ellobius talpinus* that now inhabits the Crimean Peninsula (Figure 17-2). The lower first molar of *Ellobius* from Level V is small (length = 2.80 mm, width = 1.20 mm). The sizes of the m1 of modern *Ellobius talpinus* from the Crimean Peninsula are larger, with a length minimum, mean, and maximum of 2.90 mm, 3.20 mm, 3.30 mm (n = 10) and width of 1.35 mm, 1.39 mm, 1.45 mm (n = 10). It is possible that the archaic characteristics seen in the Karabi Tamchin *Ellobius* material indicate a relatively ancient age for Level V. The lower first molar of *Ellobius* from Level V has some similarities to the m1 of the subspecies *Ellobius talpinus tanaiticus* (which now inhabits regions of

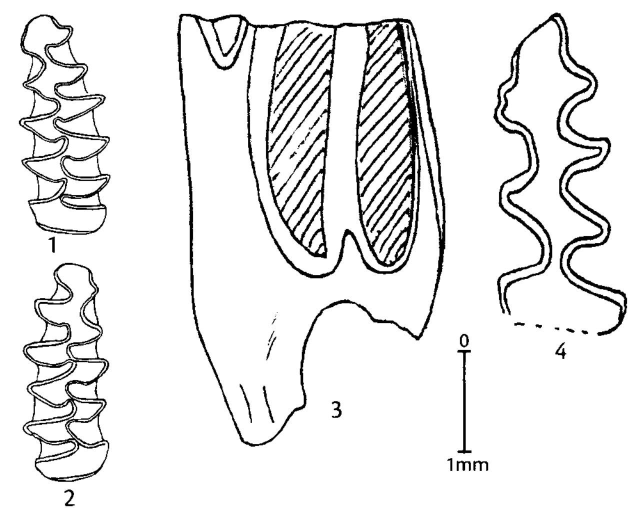


Figure 17-1—Karabi Tamchin Level V: *1, 2*–m1 of *Microtus obscurus*; *3*–m1 of *Ellobius* cf. *talpinus* (lateral side); *4*–m1 of *Ellobius* cf. *talpinus* (occlusal surface).

Table 17-1
Species composition of rodents from Karabi Tamchin and their sample content

Species	*Ecological group*	*Level II/2 (1999)*	*Level III (2000)*	*Level IV (1999)*	*Level V (2000)*
Ellobius cf. *talpinus* Pallas, northern mole-vole	open landscapes	—	—	—	1 m1
Ellobius talpinus Pallas, northern mole-vole	open landscapes (steppes, forest-steppes)	mandible with m1–m3, 1 M3, 2 incisors	—	—	—
Cricetulus migratorius Pallas, grey hamster	open landscapes (steppes)	1 m1	—	—	—
Eolagurus luteus Eversmann, yellow steppe lemming	semi-deserts, deserts, dry steppes	—	1 m1	—	—
Microtus obscurus Eversmann, "obscurus" vole	steppes, meadows	3 m1, mandible with m1–m2, maxilla with M3, 12 molars, 20 incisors	5 m1, 1 m2, 3 M2, 1 M1, 10 incisors	incisor	2 m1, incisor
Total N of species		3	2	1	2

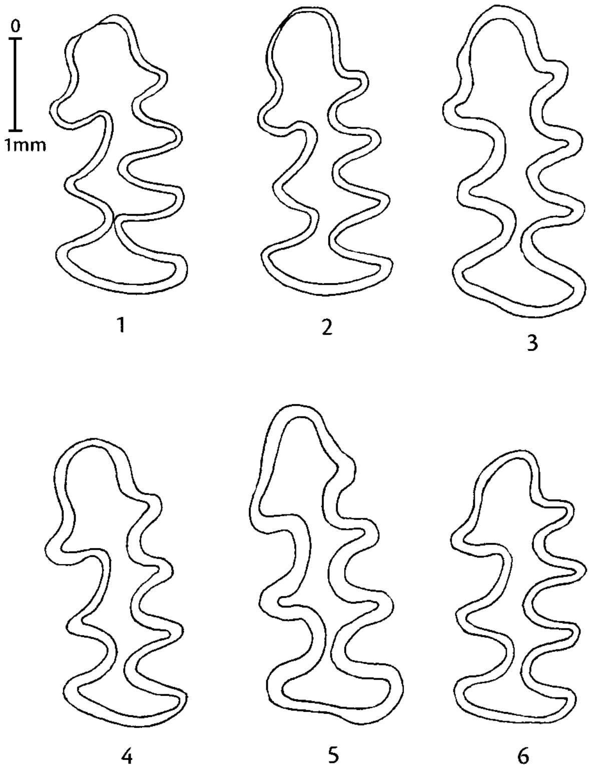


Figure 17-2—Lower first molars (m1) of modern *Ellobius talpinus* from the southern Russian Plain and Crimea. (Zoological Institute RAS, St. Petersburg collection.)

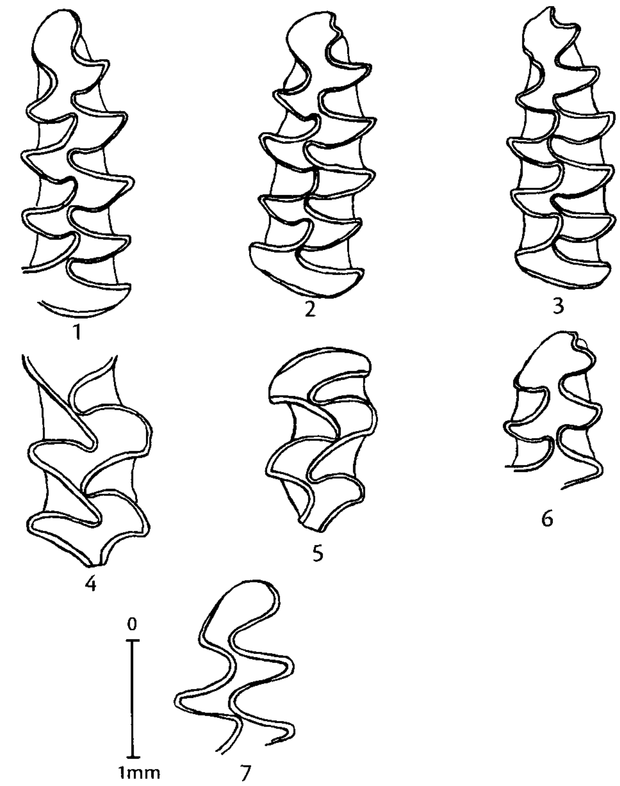


Figure 17-3—Karabi Tamchin Level III: *1-3*, 6–m1 *Microtus obscurus*; 4–M1; 5–M2 *Microtus obscurus*; 7–m1 *Eolagurus luteus*.

southern Ukraine and the northern Caucasus) and also to *Ellobius talpinus transcaspiae* (whose range is far to the east of Crimea, in Turkmenistan). The find also resembles the Early Pleistocene Crimean *Ellobius* remains described by Prof. W. Topachevski (1973). The single molar of northern mole-vole in this level seems best identified as *Ellobius* cf. *talpinus*.

Modern *Ellobius talpinus* prefers meadow-steppes and slopes of valleys with rich steppe vegetation and rather soft soils. It does not inhabit the feather grass steppes and wormwood feather grass steppes (Ognev 1950). *Microtus obscurus* likewise prefers open meadow-steppe landscapes.

The ecology of *Ellobius* cf. *talpinus* and *Microtus obscurus* suggests that during the deposition of Level V, the site environs were open meadow-steppe landscapes. Given the rarity of microfaunal remains in this level, however, they provide only a partial indication of the environment at this time.

Level III

Level III contained only the remains of *Microtus obscurus* ("obscurus" vole) and *Eolagurus luteus* (yellow steppe lemming).

The molars of *Microtus obscurus* have features typical of this species (Figure 17-3: *1-6*). The yellow steppe lemming lower first molar has a juvenile appearance and may belong to a young animal (Figure 17-3: *7*). Yellow steppe lemming is a typical open landscape animal, preferring semi-deserts, dry steppes, and even deserts. During the present time, *Eolagurus* exists only in Middle Asia, Mongolia, and China, but during the Last Glacial, its range was very wide and included the central and southern Russian Plain and Crimea. During historical times, the *Eolagurus luteus* range included the areas westwards, up to the Ural River. This species was typical for the so-called "mixed" periglacial faunas, not only of the Valdai glaciation, but also for earlier glaciations. Yellow steppe lemming was also found in the interglacial faunas of Eastern Europe. The modern *Eolagurus* prefers to inhabit desert steppes, sandy semi-deserts, and deserts (Gromov and Erbaeva 1995). During the deposition of Level III at Karabi Tamchin then, such areas were present near the site, and *Eolagurus* might have inhabited slopes with a southern exposure.

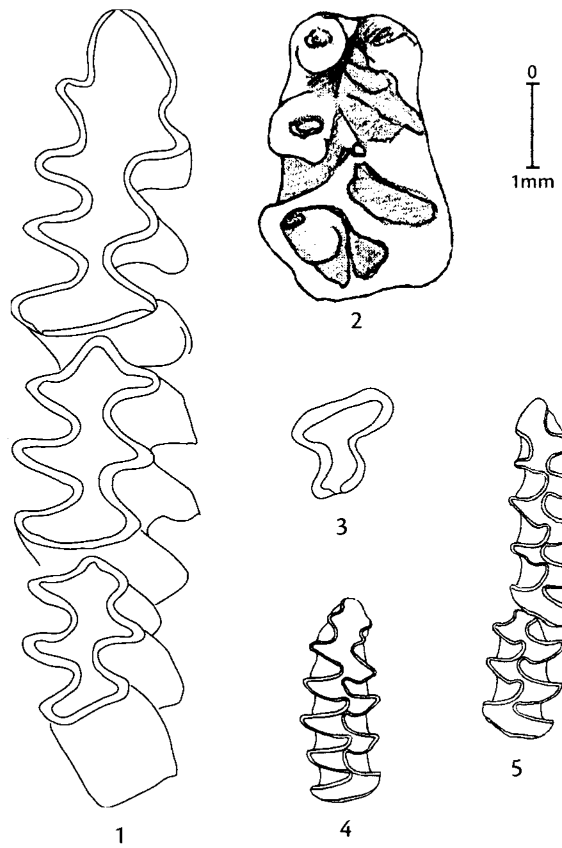


Figure 17-4—Karabi Tamchin Level II/2: *1*–m1 to m3 *Ellobius talpinus*; *2*–m1 *Cricetulus migratorius*; *3*–M3 *Ellobius talpinus*; *4*–m1 *Microtus obscurus*; *5*–m1 and m2 *Microtus obscurus*.

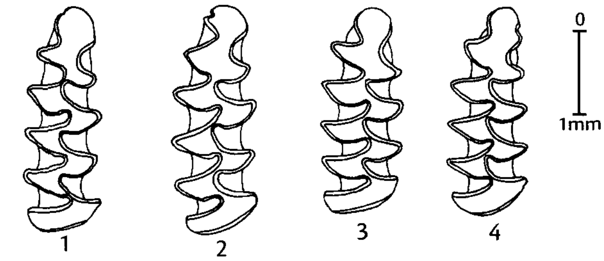


Figure 17-5—Lower first molars of modern *Microtus obscurus* from Crimea National Park (Zapovednik). (Zoological Museum, Moscow State University collection.)

Level II/2

Microfauna in Level II/2 includes remains of three species: *Ellobius talpinus*, *Microtus obscurus*, and *Cricetulus migratorius*. The *Ellobius talpinus* in this level (Figure 17-4: *1*, *3*) differs morphologically from the *Ellobius* remains in Level V. *Ellobius talpinus* prefers open landscapes, mostly steppes and forest-steppes with rich soils. This species constructs deep burrows. *Microtus obscurus* (*M. arvalis* group) inhabits steppes and meadows (Figure 17-4: *4*, *5*). *Cricetulus migratorius* (grey hamster) prefers open landscapes of different types, from forest-steppes to semi-deserts. Its most favorable habitats are plains and mountain steppes (Figure 17-4: *2*).

As a whole, the fauna of this level indicates open steppe and meadow landscapes. All of the species distinguished in Level II/2 presently inhabit Crimea.

Conclusions

The small mammal fauna from Karabi Tamchin unfortunately is quite limited: only four rodent species were identified from the site. Thus, it is difficult to use this information for the reconstruction of the exact ecological conditions during the deposition of the cultural levels. The morphological features of the remains from the oldest Level V suggest a significant age for this level.

The remains of forest and cold-tolerant species were not found in the cultural levels. Only rodents inhabiting open steppe and meadow landscapes have been identified in the site. Thus, such landscapes consistently existed near the site during human occupation. It should be taken into account, however, that the small mammal bone material in Karabi Tamchin was accumulated from the decomposition of bird pellets, mostly owl pellets. The hunting ranges of these predators include mostly open areas and extend several kilometers around the nest (Andrews 1990). Thus, the prevalence of animals of open landscapes in the deposits of Karabi Tamchin may be explained in part by this factor. However, previous studies of small mammal faunas from other Middle Paleolithic sites in Crimea have shown that remains of forest animals were found in several of them. This is the case in Kabazi V, in Starosele (Level 1), in Buran-Kaya III (Layer B and Level C), and in Kabazi II (Unit VI) (Markova 1999, Chapter 3 of this volume). Environmental changes are therefore reflected by the specific composition of the small mammal faunas, and during the extension of forested areas near the site, forest animal remains were also accumulated in the site.

The impressions gained from the mollusk data about environments near the Karabi Tamchin site (Mikhailesku, Chapter 19) differ from ours. This fact could be explained by the different ways in which mollusk and mammalian remains were accumulated in the cultural levels. If the mammalian fauna reflects an extensive area around the site (several kilometers), the mollusk fauna reflects the conditions inside the rock-shelter. The results of both analyses supplement each other, providing a picture of both local conditions in the site (mollusk fauna), as well as the surrounding landscapes (mammal fauna). The results of the large mammal faunal analysis play a very important part in these reconstructions (Burke, Chapter 16). A realistic picture of the environments and their changes during human occupations of the site may be obtained only after analyzing the results of all paleontological studies jointly.

The absence of cold-tolerant small mammals in the Middle Paleolithic sites of Crimea, including Karabi Tamchin, indicates moderate climatic conditions in Crimea during oxygen isotope stage 3 (65,000–25,000 BP). This absence may be explained by the southerly location of Crimea as well as by the rather moderate climate during stage 3 in general—the warmest period during the last glaciation. Recent climatic reconstructions have revealed a poor development of the ice sheet during this time, which was located only in Scandinavia (Arnold et al. 2002). The Russian Plain mammalian and floristic data gathered for the last part of the OIS-3 (Bryansk Interstadial, 33,000–24,000 BP) indicate that southward from 48°N, the influence of glaciation was weak and pronounced mostly in the species composition of large mammals, some of which have a wide range and plastic ecology (*Rangifer tarandus* and *Mammuthus primigenius*, for example) (Markova, Simakova, Puzachenko, and Kitaev 2002). The reconstruction of the range of permafrost on the Russian Plain during last Valdai glacial maximum also shows the absence of permafrost southward of 48°N (Nechaev 1985). Undoubtedly, the southern limit of permafrost had to have been more northerly during the warmer OIS-3. The Crimean Mountains, along with the Caucasus and Carpathians, were refugia for many warm-tolerant animals during late Valdai glacial maximum. This suggests that there were moderate climatic conditions and numerous localized biotopes in these mountains, which permitted plants and mammals adapted to mild conditions to exist there (Markova, Simakova, and Puzachenko 2002). The fairly stable and moderate climatic conditions were also comfortable for the Middle Paleolithic human inhabitants of the Crimean Mountains during the middle Valdai.

18

Aves from Karabi Tamchin

Gleb Gavris & Svetlana Taykova

Fifty-three bone fragments found in Karabi Tamchin could be attributed to fossil birds, only a very small portion of the osteal material discovered during the excavation of the site. These specimens were found throughout the four levels of Middle Paleolithic deposits. The comparative collection of Paleontological Museum of the Ukrainian Academy of Sciences was used as an aid in the identification of the bird remains. Nineteen of the avian bones were identified to species, and five fragments to genus. The unidentifiable remains include bone shafts (11), phalanges (3), spondyles (3), and ribs (2). Some of the bones have slightly damaged surfaces ("flattened" by water), rendering their identification very difficult or practically impossible.

The identified avian remains in Karabi Tamchin belong to eleven bird species. Most of the fragments (30) were recovered from Level II; this layer also contained the greatest number of bone fragments (8), belonging to four species (Table 18-1). The same number of species was found in Level III.

The analysis of the fossil bird remains by their ecological groups does not show any essential differences between the lower (III, IV) and upper levels (I, II) of the site (Table 18-2). Species that typically inhabit meadow-steppe and rocky landscapes prevail for the most part. Forest species occur in insignificant numbers and are mainly represented by birds of prey. Waterfowl are absent.

The majority of the eleven identified fossil bird species have present-day analogues that breed, migrate, or winter on the Crimean Peninsula (Kostin 1983). Only *Pyrrhocorax graculus* does not presently occur in Crimea or anywhere in Ukraine. On the other hand, such species as *Alectoris chukar* and *Sturnus roseus* hardly ever breed anywhere in Ukraine, except in Crimea.

Order: Falconiformes
Family: Accipitridae
Species: *Aquila clanga* Pallas 1811
Provenance: Level II/2, Square 10-F
Material: right radius
Description: the proximal part of the bone is present. Unfortunately, this fragment is very damaged ("flattened") by water activity. Though this damage complicates identification, the size and form of the bicipital tubercle permitted identification. This species is particularly similar to *Aquila pomarina* (lesser spotted eagle), the female bones of which are similar in size to the male bones of *Aquila clanga* (greater spotted eagle).

During the present day, the greater spotted eagle rarely occurs in Crimea and only during migrations. The nearest nesting places of this typical forest species are in the forest zone of Ukraine (Red Data Book of Ukraine 1994). A few pairs of the spotted eagle probably lived in the forests of the Crimean Mountains as late as the nineteenth century (Kostin 1983).

Order: Falconiformes
Family: Falconidae
Species: *Falco peregrinus* Tunstall 1771
Provenance: Level IA, Square G
Material: left ulna
Description: the distal part of the bone has been preserved.

TABLE 18-1
Species list and number of bird remains from Karabi Tamchin

Species	*Level I*	*Level II*	*Level III*	*Level IV*
Aquila clanga Pall. (lesser spotted eagle)	–	1	–	–
Falco peregrinus Tunst. (peregrine falcon)	1	–	–	–
Falco vespertinus L. (red-footed falcon)	–	–	–	1
Alectoris chukar (J. E. Gray) (chukar)	–	–	1	–
Perdix perdix (L.) (grey partridge)	1	4	1	–
Melanocorypha yeltonensis (J.R. Forst.) (black lark)	–	–	–	2
Sturnus roseus (L.) (rosy pastor)	–	–	–	1
Pica pica (L.) (magpie)	–	1	–	–
Pyrrhocorax graculus (L.) (Alpine chough)	–	2	–	–
Corvus monedula L. (European jackdaw)	–	–	2	–
Plectrophenax nivalis (L.) (snow bunting)	–	–	1	–
Accipitridae sp.	–	1	–	–
Corvidae sp.	–	1	–	–
Passeriformes sp.	–	1	1	–
Aves indeterminate	4	19	6	1

Presently, the peregrine is a non-migratory bird of the Crimean Mountains. This species prefers rocky landscapes for nesting. In other parts of Ukraine, *Falco peregrinus* occurs very rarely and has practically disappeared from the region.

Order: Falconiformes
Family: Falconidae
Species: *Falco vespertinus* Linnaeus 1766
Provenance: Level IV, Square 11-G
Material: left coracoid
Description: this is the sternal end and part of the scapular fragment of the bone.

This species nests in and migrates to Crimea in the present day. It inhabits open landscapes in forested areas and river valleys. The red-footed falcon occupies rocky environments only during its migrations.

Order: Galliformes
Family: Phasianidae
Species: *Alectoris chukar* (J. E. Gray 1830)
Provenance: Level III, Square 10-H
Material: left carpometacarpus
Description: the carpometacarpus is a distal fragment. This specimen is typical of Galliformes and in all ways resembles the genus *Alectoris*.

The fragment is ascribed to the species *Alectoris chukar*, since in the ornithological systematics of Eastern Europe it is an allospecies of the overspecies group. This group also includes the western Palearctic form of *Alectoris graeca* (Meisner) (Stepanyan 1990). In Crimea, chukar (Indian partridge) inhabits rocky landscapes where it lives year-round.

Order: Galliformes
Family: Phasianidae
Species: *Perdix perdix* (Linnaeus 1758)
Provenance: Level I, Square G–left tarsometatarsal; Level II/2, Square 10-G–left coracoid, right ulna, right tarsometatarsal, sternum; Level III, Square 9-G–right tarsometatarsal
Material: left tarsometatarsal, left coracoid, right ulna, right tarsometatarsal, sternum, right tarsometatarsal
Description: The tarsometatarsals from Levels I, II/2, and III are all distal fragments. The coracoid from Level II/2 includes the scapular part of the bone. The ulna is a distal fragment.

The remains of this species are the most numerous among the fossil bird bones of Karabi Tamchin (Table 18-1). Today, the grey partridge is a common non-migratory species of Crimea, living in steppe environments and arable lands.

Order: Passeriformes
Family: Alaudidae
Species: *Melanocorypha yeltonensis* (J. R. Forster)
Provenance: Level IV, Square 10-G
Material: right humerus and mandible
Description: the humerus is a distal fragment. The mandible is a fragment of the right mandibular ramus, with the lateral mandibular process.

Today, the black lark appears infrequently during winter in Crimea (Kostin 1983). It occurs mainly in the steppes and salt marshes of Kazakhstan, the Aral-Caspian plain, and east of the Volga River (Stepanyan 1990). To the west, its distribution reaches the Rostov District of Russia.

Order: Passeriformes
Family: Sturnidae
Species: *Sturnus roseus* (Linnaeus 1758)
Provenance: Level IV, Square 10-H
Material: right ulna
Description: the ulna is a distal fragment.

Currently, the rose-colored starling (rosy pastor) occurs in Crimea and prefers to nest in colonies in rocky landscapes. This species nests periodically in the Azov coast region as well.

Order: Passeriformes
Family: Corvidae
Species: *Pica pica* (Linnaeus 1758)
Provenance: Level II/2, Square 11-I
Material: right tibiotarsus
Description: this is a proximal fragment and includes the *cricta fibularis*.

This species now occurs throughout the Crimean Peninsula. It inhabits the Crimean steppe and northern piedmonts. The black-billed magpie is a common non-migratory bird in all parts of Ukraine.

Order: Passeriformes
Family: Corvidae
Species: *Pyrrhocorax graculus* (Linnaeus 1758)
Provenance: Level II/2B, Square 8-H
Material: left femur
Description: proximal and distal parts, the two fragments belong to the same bone. Morphologically, its structure is characteristic of the species *Pyrrhocorax graculus*.

The Alpine chough, a yellow-billed member of the crow family, is a high-mountain species that nests only in the upper belts of mountains. In the winter, it descends into river valleys where berry-producing scrub is present. Presently, this species is found neither in Crimea nor Ukraine; it inhabits the mountains of Central Europe and Southern Asia.

Order: Passeriformes
Family: Corvidae
Species: *Corvus monedula* Linnaeus 1758
Provenance: Level III, Square 10-E–right humerus; Level III, Square 10-H–left coracoid
Material: right humerus, left coracoid
Description: the humerus consists of a distal fragment and a damaged proximal fragment. The coracoid is a fragment of the scapular end of the bone.

Today, this species is a common non-migratory bird of Crimea and Ukraine. European jackdaws have adapted quite well to urban life and commonly nest on buildings; they will also nest in forested areas, rocks, and breaks.

Order: Passeriformes
Family: Emberizidae
Species: *Plectrophenax nivalis* (Linnaeus 1758)
Provenance: Level III/2, Square 7-I
Material: right carpometacarpus
Description: the carpometacarpus is almost intact, but the *os carpometacarpal III* is absent.

This species is a typical inhabitant of the tundra zone of the far north and Arctic coast. It can nest in northern river breaks and rocks (Stepanyan 1990). In Crimea, the snow bunting is seen only in winter.

TABLE 18-2
Ecological groups of avian remains from Karabi Tamchin

Ecological group	*Upper levels (I–II)*		*Lower levels (III–IV)*	
	N	%	N	%
Forest	2	20.0	1	11.1
Meadow-steppe	5	50.0	4	44.4
Rock	3	30.0	4	44.4

In sum, the range of avian species so far identified from the Middle Paleolithic site of Karabi Tamchin in the mountainous region of Crimea is consistent with those found there today, particularly those birds that like rocky and steppe environments. They are either year-round residents or migratory residents that visit Crimea during the winter months. The single exception is *Pyrrhocorax graculus*, the Alpine chough, which now lives in colder climes. This, and the paucity of forest-adapted birds, suggest that during the occupation of Karabi Tamchin, the area around the site was colder and less forested than it is today.

19

Snails from Karabi Tamchin, Buran-Kaya III and Chokurcha I

Constantine Mikhailesku

This report summarizes the results of malacological analyses at the sites of Karabi Tamchin, Buran-Kaya III, and Chokurcha I. The principal goals of this study of fossil snails and freshwater mollusk fauna are: (1) to define the species composition for each Mollusca assemblage from each cultural level, (2) to determine differences among the assemblages, and (3) to elucidate the paleoenvironments surrounding each site through time, as related to climatic fluctuations.

Traditional methods of snail sample selection were used on the sediments from each archeological horizon, as well as from archeologically sterile horizons. The sample selection began with the preliminary screening of sediments through 5 mm screens. A selected portion was then screened through 1.5 mm screens and the resulting fraction (between 1.5 and 5 mm in size) was washed, using the same 1.5 mm screens. Occasionally, if shells smaller than 1.5 mm were found, a 1 mm screen was also used. (This was the case for certain horizons at Karabi Tamchin, which contained very small shells of *Caecilioides acicula* and *Caecilioides raddei*.) After the sediments were washed and dried, the snail remnants were selected. Since snail shells are very fragile, most were selected directly from the screen during the dry or wet screening. Due to the poor recovery of fossil snails using this methodology in the 1996 Buran-Kaya III excavations, during the 2001 season, all sediments were water-screened through graduated sieves (5 mm to 1 mm).

The sampling methods, principal ecological groups of Crimean snails, as well as the environmental and morphometrical parameters of the identified species, have been described by Mikhailesku (1999). The following references and descriptions were used for the identification of fossil snails: Pusanov (1925, 1926, 1927), Lozek (1946), Likharev and Rammelmeier (1952), Akramovski (1976), Puissegur (1976), Starobogatov and Kutikov (1977), Shileico (1978), Motuz (1982), and Grossu (1955, 1981, 1983). In some cases, there are small differences between the published defining characteristics and the snails studied here. The descriptions of modern and fossil Crimean snails found in I.M. Likharev and E.S. Rammelmeier's 1952 monograph, *Continental Mollusks of the USSR*, therefore should be consulted, since it provides descriptions for most of the known Crimean snail species.

Snail Ecology and Methods of Environmental Reconstruction

Snails and fresh water mollusks are mostly sedentary creatures that are widely spread over diverse landscapes. As a rule, the shell of fossil snails and fresh water mollusks is well preserved in sediments, especially in dry areas, making them suitable material for stratigraphical correlations and environmental reconstructions. The distribution of snail associations, as well as the specific composition of each snail assemblage, closely reflect the local climatic and environmental conditions of their habitat. Thus, they are good paleoenvironmental markers for major climatic changes during the Quaternary.

The main factors that determine a snail's geographic distribution are:

(1) Weather and climatic conditions, usually reflected by the average values of air temperature, atmospheric pressure, precipitation, humidity, predominant direction of the wind, as well as some other meteorological factors;
(2) The type of vegetation that is the main source of the snail diet and also serves as a support for many snail species, making it an indispensable factor in their choice of habitation;
(3) Type of topographic relief, type of soil, and the composition (lithology) of the rocks are also important, especially for the distribution of rocky and soil associated snail species. Very favorable conditions for the latter assemblages are found on the calcareous soils that are ubiquitous on the Crimean Peninsula. These soils have a porous structure and contain the necessary elements for cockleshell construction, as well as for the nutrition of the snails;
(4) The presence of a water source is an indispensable condition for the distribution of certain groups of snails, especially the hydrophiles and rocky and soil-adapted species.

More detailed description of Crimean snail ecology and environmental classification is found in Mikhailesku (1999:99-114). The paleoenvironmental reconstructions presented here follow the ecological descriptions made by the French investigator Jean-Jacques Puissegur (1976:16), who correlated fresh water mollusk and snail assemblages with vegetation and landscapes. According to his classification, Crimean species may be attributed to six ecological groups (Table 19-1).

The ecological distribution of the snail species presented in Table 19-1 was also used to compose diagrams showing the ecological niches of snails from the archeological levels at Karabi Tamchin (Figure 19-1). These diagrams show the major changes in the ecological composition of the samples at the individual and specimen levels. These reflect major environmental fluctuations, which were caused mostly by climatic changes. Some snails are ecologically specialized, occurring only in certain habitats. This group includes most hydrophilic species and some rocky and soil species that are dependent on the presence of a water source and have an intrazonal distribution. The samples from the other sites (Chokurcha I and Buran-Kaya III) are too small and not sufficiently representative to compose such diagrams.

Table 19-1
Ecological groups of Crimean mollusks

Hydrophile	*Vallonia pulchella* *Vallonia costata*
Humid forest	*Vitrea crystallina* *Punctum pygmaeum*
Forest-steppe	*Clausilia gracilicosta* *Clausilia canalifera* *Vitrea pygmaea* *Vitrea subeffusa* *Vitrea nadejdae*
Meadow steppe with small trees, bushes, and shrubs	*Zebrina cylindricus*
Xeric steppe and semi-desert	*Helicella dejecta* *Helicella striata* *Helicella krynickii* *Zebrina subulata* *Chondrus bidens*
Rocky and soil	*Caecilioides acicula* *Caecilioides raddei* *Pyramidula rupestris*

Karabi Tamchin

Samples from three levels of Karabi Tamchin were selected for study: Level IV, Level III/1, and Level II/2. Twenty species of snails were identified from these levels. Table 19-2 presents the species composition and number of identified cockleshells from each cultural level. Figure 19-1 presents the percentage of each ecological group of snails within the cumulative number of species and shells in each sample.

The snails from cultural Level IV exhibit a predominance of rocky, forest, and forest-steppe species. The inhabitants of steppe landscapes are represented by only two species: *Chondrus bidens* and *Zebrina subulata*, each having a very limited number of shells (4). This suggests that near the site, the climate was

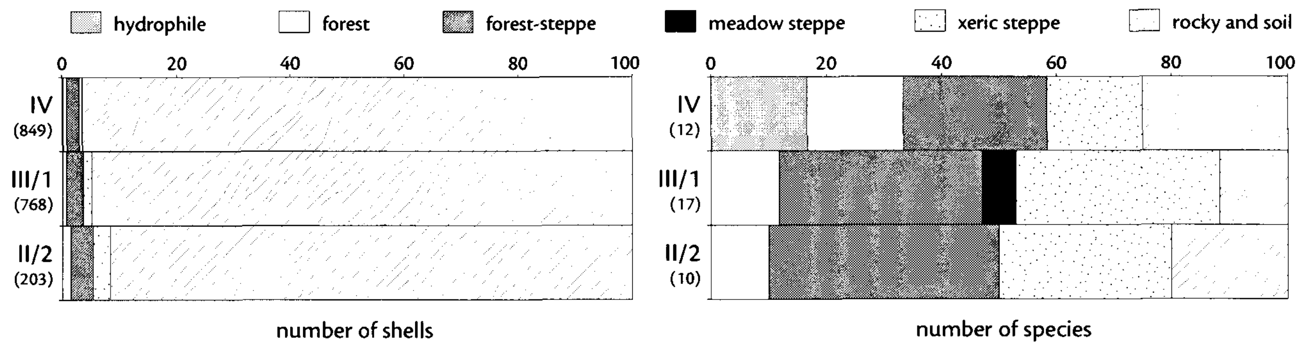


Figure 19-1—Karabi Tamchin: cumulative percentages of shells and species of fossil snails by unit (2000 excavations).

more humid and steppe landscapes were much more restricted as compared to today. Rocky and soil, forest, and forest-steppe species predominate in Level IV. There is a diverse representation of the family Vitrinidae, namely *Vitrea pygmaea*, *V. nadejdae*, *V. subeffusa*, and *V. crystallina*. The presence of *Vitrea crystallina* is interesting because it typically inhabits forests that are more humid than present-day Crimean ones. This form is specific to modern snails of the Carpathian forests, as well as forests of the central and northern parts of the Russian Plain. *Pyramidula rupestris*, *Vallonia costata*, *V. pulchella*, and *Punctum pygmaeum* are also inhabitants of forest and forest-steppe landscapes. All of these species are good indicators that forest-steppe landscapes with bushes and broad-leaved trees were near the site. The comparison of the general composition of the sample with the snail fauna found in the region today permits the supposition that, during sedimentation of Level IV, the climate was more humid and relatively colder than today.

The rock-associated species in Level IV of Karabi Tamchin are represented by *Pyramidula rupestris* and two species of *Caecilioides* (*C. raddei* and *C. acicula*), which together constitute more than 90% of the total number of shells in the sample. These species serve as reliable indicators of nearby underground water sources. *Caecilioides acicula* is represented by the variety *nodosaria*, which lives underground at a depth of 20–40 cm and prefers carbonate and humid forest soil near permanent sources of water. These remains indicate that there were some places with a very high level of underground water or, maybe, a spring or a small river in the vicinity of the site. Given the geological structure of the site and the mineral composition of the slope rocks, a nearby spring is possible. This is also confirmed by the hygroscopic nature of calcareous rocks, which absorb and preserve rain or snow water for a long time, becoming very good sources of fresh water springs. Calcareous rocks are all around the site, but some horizons evidently have finer lithological compositions and higher levels of cementation.

During the deposition of the overlying unit (Level III/1), the environmental conditions became drier and more moderate. The same kind of rocky and forest-steppe species predominated, but the number of steppic forms slightly increased. The rocky fauna was represented by the same two species, but the number of *Caecilioides raddei* dropped. The prevalence of the hydrophilic *Caecilioides acicula* serves as a good indicator that the underground water table was still very high and that a spring or stream was active close to the site. The composition of the forest-steppe fauna changes also. A few shells of Clausiliidae were found and are represented by two species: *Clausilia gracilicosta* and one shell of *Clausilia canalifera*. The preferred habitats of these are broad-leaved and coniferous forests, as well as forest-steppe landscapes with shrubs and bushes, especially junipers.

Compared with the Level IV snail assemblage, the steppe-adapted species became more numerous and more diverse in Level III/1. This involves three species of *Helicella* (*H. dejecta*, *H. striata*, and *H. krynickii*), two species of *Zebrina* (*Z. cylindricus* and *Z. subulata*), and one species of *Chondrus* (*Ch. bidens*). Such a faunal composition indicates that during sedimentation of this cultural level, there were steppe and forest-steppe landscapes around the site and that temperate climatic conditions prevailed. The large diversity of *Vitrea* and the general predominance of forest and forest-steppe species suggest that the climate was relatively more humid and probably colder than today. The condition of the assemblage, including the very thin shells and small dimensions of *Helicella* and *Chondrus* compared with their modern analogues, also confirms the hypothesis of colder conditions.

The sample from Karabi Tamchin Level II/2 numerically was much smaller than the underlying two samples, with only 203 cockleshells. The number of species was also more limited. Rocky and soil (two species) and forest-steppe (five species) fauna were still the most numerous. The presence of the hydrophilic *Caecilioides acicula* and *C. raddei* points to a nearby water source. Three species of steppe inhabitants were still present around the site in Level II/2 (*Helicella striata, Chondrus bidens,* and *Zebrina subulata*), but the total number of their shells decreased slightly compared with the underlying level. The landscape and climatic conditions appear to have been transitional between those of Level III/1 and those of today.

TABLE 19-2
Snails from Karabi Tamchin

Species	*Group*	*II/2*	*III/1*	*IV*	*Total*
Helicella (Helicopsis) dejecta Cr. et J.	xeric steppe	–	1	–	1
Helicella (Helicopsis) striata (Mull.)	xeric steppe	1	1	–	2
Helicella (Xeropicta) krynickii (Kryn.)	xeric steppe	–	2	–	2
Vitrea pygmaea Bttg.	forest-steppe	4	12	16	32
Vitrea crystallina (Mull.)	forest areas	3	4	4	11
Vitrea subeffusa Bttg.	forest-steppe	1	3	2	6
Vitrea nadejdae (Lindh.)	forest-steppe	1	2	1	4
Caecilioides raddei (Bttg.)	rocky and soil	38	106	196	340
Caecilioides acicula Mull. var. nodosaria Bttg.	rocky and soil	148	623	622	1,393
Chondrus (Buliminus) bidens (Kryn.)	xeric steppe	3	2	2	7
Chondrus (Buliminus) bidens natio *pygmaea* (Kryn.)	xeric steppe	–	1	–	1
Pyramidula rupestris (Drap.)	rocky and soil	–	–	1	1
Zebrina (Buliminus) cylindricus Mke.	meadow steppe	–	1	–	1
Zebrina (Buliminus) subulata (Rssm.)	xeric steppe	2	4	2	8
Clausilia (Mentissa) gracilicosta (Rssm.)	forest-steppe	–	4	–	4
Clausilia (Mentissa) canalifera (Rssm.)	forest-steppe	2	1	–	3
Clausilia (Mentissa) sp.	forest-steppe	–	–	–	1
Punctum pygmaeum (Drap.)	forest areas	–	1	1	2
Vallonia costata Mull.	hydrophile	–	–	1	1
Vallonia pulchella Mull.	hydrophile	–	–	1	1
Total number of shells		203	768	849	1,821
Total number of species		10	17	12	20

Buran-Kaya III

Because of the specific lithology of Buran-Kaya III, preservation of shells is very bad and their concentrations very poor. Five shells were found in Level B1 during excavations in 1996 and two shells were found in Level B during excavations in 2001 (Table 19-3). No shells were present in Level C.

The shells from Level B1 were identified as *Helicella dejecta* (2), *H. krynickii* (1), *Chondrus bidens* (1), and *Clausilia canalifera* (1). The first three species are inhabitants of xerothermic steppes and semi-deserts. These forms are typical of the arid steppes of the north coast of the Black Sea, Crimea, and Middle Asia. *Clausilia canalifera* is the only forest-steppe species in this sample. It prefers to live in relatively humid areas with stands of small trees, shrubs, and bushes on calcareous rocky slopes or close to standing water. All of these species still survive today in Crimea and those from Buran-Kaya III Layer B have the same morphometric parameters as the modern forms.

The shells from Level B are *Helicella dejecta* (1) and *Helicella krynickii* (1). Both are good indicators of arid climatic conditions and xerothermic steppe landscapes and semi-deserts.

As may be observed from Table 19-3, the xerophiles *Helicella* and *Chondrus* dominate both samples from Buran-Kaya III. They are diagnostic of Crimean Upper Pleistocene steppe landscapes. Ecologically, species of *Helicella* and *Chondrus* have a huge range of environmental adaptations, which are associated with significant variability in the morphometric parameters of their cockleshells. *Helicella dejecta, H. krynickii,* and *Chondrus bidens* are still dominant in Crimea and the most widespread in modern-day steppe landscapes. These species are also sufficiently resistant to periods of drought and cold weather conditions, so that it is not possible to assign them to a typical warm faunal assemblage. On the other hand, the presence of *Clausilia canalifera* is not typical of xerophilic fauna, since it is a forest-steppe inhabitant and prefers warmer climatic conditions and relatively more humid areas. This species may be also found among Crimean snails today, but its habitat is much more limited than the previously described three species. *Clausilia canalifera* prefers to live close to junipers or other bushes usually located near standing water, floodplains, or underground water sources.

TABLE 19-3
Snails from Buran-Kaya III Layer B

Species	*Group*	*B1*	*B*
Helicella (Helicopsis) dejecta Cr. et J.	xeric steppe	2	1
Helicella (Xeropicta) krynickii (Kryn.)	xeric steppe	1	1
Chondrus (Buliminus) bidens (Kryn.)	xeric steppe	1	–
Clausilia (Mentissa) canalifera (Rssm.)	forest-steppe	1	–
Total number of shells		5	2
Total number of species		4	2

Chokurcha I

Only two shells were collected from Chokurcha I; both were *Helicella striata* and were found in Level IV-S during the 2000 excavations. *Helicella striata* is an inhabitant of xerothermic steppe and semi-deserts, and is widely distributed in the steppe zone of the Russian Plain, as well as in modern Crimea. The morphometric parameters and surface sculpture of the fossil shells identified from Chokurcha I do not differ in modern specimens from the same area.

Correlations and Conclusions

The analyses of Quaternary snail and freshwater fauna from Eastern Europe (Russia, Ukraine, Moldova), Central Europe (Romania, Poland, the Czech Republic, Slovenia), and Western Europe (France, Germany) demonstrate that during the last million years the evolution of snails and freshwater Mollusca took place predominantly on the levels of morphs, nations, and subspecies. Analyses of the patterned composition of Crimean fossil snail assemblages, in contrast to the modern faunal composition, confirms this conclusion. The main changes in Crimean snail assemblages during the Upper Pleistocene reflect changes in paleoenvironment (primarily temperature and humidity) and less so the evolutionary transformation of fossil species.

During the Last Glacial, it is possible to recognize some interstadials or short periods of warming in Southeastern Europe and along the Northwest Coast of the Black Sea, including the Krutitsa/Amersfoort-Brörup, Odderade, Moershoofd, Bryansk/Hengelo, Arcy/Denekamp, Tursac, Laugerie/Lascaux, Bölling, and Allerød interstadials. Their number and names, as well as their geochronological associations, differ from region to region; it is therefore difficult to make reliable regional or inter-regional correlations using only the malacofaunal data. During the Late Pleistocene, Mollusca assemblages primarily reflected environmental changes rather than evolutionary ones; the studied fauna are therefore subdivided into three categories: glacial or stadial, interstadial, and interglacial. This is the first and most difficult step in faunal analysis; to do it properly there should be very large and representative samples. Although Crimean Pleistocene snail collections are large, many samples are homogenous and not truly representative.

The peculiarity of the Crimean snail composition is that during the warm (interglacial and interstadial) phases, the number of cryophilic species evidently decreased, while there was a significant increase in thermophilic species. Additionally, for freshwater assemblages that react only to temperature changes, the Crimean snail fauna are also very sensitive to changes in humidity. Thus, to correctly distinguish the type of snail assemblage (glacial, interstadial, or interglacial), the number of hydrophiles and the real proportion among the main ecological groups of snails should be analyzed. For example, interglacial and interstadial snail assemblages are recognizable not only based on larger proportions of thermophiles as compared with the glacial assemblages, but also by increased numbers of hydrophiles and a reduced percentage of xerophiles. The evaluation of changes in humidity is also very important for paleoenvironmental reconstructions in Crimea: because of its southern latitude, the temperature variations during the Last Glacial were not so marked as in the periglacial areas of the Russian Plain. The very big differences in site altitudes present another difficulty for snail fauna correlations. At times, the same climatic variations brought about different changes in the composition of snail assemblages in the upper mountain areas compared to those in the Crimean plain or intermountain valleys.

The general impression given by the Karabi Tamchin snail assemblages is that the different levels of the site reflect more humid and colder climatic conditions as compared to present day conditions. All three samples evidently represent interstadial-type fauna and may correspond to one or more interstadials of the Last Glacial. As may be observed in Figure 19-1, there are some significant changes in the specimens and the ecological group composition from assemblage to assemblage. It is not clear, however, what these faunal changes mean. They may reflect either different stages of snail assemblage evolution in the context of a single interstadial, or separate faunal assemblages of multiple interstadials.

The differences among snail assemblages at Karabi Tamchin, especially those between Levels IV and III/1, may be seen more clearly by comparing the diagrams of ecological groups and species composition of these samples. In Level IV, there is a very low proportion of xerophiles (less than 20%) and a high proportion of hydrophiles, forest inhabitants, and rocky and soil inhabitants. Also in Level IV, two species of hydrophiles, *Vallonia costata* and *Vallonia pulchella*, are present, as well as *Punctum pygmaeum* (typical of humid forest) and *Pyramidula rupestris* (typical of rocky and soil). All of these are characteristic of relatively humid forest areas and/or intrazonal landscapes close to springs, streams, or standing water. In Level III/1 in contrast, there is a higher percentage of xerophile (*Helicella dejecta*, *H. striata*, *H. krynickii*, *Chondrus bidens* natio *pygmaea*) and meadow steppe specimens (*Zebrina cylindricus*), as well as forest-steppe inhabitants, like *Clausilia gracilicosta* and *Clausilia canalifera*.

The Crimean fossil snail fauna is very poorly known and there are thus few analogues or equivalent collections for comparisons and correlations. The main environmental changes associated with the studied sites can be seen more clearly by comparing the ecological diagrams of Karabi Tamchin (Figure 19-1) and the western Crimean site of Starosele (Mikhailesku 1999:table 5-7). The compositional comparison of the Karabi Tamchin and Starosele snail assemblages demonstrates that these fauna have many similar elements. For example, the snails from Levels III/1 and IV of Karabi Tamchin are comparable to the snail assemblage from Level 2 of Starosele. Of the seventeen snail species identified in Level III/1 of Karabi Tamchin, about half are also present in Starosele Level 2. The morphometric parameters and shell sculptures of each species are also very similar. Despite these parallels, the assemblages from Karabi Tamchin appear more impoverished than the assemblage from Starosele Level 2. Both reflect relatively warm and humid conditions where the same forest-steppe, steppe, and rocky and soil species are predominant. The Karabi Tamchin fauna is a typical interstadial assemblage and represents a more humid and relatively colder climate than today. It can probably be correlated with one or more of the interstadials of the Last Glacial, including the Moershoofd.

The snail assemblage of Karabi Tamchin Level III/1 is comparable to the assemblages from Kabazi II Unit II and Kabazi V Unit II (Mikhailesku 1999: tables 5-4 and 5-5). These three sites are primarily characterized by xerophilic, meadow, and forest-steppe species (*Helicella dejecta*, *H. krynickii*, *Chondrus bidens*, *Zebrina cylindricus*, *Vitrea pygmaea*, *V. subeffusa*, and *Clausilia gracilicosta*). A comparison of the general composition of these assemblages indicates that the Karabi Tamchin snails reflect more humid and evidently more mesic conditions than do the snails of Kabazi II and Kabazi V. This may be explained by the presence of a water source near Karabi Tamchin and by the geographic location of this site. The composition of the fossil snail assemblages from Karabi Tamchin suggest that moderate climatic conditions prevailed and that a combination of broad-leaved forest and meadow steppes with bushes and shrubs grew around the site. These paleoenvironmental reconstructions are in close agreement with the pollen data of N. Gerasimenko from Unit II of Kabazi II (see pollen zone VIII in Gerasimenko 1999:131-132).

Evidently representing a warm faunal complex (thermocomplex), the Karabi Tamchin assemblages may also be correlated with the warm freshwater snail assemblages in the first terraces of the Eastern European rivers Dnieper, Dniester, Prut, and Danube (Mikhailesku 1990; Mikhailesku and Markova 1992; Markova and Mikhailesku 1994). In addition, they may be correlated with the snail assemblages of the Moershoofd stratigraphical unit ("ash horizon") from the loessic Mousterian sites of Molodova I, Molodova V, and Kormani IV in the Middle Dniester area (Motuz 1982; Ivanova 1982). The sediments from Paleolithic sites representing the Moershoofd interstadial in northern Moldova and western Ukraine are clearly recognized and well correlated because at many sites there is an ash horizon up to 10 cm thick, which serves as a formidable stratigraphical marker for regional correlations. It provides evidence for a very large fire that produced a classic thanatocoenosis. Abundant remains of fossil snails are found in this horizon, yielding adequate samples for absolute dating: the results range from 44,000 to 41,000 BP (Ivanova 1982:231).

The snail assemblage from Level II/2 of Karabi Tamchin is both homogenous and limited, representing colder and drier conditions than the snail assemblage of Starosele Level 2. In spite of the fact that about 40% of the same species are present in both assemblages, the Karabi Tamchin Level II/2 fauna look much more impoverished. This level may be correlated with the end of the same interstadial or with one of the interstadials of the Middle to Late Glacial, when the climate was significantly colder and drier than today.

Unfortunately, it is difficult to be sure of such large-scale correlations because of the high level of endemism in Crimean snail fauna and the significant distances between these sites. In spite of its geographic location, the Crimean Peninsula may possess some regional peculiarities in Quaternary climatic oscillations and may also have different trends, as compared to its analogs in the continental neighboring areas of the Eastern European Plain.

20

Karabi Tamchin: Lithic Assemblages from Selected Levels

Alexander I. Yevtushenko

This chapter describes the lithic assemblages recovered from four levels of Karabi Tamchin during excavations at the site between 1999 and 2001. The lithic material of Level II/2 and Level III displays generally similar technological and typological patterns and can be attributed to the Western Crimean Mousterian. Level IV/2 and Level V display similarities in their technological and typological patterns and can be attributed to the Crimean Micoquian. Despite the difference in the lithic traditions of the two groups, all assemblages exhibit the same type of occupation and raw material resource exploitation.

Basic Assemblage Patterning

In general, stone artifact assemblages from Karabi Tamchin are divided into six major categories: core-like pieces, flakes, blades, tools, and debris (chunks and chips) (Table 20-1). The category core-like pieces includes cores, pre-cores, and fragments of broken cores. The flakes and blades are debitage, without traces of secondary treatment. The tools include regularly retouched unifacial and bifacial implements, broken fragments of tools, and irregularly retouched pieces. Chunks are broken pieces and small fragments of unidentifiable debitage. Chips are debitage less than 29 mm in maximum dimension. The use of screens during excavations resulted in the recovery of even the smallest artifacts. As a result, the vast majority of artifacts recovered in each assemblage were chips. Most chips are too small to study attributes such as platform characteristics, scar patterns, shapes, etc. Chips in each level (Table 20-2) are subdivided according to their maximum dimensions into three intervals: large (with maximum dimensions between 29.9 and 20.0 mm), medium (19.9 mm to 10.0 mm), and small (less than 10.0 mm). It is impossible to know which chips in each metric interval could have come from tool retouch and which chips could have come from core reduction. Although chips, chunks, and unidentifiable pieces of debitage are listed under debris, some chips and chunks might have been used as blanks for tool production.

The essential counts of cores, blades, flakes, and tools show both distinctions and similarities between the discussed assemblages (Table 20-1). In the Level II/2 assemblage, cores are few, debitage (blades plus flakes) represents 41.7%, while more than half of the artifacts are tools. In the Level III assemblage, cores, flakes, blades, and tools occur in about the same proportions as in uppermost level. The same is true for Levels IV/2 and V, except for a lower percentage of blades and a higher percentage of tools.

Based on essential counts, the assemblages of Karabi Tamchin might be divided in two groups. The first group includes the assemblages of Level II/2 and Level III, while the other group includes the assemblages of

TABLE 20-1
Karabi Tamchin artifact totals

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Core-like pieces	4	3.9	5	4.2	3	2.5	–	–
Blades	14	13.6	13	10.9	9	7.4	16	7.4
Flakes	29	28.1	36	30.3	28	22.9	56	26.1
Tools	56	54.4	65	54.6	82	67.2	143	66.5
Chips	849	–	1,669	–	4,749	–	12,872	–
Chunks & unidentifiable debitage	76	–	37	–	47	–	133	–
Total	1,028	100	1,825	100	4,918	100	13,220	100

Level IV/2 and Level V. These groups are characterized by different proportions of large, medium, and small chips (Table 20-2). In Level II/2 and Level III, small and medium chips are more or less equally represented, while large chips account for 14.1% and 8.7 % of all chips. In contrast, in Level IV/2 and Level V, the majority of chips are small, while large and medium sized chips occur in smaller proportions than they do in the assemblages of Level II/2 and Level III (Table 20-2).

TABLE 20-2
Karabi Tamchin chip dimensions in millimeters

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
20–29	120	14.1	146	8.7	126	2.7	232	1.8
10–19	436	51.4	752	45.1	1,221	25.7	2,984	23.2
< 10	293	34.5	771	46.2	3,402	71.6	9,656	75.0
Total	849	100	1,669	100	4,749	100	12,872	100

Raw Material Availability and Raw Material Selection

The Internal and External Ridges of the Crimean Mountain, formed of Cretaceous and Paleogene rocks, are characterized by rich flint sources, which were used as the main raw material sources during the whole of the Stone Age. Flint outcrops, however, are totally absent within the Main Ridge of Crimean Mountains, which are formed mainly of Jurassic and Triassic rocks. The area of the low plateau of Karabi Yaila, where Karabi Tamchin is situated, is no exception, and flint outcrops are absent there. A single type of local material—chert nodules—is useful for stone tool production and it is found in Jurassic deposits. Nevertheless, the majority of stone artifacts at Karabi Tamchin were made on a fine-grained grey/dark grey flint, which, when patinated, becomes whitish-grey (Table 20-3). The closest sources of grey flint with such characteristics are situated 25–30 km north of the site.

The flint raw material was subdivided according to degree of patination into four groups: (1) dark grey flint, unpatinated; (2) grey flint with light patina; (3) dark grey flint with green patina; (4) deeply patinated whitish flint. Other raw materials used at Karabi Tamchin are the local coarse-grained cherts that included three types: yellow, grey, brown. Such local chert nodules are sometimes seen at the bottom of the Tamchin River Valley, as well as on slopes under the Jurassic escarpment.

In Level II/2, almost all cores, flakes, blades, and tools were made on flint (Table 20-3). The local cherts are not represented by primary flaking or in the tool assemblage. There is a single flake of the local yellow chert. Unpatinated flint artifacts are absent in this level; most have a light patinated surface. There is one denticulate tool made on a flake of dark grey flint with a green patina. It should be noted that the retouched edge of the tool is not patinated and looks fresher than the other surfaces of the blank. Probably, this blank was reutilized and is not connected with debitage produced on-site.

Almost all artifacts are made on flint in Level III (Table 20-3). A simple retouched flake and a broken tool have no traces of patina, while about two-thirds are lightly patinated. The rest are deeply patinated. Local chert accounts for 5% of the artifacts: 2 simple retouched pieces and 3 tools, all made on yellow chert, plus 1 core on grey chert.

Although the vast majority of artifacts from Level IV/2 are flint (Table 20-3), the percentage of artifacts made on local cherts (11.7%) in this level is much larger than in the assemblages of Level II/2 and Level III. There are 7 pieces (one core, one flake, four retouched pieces, and one tool) made on yellow chert, 6 pieces (one blade, two flakes, one retouched piece, and two tools) made on grey chert, and 1 tool made

TABLE 20-3
Karabi Tamchin: distribution of artifacts by raw material types†

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Flint, grey with light patina	76	73.8	75	63	59	49.3	124	58.5
Flint, grey with deep patina	25	24.4	36	30.3	39	32.5	48	22.7
Flint, dark grey	–	–	2	1.7	7	5.8	19	9.0
Flint, dark grey with green patina	1	0.9	–	–	1	0.8	–	–
Chert, yellow	1	0.9	5	4.2	7	5.8	17	8.0
Chert, grey	–	–	1	0.8	6	5.0	2	0.9
Chert, brown	–	–	0	–	1	0.8	2	0.9
Total	103	100	119	100	120	100	212	100

†does not include chips or chunks

on brown chert. Again, most artifacts are patinated, although they are rather evenly divided between light and heavy patination. One simple concave scraper was made on a dark grey flint flake with a green patina. The retouched edge of the tool has traces of secondary reutilization.

Almost all artifacts from Level V are flint, although 10% are on local chert (Table 20-3). While 9% of the artifacts are unpatinated, the rest are patinated, with light patination dominating. It should be noted that a significant part of the heavily patinated pieces (about 40%) are yellowish in color, a result of specific surface chemical modification in the brecciated sediment. Artifacts made on local raw materials are more common than in the upper levels (Table 20-3).

Thus, all the assemblages are mainly flint, which might have been transported to the site from outcrops situated some 25–30 km from Karabi Tamchin. The flint artifacts in Levels II/2, III, and IV/2 include all artifact categories: core-like pieces, debitage, tools, and waste. At the same time, core-like pieces are absent in the assemblage of Level V. The utilization of local cherts is minor in all assemblages. Apparently, the assemblages of Levels II/2 and III included an occasional piece unconnected with on-site primary flaking. There is one yellow chert flake in Level II/2, and two tools on yellow chert and one core on grey chert in Level III, but no associated debitage. On the other hand, the assemblages of Levels IV/2 and V indicate a wider use of local chert raw materials. In Level IV/2 there are pieces of debitage, a core, and tools made on yellow chert, debitage and tools made on grey chert, and one tool made on brown chert. Probably, during the occupation of Level IV/2, yellow and grey cherts were flaked on-site, but the tool on brown chert was imported. The assemblage of Level V consists of debitage and tools made on yellow chert, while grey and brown cherts are represented only by tools. Evidently, yellow chert was flaked on-site, while the tools on grey and brown cherts were imported.

Patterns of Core Reduction

There are few core-like pieces in Levels II/2, III, and IV/2, and none in Level V (Table 20-1). The majority of cores are small, exhausted pieces, without clear patterning. On the other hand, there are major differences between these assemblages in the range and kind of reduction patterns used. While some Levallois blanks and tools made on Levallois blanks were recovered from Levels II/2 and III, no indication of Levallois flaking was found in Levels IV/2 and V.

Level II/2

There are three complete and one broken flint cores in the assemblage of Level II/2. The broken core was made on a flake, while the complete cores were made on flint plaquettes.

The largest core (61 mm long, 54 mm wide, and 10 mm thick) has a semi-ovoid flaking surface and a series of unidirectional/parallel removals from the main platform. The core has one flaking surface, one main faceted platform, and three supplementary faceted platforms, two lateral edges and one distal. The back of the core is flat and 75% cortex covered.

One sub-rectangular core (39 mm long, 30 mm wide, and 20 mm thick) has one flaking surface with unidirectional removals from one main faceted platform (Figure 20-1: *4*) and one lateral supplementary faceted platform. The main scar on the flaking surface is 34 mm long and 22 mm wide. The back is irregular and half covered by cortex.

An ovoid core (33 mm long, 34 mm wide, and 22 mm thick) also has one flaking surface with a removal 32 mm long and 21 mm wide from a single main faceted platform. The core has one lateral supplementary faceted platform. The back is convex, with no cortex.

There is one small broken core (30 mm long, 31 mm wide, and 12 mm thick). The core has one flaking surface and one main faceted platform (Figure 20-1: *3*). There are no supplementary platforms. The largest scar on the flaking surface is 30 mm long and 22 mm wide. The back is broken and has some cortex.

Level III

Four cores and one pre-core were found in Level III. The pre-core is made on a flint plaquette 40 mm long, 42 mm wide, and 11 mm thick. It has a single flaking surface, a main faceted platform, and a lateral faceted supplementary platform (Figure 20-1: *2*). Obviously, only a single primary flake (30 mm × 24 mm) was removed from the flaking surface. After that, the lateral supplementary platform was prepared and a number of chips were taken off to form the lateral convexity of the flaking surface for the next removal. The back is flat and completely covered by cortex.

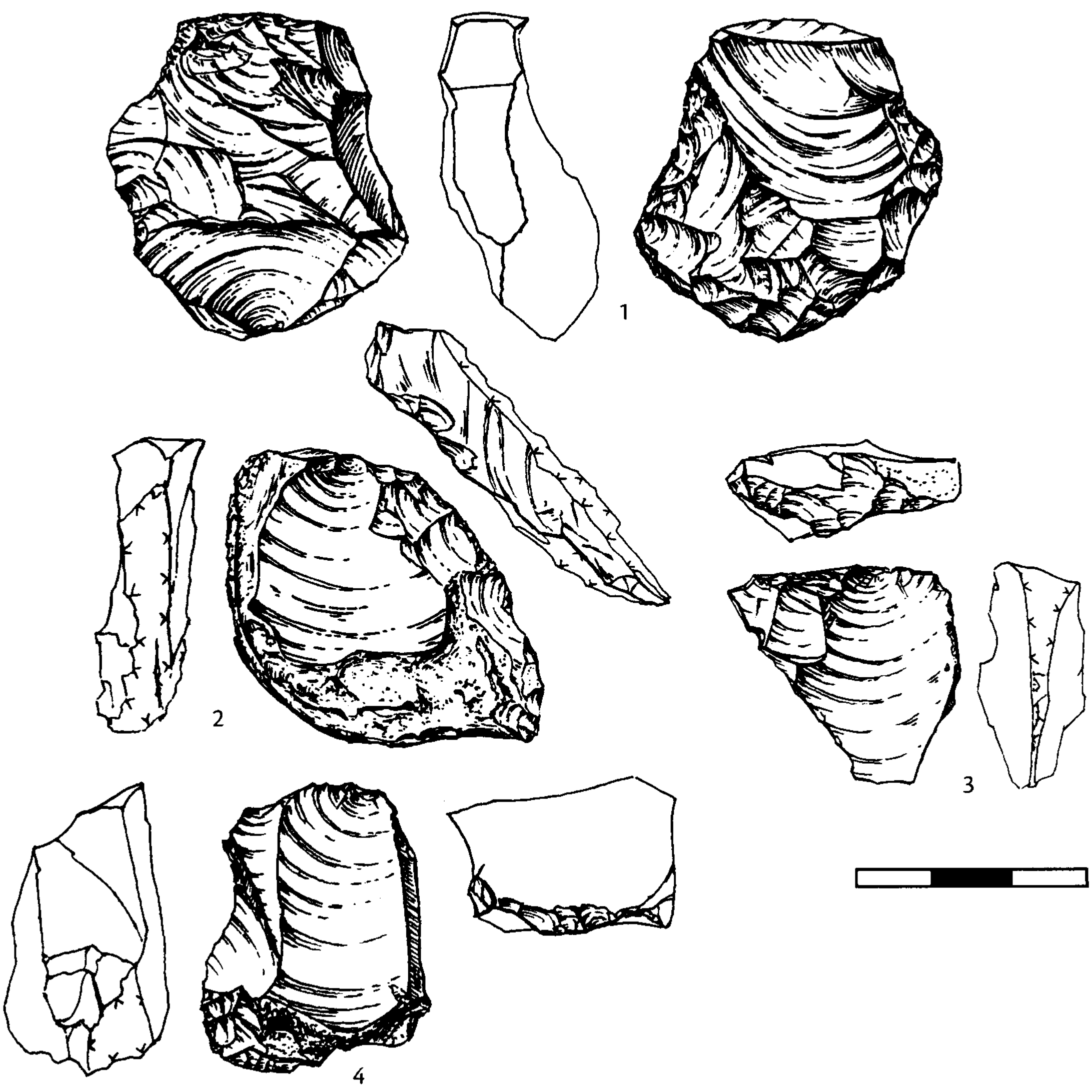


Figure 20-1—Karabi Tamchin Level II/2 (3, 4) and Level III (1, 2) core-like pieces: *1*–bidirectional opposed platform core with lateral supplementary platforms; *2*–pre-core; *3, 4*–unidirectional cores with lateral supplementary platforms.

A flint parallel core (39 mm long, 42 mm wide, and 17 mm thick) has one rectangular flaking surface, one main faceted platform, and two supplementary faceted platforms (Figure 20-1: *1*). Scars of three removals are visible on the flaking surface, the largest of which is 39 mm long and 20 mm wide. There are two lateral supplementary platforms and one distal platform. The back is irregular and more than 50% of it is covered by cortex.

A convergent core (55 mm long, 52 mm wide, and 18 mm thick) on a grey chert flake has a sub-triangular flaking surface, one main faceted platform, and two supplementary faceted platforms (Figure 20-2: *2*). Scars of two successful removals and a series of unsuccessful removals are visible on the flaking surface, the largest of which is 48 mm long and 25 mm wide. There are two lateral supplementary platforms. The back is convex, without any traces of cortex.

A bidirectional core (44 mm long, 43 mm wide, and 20 mm thick) was made on a flint nodule or thick flake (Figure 20-2: *1*). This core exhibits two bidirectional removals on one flaking surface, one platform that is faceted, and another that is unfaceted. The largest scar is 17 mm long and 32 mm wide. A single lateral supplementary platform is faceted. The back is broken.

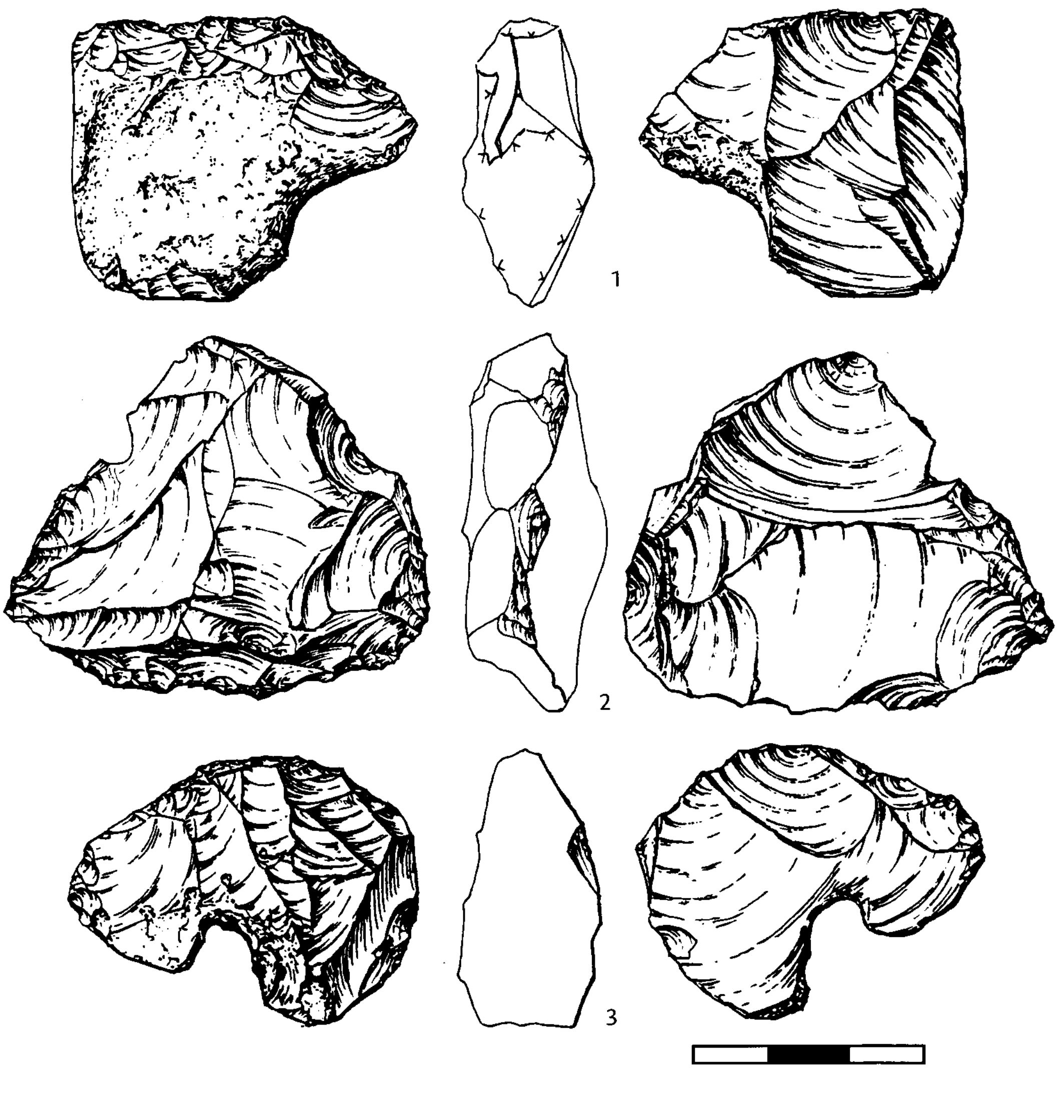


Figure 20-2—Karabi Tamchin Level III core-like pieces: *1, 3*–unidirectional cores with lateral supplementary platforms; *2*–convergent core with supplementary platforms.

The broken core is a relatively large (35 mm long, 43 mm wide, and 15 mm thick) fragment on a flake (Figure 20-2: *3*). This core has a main faceted platform, a lateral supplementary faceted platform, and a remnant of the flaking surface. Traces of two removals remain on the flaking surface. The largest is 34 mm long and 41 mm wide. The back of the core is convex and partially cortex covered.

Level IV/2

There are three exhausted cores in Level IV/2: two are multi-platform and one is bifacial bi-parallel. One multi-platform core with three main platforms and one flaking surface is on local yellow chert, 39 mm long, 30 mm wide, and 16 mm thick. Two of the platforms are faceted and one is not. The flaking surface is rectangular and there are scars of four removals, the largest of which is 27 mm long and 11 mm wide. The back is flat and without cortex.

Another multi-platform flint core with three main platforms and one rectangular flaking surface is 30 mm long, 24 mm wide, and 13 mm thick. Two of the platforms are unfaceted and one is faceted. Scars of two removals are visible, the largest of which is 21 mm long and 16 mm wide. The back is flat and without cortex.

The bifacial flint core (48 mm long, 33 mm wide, and 16 mm thick) has two main platforms and two opposing rectangular flaking surfaces. The main platforms, both unfaceted, are at the basal part of core, but each is connected with its own surface. Obviously, the core was reutilized. The first stage of core reduction saw a number of light convergent removals, the largest of which is 40 mm long and 12 mm wide. After that, the platform of the core was re-made and prepared for the exploitation of the opposite flaking surface. Two removals were struck from that surface, the largest of which is 35 mm long and 30 mm wide.

Thus, the assemblages of Levels II/2 and III contain unidirectional and bidirectional cores with lateral/distal convexities created from supplementary platforms. These cores are not Levallois in the typological sense, but might be expected from a Levallois method during the last stages of core reduction. Obviously, the core reduction strategy in Levels II/2 and III has analogies to the technologies of Western Crimean Mousterian, where the Levallois method was used.

On the other hand, cores from Level IV/2 do not have supplementary platforms. Two of these are multi-platform and one is bifacial bi-parallel with two flaking surfaces. Such cores are associated with ad hoc technologies that are common in the Crimean Micoquian.

Blank Variability

The specific setting of Karabi Tamchin in the mountainous region relatively far from quality flint sources suggests that artifact production in all occupation levels mainly depended upon imported raw materials. The presence of cores and debitage permit, without any question, the supposition that primary flaking of imported raw materials took place on-site. On other hand, the very high proportions of tools in each assemblage may indicate that some tools were produced off-site. This can be investigated by an analysis of blanks recovered at Karabi Tamchin.

The category of blanks includes debitage without traces of secondary treatment, as well as flake and blade tools. Excluded from blank analyses are bifacial tools, cores, chunks, chips, unidentifiable debitage, and unidentifiable tool fragments, although some of them could have been used as blanks for tool production.

All the assemblages here are too small to subdivide blanks into flakes, blades, and primary pieces for attribute analyses. Moreover, a considerable number of blanks in each assemblage are broken. Therefore, the following discussions of blank morphology are based on combined blade/flake samples.

Blanks potentially have many attributes, but the most important are the dimensions, scar pattern, cortex, shape, striking platform, lateral, and distal profiles. Each blank assemblage has been subdivided into debitage, retouched pieces, and unifacial tools.

There are two different assemblage groups at Karabi Tamchin: assemblages of Levels II/2 and III are Western Crimean Mousterian, while the assemblages of Levels IV/2 and V are Crimean Micoquian. Thus, focus will be placed on the differences and similarities of these groups.

Blank Composition

Although there are twice as many flakes as blades in the debitage of Level II/2 (Table 20-1), there are five times as many flake tools as blade tools. Among unifacial tool blanks that could be identified, there is one denticulate made on a core trimming flake: it is a by-product of tool re-sharpening, potentially unconnected with primary flaking. The total number of blanks includes 21 blades and 63 flakes (Ilam = 25.0).

There are almost three times as many flakes as blades in the debitage of Level III (Table 20-1), while there are 5 times as many identifiable flake tool blanks as blade tool blanks. Thus, in total, there are 20 blade blanks and 72 flake blanks (Ilam = 21.7).

There are three times as many flakes as blades among the debitage of Level IV/2 (Table 20-1) and seven times as many identifiable flake tool blanks as blade tools blanks. Thus, in total, there are 14 blade blanks and 63 flake blanks (Ilam = 18.2).

Combined, there are three and a half times more flakes than blades among the debitage for the two upper levels (Table 20-1), and five times as many identifiable flake tool blanks as blade tool blanks. In total, there are 26 blades and 99 flakes (Ilam = 20.8).

The assemblages of Level IV/2 and V have relatively low percentages of blades and among them are trimming pieces—by-products of the reshaping and thinning of bifacial tools. These trimming blanks include 1 unretouched trimming blade, 2 unifacial tools made on small chip-sized blanks from Level IV/2, 2 trimming blades, 3 trimming flakes, and 1 tool made on a trimming flake from Level V. In addition, 7 blade blanks from Level IV/2 and 16 blade blanks from Level V are distal fragments and some of these could be broken trimming elements.

Shape Characteristics

Several shape attributes were recorded for the blank assemblages: blank shape, blank profile, and profile at distal end (Table 20-4). Although Levels II/2 and III belong to the Western Crimean Mousterian and Levels IV/2 and V are Crimean Micoquian, there are few differences between them in these attributes. Irregular shapes always dominate, followed by expanding and then rectangular. Other shapes occur sporadically, although parallel are more characteristic of the upper two levels than of the lower two (Table 20-4). The same pattern is true for lateral profiles, where there are no significant differences in types from level to level. Incurvate always dominates, usually followed by twisted and then flat. As expected, convex profiles are rare (Table 20-4). For distal profiles, there does appear to be a difference between the upper and lower assemblages. Hinged extremities are more common in Levels II/2 and III, while blunt extremities are more common in Levels IV/2 and V. Of course, in all assemblages, feathering is very common, if not dominant (Table 20-4).

Dorsal Scar Patterns

The large numbers of recognized dorsal scar patterns notwithstanding, only two types occur with high frequencies in all assemblages: unidirectional and unidirectional-crossed. Convergent and three-directional also occur regularly in all assemblages but in lower proportions (Table 20-5). Pieces with crested and *débordant* scar patterns, even combined, are few, but there is reason to think that those blanks are not connected with core reduction strategies in Levels IV/2 and V. They might have come from the rejuvenation

Table 20-4
Karabi Tamchin blank shapes and profiles

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
Shapes	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Rectangular	3	6.1	9	14.5	4	7.5	9	12.0
Expending	13	26.5	21	33.8	26	49.1	20	26.7
Triangular	4	8.2	4	6.5	4	7.5	4	5.3
Crescent	1	2.0	4	6.5	1	1.9	–	–
Ovoid	1	2.0	1	1.6	–	–	–	–
Parallel	5	10.2	4	6.5	1	1.9	3	4.0
Diagonal	4	8.2	1	1.6	–	–	3	4.0
Irregular	18	36.8	18	29	17	32.1	36	48.0
Total	49	100	62	100	53	100	75	100
Lateral Profiles								
Flat	15	20.8	12	14.8	11	16.7	29	26.9
Convex	5	6.9	10	12.4	6	9.1	2	1.8
Incurvate	39	54.2	36	44.4	33	50.0	48	44.4
Twisted	13	18.1	23	28.4	16	24.2	29	26.9
Total	72	100	81	100	66	100	108	100
Distal Profiles								
Feathering	18	38.3	20	37.0	16	31.4	37	52.2
Hinged	19	40.4	25	46.3	16	31.4	17	23.9
Blunt	9	19.2	8	14.8	17	33.3	15	21.1
Overpassed	1	2.1	1	1.9	2	3.9	2	2.8
Total	47	100	54	100	51	100	71	100

Table 20-5
Karabi Tamchin blank dorsal scar patterns

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
Scar Patterns	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Unidirectional	15	21.7	17	26.2	14	23.7	21	25.0
Convergent	8	11.6	6	9.2	9	15.3	6	7.1
Bidirectional	5	7.3	3	4.6	9	15.3	14	16.7
Unidirect.-crossed	20	29.0	19	29.2	15	25.4	23	27.4
3-directional	8	11.6	10	15.4	4	6.7	11	13.1
Radial	1	1.4	–	–	–	–	1	1.2
Primary	5	7.3	7	10.8	2	3.4	5	5.9
Crested	1	1.4	–	–	2	3.4	1	1.2
Débordant	4	5.8	3	4.6	3	5.1	1	1.2
Irregular	2	2.9	–	–	1	1.7	1	1.2
Total	69	100	65	100	59	100	84	100
Cortex								
None	44	56.4	43	60.6	32	56.1	51	57.9
<25%	17	21.8	13	18.3	11	19.3	20	22.7
25–50%	9	11.5	6	8.5	9	15.8	8	9.1
50–75%	3	3.9	2	2.8	3	5.3	4	4.6
75–100%	5	6.4	7	9.8	2	3.5	5	5.7
Total	78	100	71	100	57	100	88	100

of bifacial tool edges. Moreover, one of the *débordant* blades from Level IV/2 is made on a greenish patinated piece.

The percentage of cortex on blanks is quite consistent, although blanks with more than 75% cortex are more common (yet still not numerous) in the Western Crimean Mousterian than in the Crimean Micoquian assemblages (Table 20-5).

Platform Characteristics

Observations about platform characteristics relate to both striking platform preparation and whether or not blanks have lipping at the intersection of the platform and the ventral surface. For an individual artifact this will not provide unequivocal evidence for hard hammer versus soft hammer percussion, but for the assemblage overall, the dominance of lipping or its absence will indicate the probable typical mode of detachment (Marks and Monigal 1998:134).

The assemblages of Levels II/2 and III are characterized by high percentages of faceted platforms, compared to Levels IV/2 and V (Table 20-6). The latter levels are strikingly different from the upper ones in their moderate presence of cortical platforms (virtually lacking in the upper levels) and in a greater occurrence of unfaceted platforms.

Most of the prepared platforms are multiple faceted. Among those in the upper levels, there is a series of flakes that should be expected from Levallois technology. Such blanks have massive faceted platforms, unidirectional-crossed or 3-directional scar patterns, flat or slightly incurvate lateral profiles, and elongated shapes. Obviously, blanks with such characteristics could come from the exploitation of cores with supplementary platforms, which predominates in Levels II/2 and III. Typologically, Level II/2 has 3 Levallois blanks: a blade, a tool on blade, and a simple retouched flake. Four Levallois blanks were recovered in Level III: a flake, a retouched flake, a tool on an elongated flake, and a tool on blade. Moreover, there are several *débordant* blanks in each of these levels (3 in Level II/2 and 4 in Level III) that also are common for Levallois technology. As expected, the indices of platform preparation are high (Table 20-6).

The pattern of Levels IV/2 and V with a high proportion of unfaceted platforms is related to the absence of Levallois technology in those levels. Again, as expected, this is reflected in lower faceting indices (Table 20-6).

Table 20-6
Karabi Tamchin blank platform preparation and lipping

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
Platform type	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Cortex	1	2.0	–	–	5	13.1	6	10.2
Plain	11	22.5	16	30.8	12	31.6	30	50.8
Dihedral	1	2.0	6	11.5	2	5.3	9	15.3
Polyhedral	2	4.1	2	3.9	7	18.4	4	6.8
Multiple faceted	34	69.4	28	53.8	12	31.6	10	16.9
Total	49	100	52	100	38	100	59	100
Lipping								
Not lipped	45	91.8	48	92.3	33	86.8	49	83.1
Lipped	1	2.1	–	–	2	5.3	4	6.8
Semi-lipped	3	6.1	4	7.7	3	7.9	6	10.1
Total	49	100	52	100	38	100	59	100
IF large	75.5		69.2		55.3		39	
IF strict	69.4		53.8		31.6		16.9	

Blank Dimensions and Blank Selection

The majority of blanks recovered in the assemblages of Karabi Tamchin are small and only a few pieces in each level had maximum dimensions over 50 mm (Table 20-7). In addition, a significant number of blanks from each level are transverse flakes, so these were considered to be a separate group, along with regular flakes and blades (Table 20-7), in order to better understand and describe the differences between blank production and blank selection for tool manufacture.

The average dimensions of the debitage types are very similar for all assemblages. A single exception is the low average thickness for blades in Level III, but this is based on a sample of only 4 blades, 2 of which were long and relatively thin.

The average dimensions of retouched pieces and unifacial tools are greater for blade and flake tool blanks than for the debitage samples in each assemblage (Table 20-7). The mean dimensions of transverse flake blanks, however, are the same as for the debitage. Level II/2 has a series of large tools, among which is a retouched blade 87 mm long, a retouched flake 89 mm long, and a double scraper on a blade 72 mm long. Such large tools do not occur in the other levels. For instance, the largest tool from Level III is a simple scraper made on a blade 54 mm long, the largest tool from Level IV/2 is a convergent scraper on a flake 59 mm long, and the largest tool from Level V is a simple scraper on a flake 62 mm long.

It might be expected that blank selection for tool production would have given preference to some attribute discussed above. As shown by the comparative investigations, there are no significant differences among the proportional occurrences of debitage, retouched pieces, and unifacial tools in the majority of blank attributes. Even these few differences may be unimportant when the possible effects of the small samples from each level are taken into account.

All Karabi Tamchin assemblages have a high percentage of tools that obviously resulted from a paucity

TABLE 20-7

Karabi Tamchin average dimensions of debitage, retouched pieces, and tools†

	Level II/2			*Level III*			*Level IV/2*			*Level V*		
Debitage	*Blades*	*Flakes*	*Transv. Flakes*	*Blades*	*Flakes*	*Transv. Flakes*	*Blades*	*Flakes*	*Transv. Flakes*	*Blades*	*Flakes*	*Transv. Flakes*
Length, mm	37.7	32.8	21.3	37.0	34.9	21.9	37.2	34.7	23.9	40.3	32.7	25.5
Width, mm	16.9	20.2	32.4	15.0	24.0	32.5	15.0	25.6	32.8	17.0	21.8	36.8
Thickness, mm	6.0	6.7	9.1	3.5	6.6	6.0	6.2	6.4	8.2	4.9	5.7	7.7
L/W	2.2	1.6	0.7	2.5	1.5	0.7	2.5	1.4	0.7	2.4	1.5	0.7
W/L	0.4	0.6	1.5	0.4	0.7	1.5	0.4	0.7	1.4	0.4	0.7	1.4
T/L*100, %	15.9	20.3	42.9	9.5	19.0	27.4	16.7	18.4	34.2	12.1	17.4	30.1
T/W*100, %	35.6	33.0	28.2	23.3	27.6	18.5	41.3	25.0	24.9	28.7	26.1	20.8
Retouched pieces												
Length, mm	64.5	44.4	23.0	45.5	37.5	22.0	38.0	33.4	23.5	44.0	36.6	21.0
Width, mm	27.5	28.4	35.0	18.5	28.5	38.0	17.0	21.5	31.0	18.3	27.0	36.0
Thickness, mm	9.0	6.6	7.0	6.5	6.0	7.0	7.0	6.9	7.0	5.7	8.4	5.0
L/W	2.3	1.6	0.7	2.5	1.3	0.6	2.2	1.6	0.8	2.4	1.4	0.6
W/L	0.4	0.6	1.5	0.4	0.8	1.7	0.4	0.6	1.3	0.4	0.7	1.7
T/L*100, %	14.0	14.9	30.4	14.3	16.0	31.8	18.4	20.6	29.8	12.9	23.0	23.8
T/W*100, %	32.7	23.2	20.0	35.1	21.1	18.4	41.2	32.0	22.6	30.9	31.1	13.9
Unifacial tools												
Length, mm	59.3	37.6	27.3	48.0	38.7	23.2	41.7	39.0	36.0	47.2	36.6	24.4
Width, mm	22.0	26.7	32.8	21.7	25.4	35.2	18.7	27.9	45.5	22.2	26.6	36.6
Thickness, mm	8.0	6.7	8.8	6.7	6.7	9.3	8.0	8.7	10.5	6.0	9.5	9.0
L/W	2.7	1.4	0.8	2.2	1.5	0.7	2.2	1.4	0.8	2.1	1.4	0.7
W/L	0.4	0.7	1.2	0.5	0.7	1.5	0.4	0.7	1.3	0.5	0.7	1.5
T/L*100, %	13.5	17.7	32.1	22.6	17.3	40.3	19.2	22.3	29.2	12.7	25.9	36.9
T/W*100, %	36.4	24.9	26.7	41.2	26.4	26.5	42.9	31.2	23.1	27.0	35.6	24.6

†complete pieces only

of raw material. Because of this, the proportional occurrences of most attributes are related to tool characteristics. The analysis of blank variability has shown that in conditions of raw material shortage, blank selection is biased toward the largest available pieces, while other characteristics such as scar pattern, shape, lateral profile, etc., are not decisive factors. All types of blades, flakes, and transversal flakes were widely used as blanks for tool production. The proportional occurrence of tools by blank types (Table 20-8) shows that there are relatively few differences among levels. It seems, in spite of the quite different technologies used to produce blanks in Level II/2–Level III and Level IV/2–Level V, the tool assemblages have a similar pattern of blank selection. On the other hand, morphological differences among blank types did play a secondary role in blank selection. It is obvious that the primary criterion in blank selection for tool production was blank size. The longest edge of blades and regular flakes is the lateral edge, while for transverse flake the longest edge is the distal edge. In this sense, in each assemblage, the division of blanks by their maximum dimensions shows that the larger the blank, the more likely it was used for tool production (Table 20-9). This selective preference for large blanks does not mean that smaller blanks were not also retouched. About half of the blanks measuring 30–49 mm in each level were made into tools. Also, in each level there are tools made on chip-sized blanks (< 30 mm in maximum dimension). On the other hand, an appreciable percentage of tools in each level are invasively retouched and heavy resharpened implements. With each resharpening, the tool became smaller and many of tools do not reflect their original blank dimensions. Thus, many of the chip-dimensioned tools with heavy rejuvenation of their edges might have been much larger before resharpening.

TABLE 20-8

Karabi Tamchin tool assemblages by blank types

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Blades	7	16.7	7	12.7	5	12.5	10	18.9
Regular flakes	30	71.4	41	74.6	31	77.5	37	69.8
Transverse flakes	5	11.9	7	12.7	4	10.0	6	11.3
Total	42	100	55	100	40	100	53	100

TABLE 20-9
Karabi Tamchin blanks grouped by maximum dimension

	Level II/2					*Level III*					*Level IV/2*					*Level V*				
	Debitage	*Retouched pieces*	*Tools*	*Total*		*Debitage*	*Retouched pieces*	*Tools*	*Total*		*Debitage*	*Retouched pieces*	*Tools*	*Total*		*Debitage*	*Retouched pieces*	*Tools*	*Total*	
	N	*N*	*N*	*N*	*%*	*N*	*N*	*N*	*N*	*%*	*N*	*N*	*N*	*N*	*%*	*N*	*N*	*N*	*N*	*%*
20–29 mm	120	1	3	124	67.0	146	2	3	151	71.9	126	2	3	131	71.6	232	9	9	250	76.2
30–39 mm	21	6	15	42	22.7	31	3	10	44	20.9	22	10	10	42	23.0	35	6	20	61	18.6
40–49 mm	4	4	5	13	7.0	4	3	3	10	4.8	3	1	1	5	2.7	2	1	6	9	2.7
50–59 mm	–	1	1	2	1.1	–	1	3	4	1.9	1	–	4	5	2.7	3	2	2	7	2.1
60–69 mm	–	–	1	1	0.5	1	–	–	1	0.5	–	–	–	–	–	–	–	1	1	0.3
70–79 mm	–	–	1	1	0.5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
80–89 mm	–	2	–	2	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Total	145	14	26	185	100.0	182	9	19	210	100.0	152	13	18	183	100.0	272	18	38	328	100.0

Tool Assemblages

As discussed above, the tool assemblages of Karabi Tamchin have been divided into four groups: bifacial tools, unifacial tools, retouched pieces, and tool fragments. Not all of these tool groups, however, are useful for typological definition.

Most retouched pieces have light or very light marginal retouch: only several edges from each level have irregular scalar retouch. Because retouched pieces exhibit little modification of their edges, it is possible to suggest that most of these retouched pieces were used only briefly and without resharpening. On the other hand, some these could have resulted from natural edge damage, unconnected with human activity.

Tool fragments are mostly broken unifacial tools. These broken tools have different types of retouch but are very small. As such, they provide little typological information and are not useful for assemblage comparisons. Thus, tool fragments and retouched pieces were counted as tools *sensu lato*. They are not included in the restricted type list but are shown as separate categories by retouch surface or position (Table 20-10).

Regular retouched implements, tools *sensu stricto*, include bifacial and unifacial tools that are described according to the typological classification of flint artifacts used previously for investigations of the Western Crimean Middle Paleolithic (Chabai 1998c, 1998d; Chabai and Demidenko 1998; Marks and Monigal 1998; Yevtushenko 1998b).

Bifacial tools were recovered in Levels IV/2 and V, but they were absent in Levels II/2 and III (Table 20-10). Among the bifacial tools, there are only pieces reduced plano-convexly. In general, bifacial tools include only points and scrapers. Taking into account that almost all bifacial tools from Karabi Tamchin are very reduced, however, such a subdivision is unreasonable. Depending upon the number of retouched edges, bifacial tools were divided into simple, convergent, and double. Additional attributes used in the classification of bifacial tools were the presence or absence of other typological elements, such as natural, plain, or faceted backs.

Unifacial tools include continuously retouched implements with dorsal, ventral, alternating, and alternate retouch. These unifacial tools are subdivided into several tool classes, such as points, scrapers, denticulates, notches, endscrapers, and perforators. According to the number of retouched edges, edge shapes, and edge placement, most of the tool classes were subdivided into subsets based on the overall tool shape.

Because of small sample sizes, the percentages of the different unifacial tool classes are only suggestive. The main groups of unifacial tools are points and scrapers, while other tools, such as denticulates, notches, endscrapers, perforators, etc., occur in very small numbers. On the other hand, many of the unifacial tools have both a small size and extensive edge modification, making classification, at times, difficult. For instance, the distinction between points and convergent scrapers is based on the sharpness of the pointed tip, but it is objectively difficult to separate points from convergent scrapers when they are made on small blanks and have heavy invasive retouch. The tools consist of simple with one retouched edge (lateral, transverse, and transverse-oblique), double, and convergent. The correlations of simple, double, and convergent tools reflect the morphological characteristics of the unifacial toolkits (Table 20-11).

TABLE 20-10
Karabi Tamchin, tool assemblages by level (continued on following page)

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Points	*7*	*22.6*	*3*	*10.7*	*4*	*11.4*	*15*	*25.0*
Sub-triangular	2	6.5	–	–	–	–	3	5.0
Crescent	–	–	–	–	–	–	1	1.7
Sub-crescent	–	–	–	–	–	–	1	1.7
Semi-trapezoidal	–	–	–	–	–	–	2	3.3
Amorphous	1	3.2	–	–	–	–	1	1.7
Lateral	1	3.2	1	3.6	–	–	–	–
Tip fragment	3	9.7	2	7.1	4	11.4	7	11.7
Scrapers	*19*	*61.3*	*18*	*64.3*	*26*	*74.3*	*37*	*61.7*
Transverse straight	–	–	–	–	–	–	2	3.3
Transverse convex	1	3.2	2	7.1	–	–	1	1.7
Transverse wavy	–	–	–	–	–	–	1	1.7
Transverse-oblique straight	1	3.2	1	3.6	–	–	1	1.7
Transverse-oblique convex	–	–	–	–	2	5.7	1	1.7
Lateral straight	6	19.4	1	3.6	4	11.4	8	13.3
Lateral convex	–	–	5	17.9	7	20.0	5	8.3
Lateral concave	–	–	–	–	1	2.9	1	1.7
Lateral wavy	–	–	1	3.6	–	–	7	11.7
Double straight	–	–	–	–	1	2.9	1	1.7
Double convex	–	–	1	3.6	–	–	2	3.3
Double wavy	–	–	1	3.6	–	–	–	–
Double straight-convex	2	6.5	–	–	–	–	2	3.3
Double straight-concave	–	–	–	–	1	2.9	–	–
Double convex-concave	1	3.2	–	–	–	–	–	–
Convergent sub-triangular	2	6.5	2	7.1	–	–	1	1.7
Convergent leaf	–	–	1	3.6	–	–	–	–
Convergent sub-crescent	–	–	–	–	–	–	1	1.7
Convergent semi-crescent	–	–	1	3.6	–	–	1	1.7
Convergent sub-rectangular	–	–	–	–	–	–	1	1.7
Convergent semi-rectangular	–	–	–	–	1	2.9	–	–
Convergent sub-trapezoidal	–	–	–	–	–	–	–	–
Convergent semi-trapezoidal	3	9.7	–	–	1	2.9	–	–
Convergent amorphous	1	3.2	–	–	5	14.3	–	–
Convergent tip fragment	2	6.5	2	7.1	3	8.6	1	1.7
Denticulates	*2*	*6.5*	*2*	*7.1*	–	–	*2*	*3.3*
Transverse	–	–	–	–	–	–	1	1.7
Simple	1	3.2	1	3.6	–	–	–	–
Double	1	3.2	1	3.6	–	–	1	1.7
Notches	*2*	*6.5*	*4*	*14.3*	*1*	*2.9*	–	–
Simple lateral	1	3.2	2	7.1	1	2.9	–	–
Simple distal	0	0.0	2	7.1	–	–	–	–
Double distal-lateral	1	3.2	–	–	–	–	–	–
Endscrapers	–	–	*1*	*3.6*	–	–	*1*	*1.7*
Atypical distal	–	–	–	–	–	–	1	1.7
Atypical proximal	–	–	1	3.6	–	–	–	–
Perforators	*1*	*3.2*	–	–	–	–	–	–
Sub-triangular	1	3.2	–	–	–	–	–	–
Bifacial tools	–	–	–	–	*4*	*11.4*	*5*	*8.3*
Simple convex	–	–	–	–	–	–	1	1.7
Leaf-shaped	–	–	–	–	1	2.9	1	1.7
Semi-crescent	–	–	–	–	1	2.9	–	–
Sub-triangular	–	–	–	–	1	2.9	1	1.7
Bifacial, unidentifiable	–	–	–	–	1	2.9	2	3.3
Restricted total	*31*	*100.0*	*28*	*100.0*	*35*	*100.0*	*60*	*100.0*

TABLE 20-10 CONTINUED
Karabi Tamchin tool assemblages by level

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Retouched pieces	*18*		*19*		*27*		*24*	
Lateral	16		15		17		14	
Distal	1		1		2		3	
Proximal	–		–		1		2	
Bilateral	1		3		7		5	
Tool fragments	*7*		*18*		*20*		*59*	
Obversely retouched	7		14		18		53	
Inversely retouched	–		2		–		2	
Alternately retouched	–		2		1		3	
Bifacially retouched	–		–		1		1	
Total	56		65		82		143	

The following types of retouch were recognized: scalar, combined (scalar plus sub-parallel), stepped, marginal, and irregular. Sub-parallel retouch only occurred in combination with scalar retouch. It is important to note that complex tools with two or more working edges (double scrapers, points, and convergent scrapers), as a rule, exhibit different types of retouch and retouch intensity on their working edges. Taking this into account, each edge of the unifacial tools was investigated separately.

Based on the extent of the retouch, tool edges were subdivided into light retouch (1–2 retouched rows), medium retouch (multi-row retouch in strips < 5 mm wide), and heavy retouch (multi-row retouch in strips > 5 mm wide). Retouch angles were subdivided into flat (< 45°), semi-steep (45°–60°), and steep (> 60°). Using a combination of retouch type, width of retouch, and retouch angle, it was possible to divide tools into three grades of exhaustion:

(A) Not exhausted—all working edges have retouch that is light, flat, or semi-steep scalar;
(B) Semi-exhausted—even if one working edge has medium retouch by flat or semi-steep scalar or combined retouch it goes here;
(C) Exhausted—even if one working edge has heavy steep or semi-steep stepped retouch it is considered exhausted.

The results are shown in Table 20-11.

TABLE 20-11
Karabi Tamchin, morphological structure of unifacial tools

	Level II/2					*Level III*					*Level IV/2*					*Level V*				
	A	*B*	*C*	*Total*		*A*	*B*	*C*	*Total*		*A*	*B*	*C*	*Total*		*A*	*B*	*C*	*Total*	
	N	*N*	*N*	*N*	%	*N*	*N*	*N*	*N*	%	*N*	*N*	*N*	*N*	%	*N*	*N*	*N*	*N*	%
Simple	–	–	8	8	30.8	2	6	2	10	47.6	5	7	2	14	46.7	4	15	8	27	51.9
Double	–	3	–	3	11.5	–	1	1	2	9.5	–	–	2	2	6.6	–	3	2	5	9.6
Convergent	3	9	3	15	57.7	2	4	3	9	42.9	1	7	6	14	46.7	–	6	14	20	38.5
Total	3	12	11	26	100	4	11	6	21	100	6	14	10	30	100	4	24	24	52	100

A - not-exhausted tools; B - semi-exhausted tools; C - exhausted tools

LEVEL II/2

The tool assemblage of Level II/2 consists of 31 unifacial tools, 18 retouched pieces, and 7 tool fragments. Bifacial tools are absent (Table 20-10).

Unifacial Tools

The unifacial toolkit for Level II/2 is dominated by scrapers, followed by points (Table 20-10), and all tools are made on flint. With the exception of a single scraper fragment and a perforator, all retouch is dorsal (93.5%).

The two sub-triangular points are made on flakes, one with dorsal basal thinning (Figure 20-3: *1*). The amorphous point is on a blade (Figure 20-3: *2*). The ventrally thinned pointed tip of this tool is situated at the proximal end of the blank. The lateral point is made on a flake and has a retouched lateral edge and

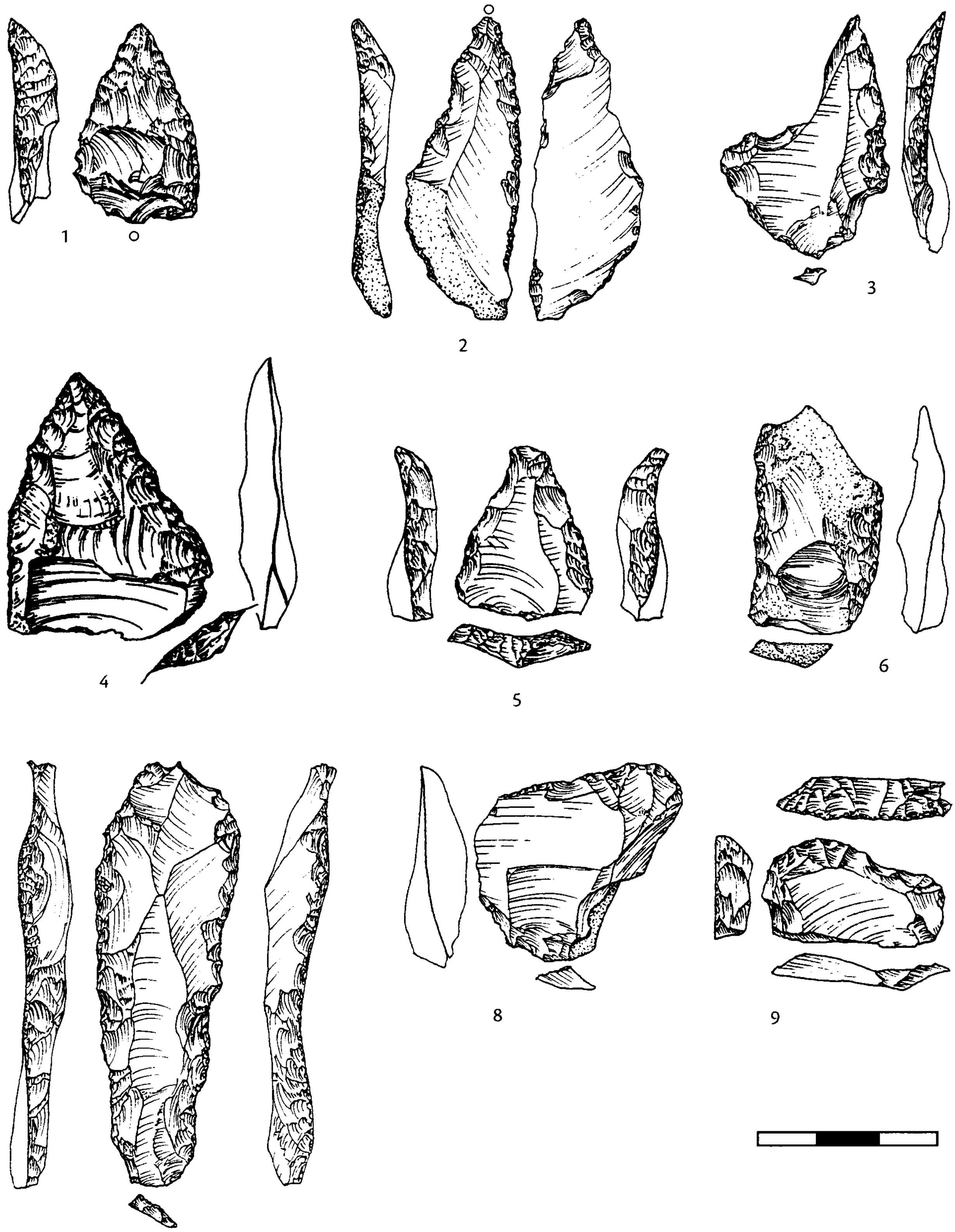


Figure 20-3—Karabi Tamchin Level II/2 tools: *1*–sub-triangular, basally thinned point; *2*–amorphous shaped point; *3*–lateral re-utilized point; *4*–semi-trapezoidal (*déjeté*) scraper; *5*–sub-triangular convergent scraper; *6*–double convex-concave shaped scraper; *7*–double straight-convex shaped scraper; *8*–transversal-oblique straight scraper; *9*–transversal wavy scraper.

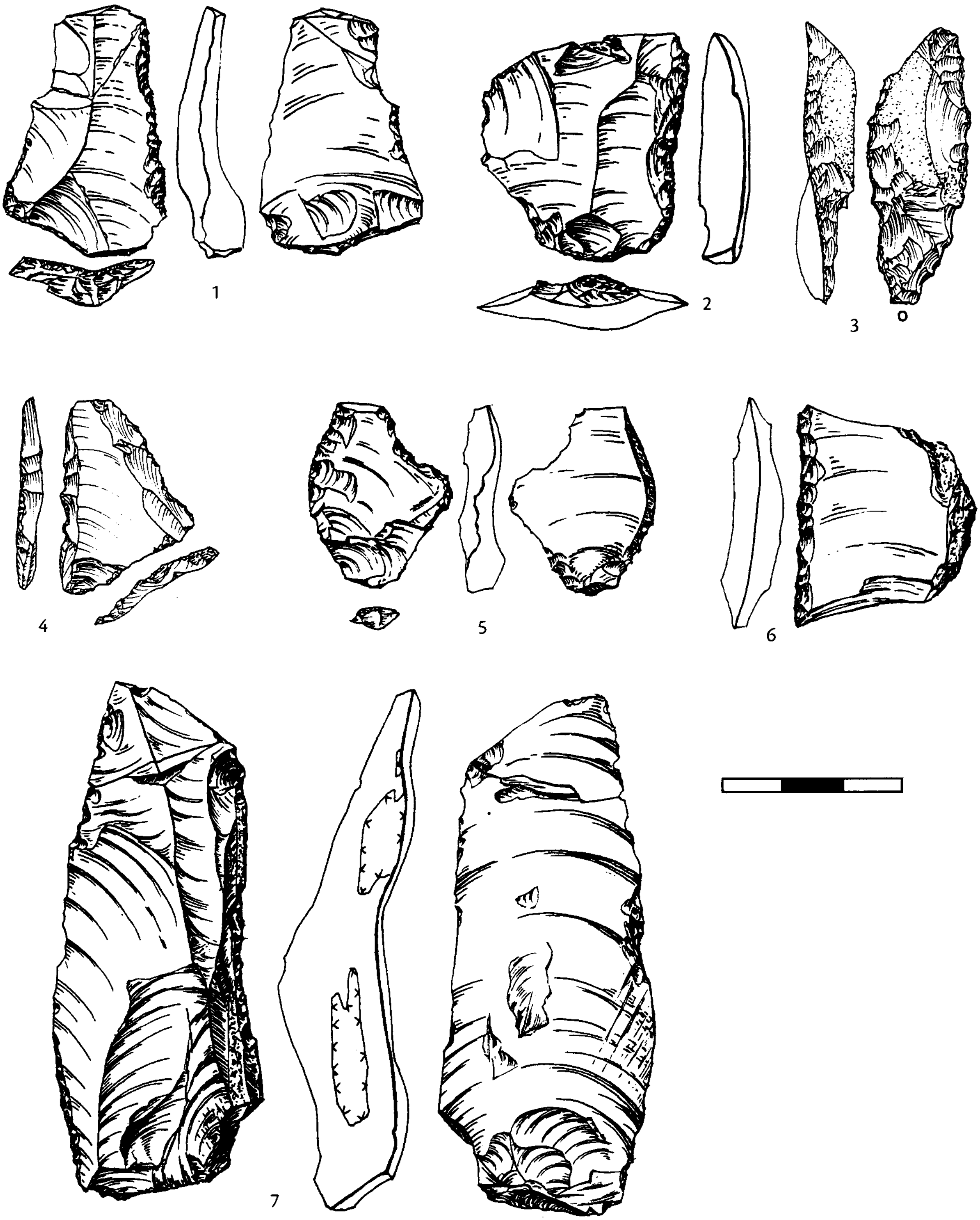


Figure 20-4—Karabi Tamchin Level II/2 tools: 1, 2–lateral straight scrapers; 3–double denticulate tool; 4–retouched flake; 5–simple notched tool; 6–lateral straight scraper with natural back; 7–retouched blade.

retouched tip (Figure 20-3: *3*). Obviously, the distal end of the tool was broken and then it was reutilized. Tip fragments represent broken pointed extremities of points.

Scrapers are mainly convergent or simple lateral (Table 20-10). The single transverse scraper is convex and made on a flake (Figure 20-3: *9*). The transverse-oblique scraper is also on a flake and has a straight retouched edge (Figure 20-3: *8*). All lateral scrapers are straight (Figure 20-4: *1, 2, 6*): one is on a transverse flake (Figure 20-4: *2*), while all others are made on regular flakes. One has a plain back accommodation and is distally truncated-faceted.

Both straight-convex scrapers are relatively large. One is made on a blade (Figure 20-3: *7*), the other on an elongated Levallois blank. The convex-concave scraper is on a regular flake (Figure 20-3: *6*). Both sub-triangular scrapers are made on large chips (Figure 20-3: *5*). All semi-trapezoidal scrapers are canted (*déjeté*). One is made on a broken flake, another on a transverse flake, while the third is on a regular flake (Figure 20-3: *4*). The amorphous scraper is on a regular flake. Both tip fragments are heavily exhausted, broken pointed parts of convergent scrapers. One has alternate retouch of its working edges.

One denticulate on a trimming flake has a straight edge, while the other, on a blade (Figure 20-4: *3*), has two straight edges. Both notched tools are only lightly retouched. The single lateral notch is on a regular flake (Figure 20-4: 5), while the double notch, one lateral and the other distal, is on a broken flake. The perforator is on a crested flake, has alternately retouched edges, and is ventrally thinned at its tip.

Thus, the unifacial tools are comprised of 28 dorsally retouched pieces, 2 alternating retouched pieces, and 1 alternately retouched piece. One piece among these, a scraper, had a natural back; it is also the only laterally truncated-faceted piece. Three of the unifacial pieces have ventral thinning; on two of these the thinning occurs at the tip, while on the third it is basal.

Tool Fragments

Tool fragments are broken tools; all are made on flint with dorsal retouch (Table 20-10).

Retouched Pieces

All retouched pieces are on flint and, aside from three with alternating retouch, all have dorsal retouch (Table 20-10). The laterally retouched pieces include 3 blades, 11 flakes, 1 chip, and 1 chunk. One blade is relatively large (89 mm × 50 mm × 9 mm) and has a multi-faceted platform (Figure 20-4: *7*). The retouched flakes include 7 regular flakes, 1 Levallois flake, and 3 *débordant* flakes. The distal retouched piece is on a broken flake. The bilateral retouched piece is on a transverse flake.

Level III

The tool assemblage of Level III consists of 28 unifacial tools, 19 retouched pieces, and 18 tool fragments. Bifacial tools are absent (Table 20-10).

Unifacial Tools

Over half of the unifacial tools in Level III are scrapers, while points, denticulates, notches, and endscrapers appear in low numbers (Table 20-10). Only two notched tools are made on yellow chert; the others are on flint. All unifacial tools have dorsal retouch, except for a single notched tool with alternate retouch and a convex scraper with inverse retouch.

There are two small point tips and a single lateral point made on an elongated flake (Figure 20-5: *1*).

Scrapers have considerable typological variability, although simple forms are predominant (Table 20-10). The convex transverse scrapers and the transverse-oblique scraper are made on transverse flakes. The former are exhausted (Figure 20-6: *4*). The working edge of the transverse-oblique scraper is straight and has invasive retouch. The straight scraper is made on a flake. The blanks used for simple convex scrapers include 2 regular flakes (Figure 20-6: *2*), 1 blade (Figure 20-6: *1*), 1 elongated Levallois flake (Figure 20-5: *7*), and 1 Levallois blade (Figure 20-5: *8*). The one on a simple blade is ventrally retouched and has ventral back thinning (Figure 20-6: *1*). While the scraper on Levallois flake is lightly retouched, all others have invasive retouch. The lateral scraper with a wavy working edge is made on a broken flake and is lightly retouched (Figure 20-6: *3*). The double-convex scraper is on a chip and has a distal faceted truncation (Figure 20-5: *5*). The double-wavy scraper (Figure 20-5: *3*) is made on a blade and is exhausted. One sub-triangular scraper is on a large chip (Figure 20-5: 2), another is on a flake, and both are invasively retouched. The leaf-shaped scraper is made on a flake (Figure 20-5: *6*) and is exhausted. The semi-crescent scraper is on a chip and has invasive retouch. One of tip fragments is a broken distal part of a convergent scraper and is too small to define the blank type. Another is on a relatively large trimming flake produced during the rejuvenation of the terminal end of a convergent scraper (Figure 20-5: *4*). Both tip fragments are heavy exhausted.

The simple denticulate is lightly retouched and on a flake, although its proximal end has a faceted truncation. The double-wavy denticulate (Figure 20-6: *5*) is made on a blade and is exhausted. All notched pieces have light retouch. Both lateral notches are made on transverse flakes, with alternate retouch. One distal notch is on a transverse flake; the other is broken. The endscraper is atypical (Figure 20-6: *6*), is on an irregularly shaped transverse flake, and has heavy steep combined basal retouch.

There are no tools with back accommodation. Only one tool has ventral thinning, while two tools are proximally truncated-faceted.

Tool Fragments

All tool fragments are flint and have dorsal retouch.

Retouched Pieces

Most retouched pieces (Figure 20-6: *7–10*) are flint, although two are on regular yellow chert flakes. Lateral retouched pieces include 1 blade, 11 flakes, 2 chips, and 1 chunk. There are 8 regular flakes, 1 transverse flake, 1 Levallois flake, and 1 *débordant* flake with marginal dorsal retouch. The distal retouched piece is on a flake. Two of the bilaterally retouched pieces are made on blades and one is on an overpassed flake.

Level IV/2

The tool assemblage of Level IV/2 consists of 4 bifacial tools, 31 unifacial tools, 27 retouched pieces, and 20 tool fragments (Table 20-10).

Bifacial Tools

Each bifacial tool has a different shape (Table 20-10) but all are plano-convex and exhausted. The sub-leaf

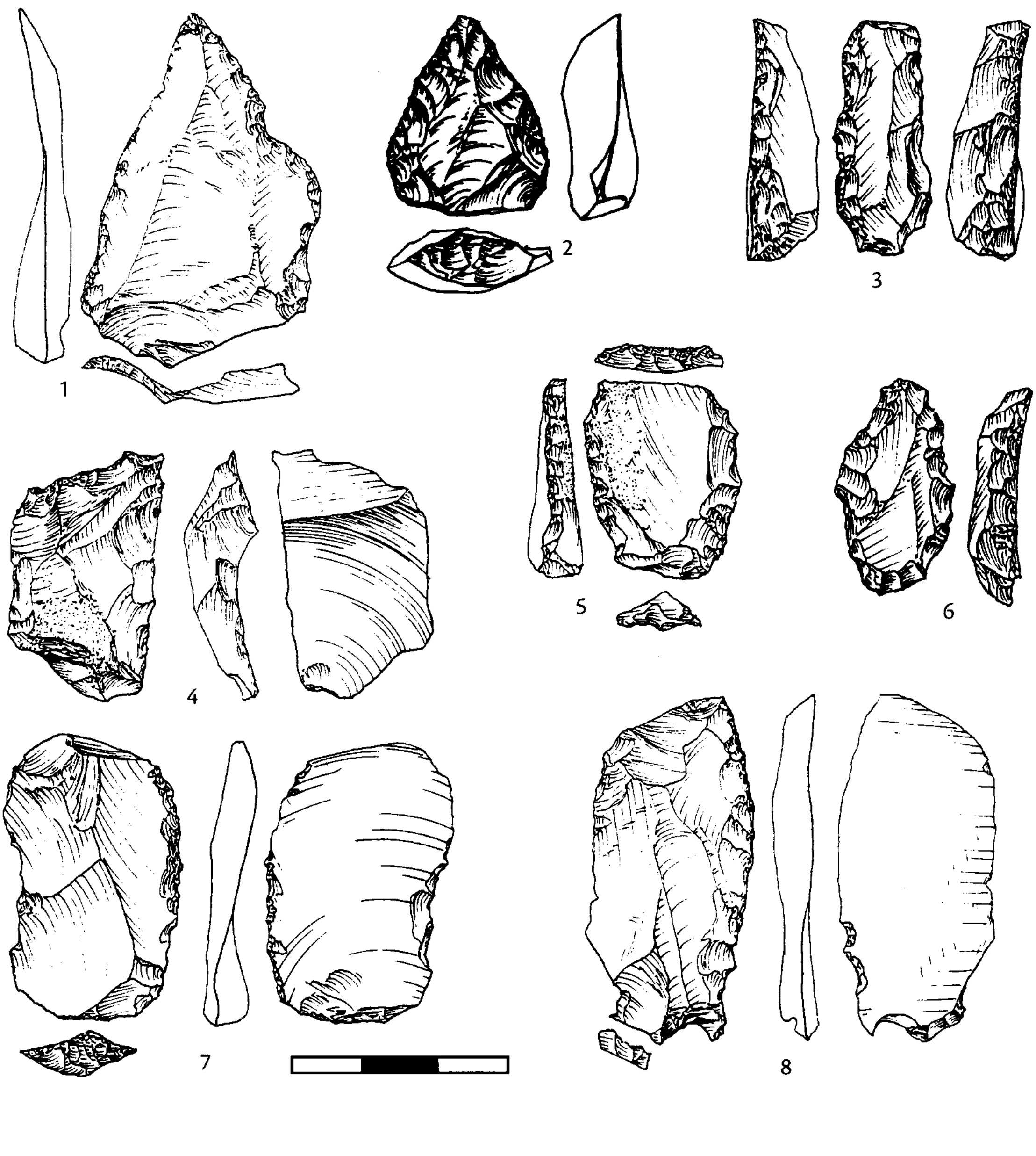


Figure 20-5—Karabi Tamchin Level III tools: *1*–lateral point; *2*–sub-triangular convergent scraper; *3*–double wavy scraper; *4*–tip fragment of convergent scraper; *5*–double convex scraper; *6*–leaf-shaped convergent scraper; *7*–lateral convex scrapers made on Levallois flake; *8*–lateral convex scraper made on Levallois blade.

example (Figure 20-7: *1*) is on a flint plaquette and is relatively large: 64 mm long, 44 mm wide, and 20 mm thick. Two edges are retouched from the convex side by stepped and scalar retouch. One edge had a natural back, covered by cortex. The edges exhibit traces of resharpening. The sub-triangular example (Figure 20-7: *2*) is also on a flint plaquette (57 mm long, 46 mm wide, and 17 mm thick). Its edges have scalar retouch. It also has a natural back. The sub-crescent bifacial tool (Figure 20-7: *3*) is small: 27 mm in length, 16 mm in width, and 9 mm in thickness. Obviously, the tool is made on a flake. Its edges have scalar and stepped retouch and it is heavily reduced and exhausted through multiple rejuvenations of the working edges. The unidentifiable bifacial tool (39 mm long, 28 mm wide, and 14 mm thick) is broken. It has stepped retouch and is very exhausted.

Unifacial Tools

Unifacial tools in Level IV/2 are mainly scrapers of different types (Table 20-10). Most are on flint, but there are several tools on local chert. Among these are 1 point made on brown chert and 2 simple scrapers made on grey chert. With the exception of 4 scrapers (2 with ventral, 1 with alternate, and 1 with alternating retouch), all tools have dorsal retouch.

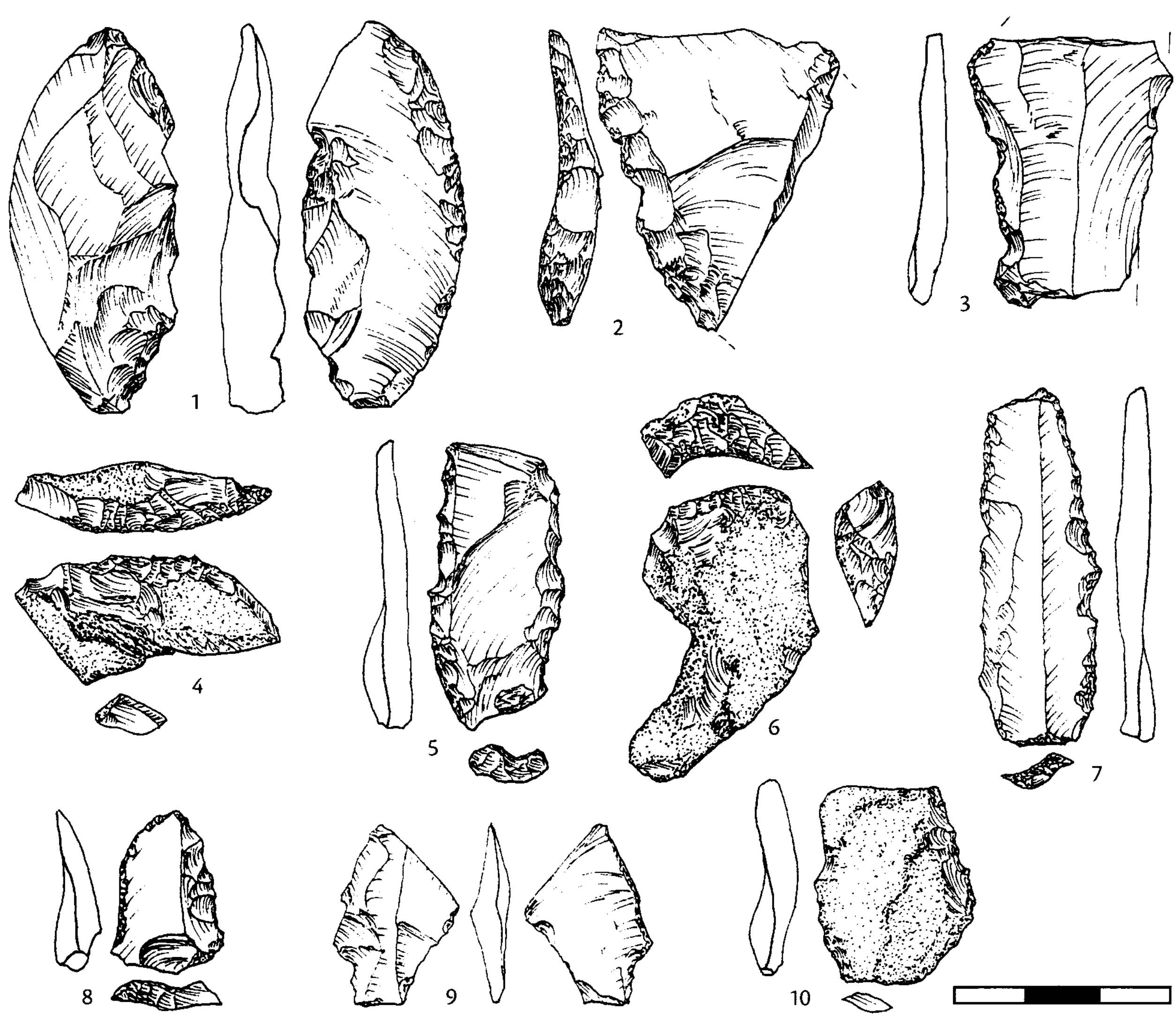


Figure 20-6—Karabi Tamchin Level III tools: *1*–lateral ventrally retouched convex scraper with thinned back; *2*–lateral convex scraper; *3*–lateral wavy scraper; *4*–transversal convex scraper; *5*–double denticulate tool; *6*–atypical endscraper; *7*–retouched blade; *8, 9, 10*–retouched chips.

Three of the 4 point tips have invasive retouch and one is heavily exhausted. Three are simple broken fragments but one came from a special rejuvenation of the pointed end of some point. One of broken tips is on chert, all others are on flint. Double and convergent scrapers are most common (Table 20-10). The transverse-oblique scrapers are convex and are on transverse flakes (Figure 20-8: *10*). One is exhausted, while the other is lightly retouched (Figure 20-8: *4*).

Lateral scrapers are mainly convex (Table 20-10). Two with straight edges are on regular flakes and have invasive retouch; one of these also has ventral thinning (Figure 20-8: *9*), another is on blade (Figure 20-8: *6*), and another on a chip. The tool on chip has an alternating lightly retouched edge and a plain back on the opposite edge. Most of the convex scrapers have invasive retouch; only 2 pieces have light retouch. One of these is chip-sized (Figure 20-8: *2*), all others are on flakes (Figure 20-8: *5*, *7*). One flake scraper has ventral basal thinning. Another flake scraper is of grey chert and has a natural back on the unretouched lateral edge. The concave scraper, on a grey flint flake, has invasive, ventral retouch and both surfaces are covered by a deep green patina, although there is no patination on the retouched areas. Obviously, this tool was reutilized from some ancient blank.

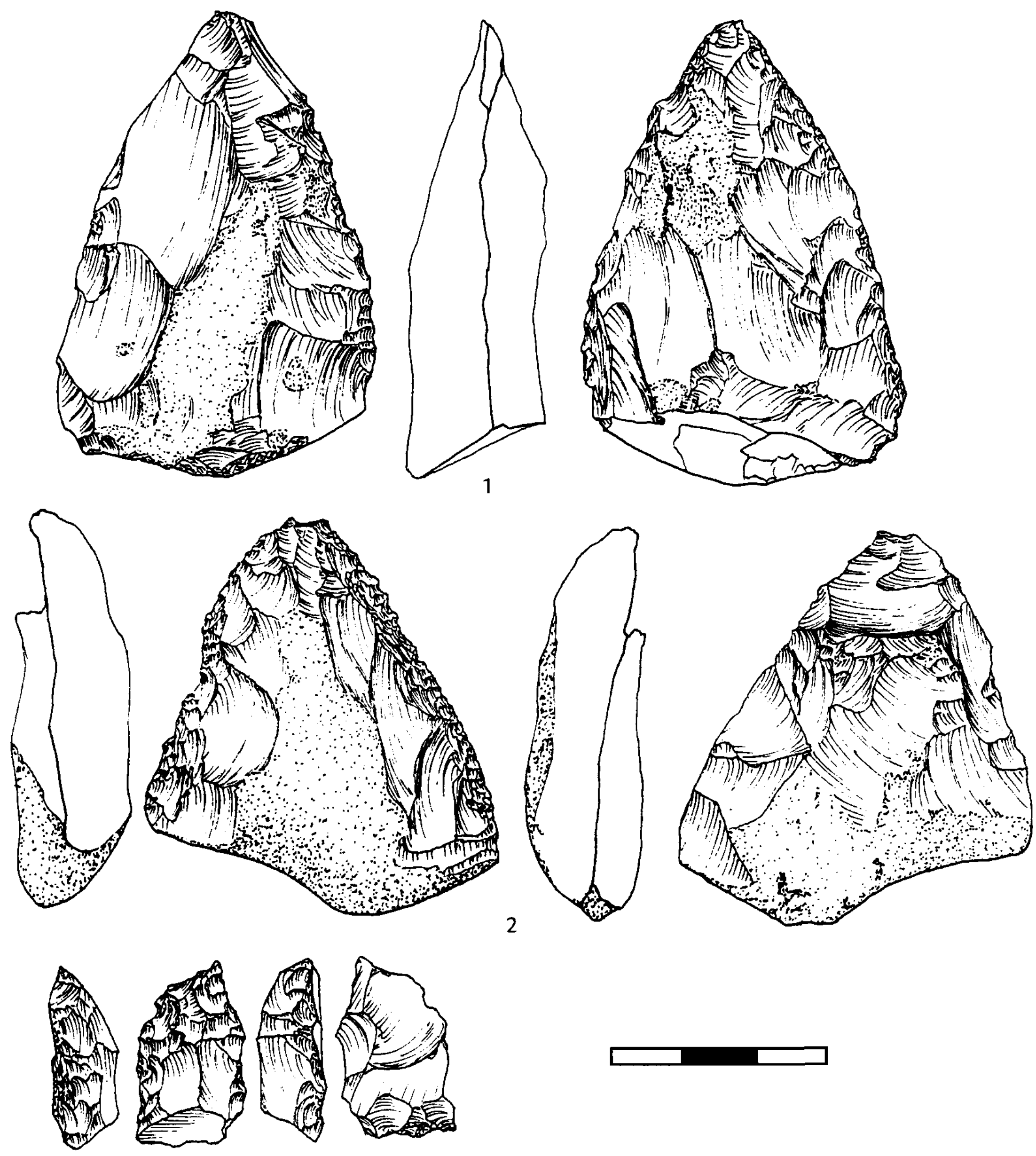


Figure 20-7—Karabi Tamchin Level IV/2 tools: *1*–sub-leaf shaped naturally backed bifacial tool; *2*–sub-triangular naturally backed bifacial tool; *3*–semi-crescent bifacial tool.

Both double scrapers are exhausted. The double-straight scraper is on a chip, while the straight-concave scraper is on a trimming chip.

Convergent scrapers are mainly amorphous (Table 20-10). The semi-rectangular scraper is made on a chip that has light alternate retouch. The semi-trapezoidal scraper is made on a flake by invasive retouch and its proximal end is ventrally thinned. Both semi-rectangular and the semi-trapezoidal scrapers are canted (*déjeté*). Two of amorphous-shaped scrapers are on chips, one is on a blade, and the others are on flakes (Figure 20-8: *1*). All have invasive retouch. Three have the pointed tip at the proximal end of the blank. One of the latter and one regular example have thinned tips. All tip fragments of convergent scrapers are heavy exhausted. Two are broken distal parts of convergent

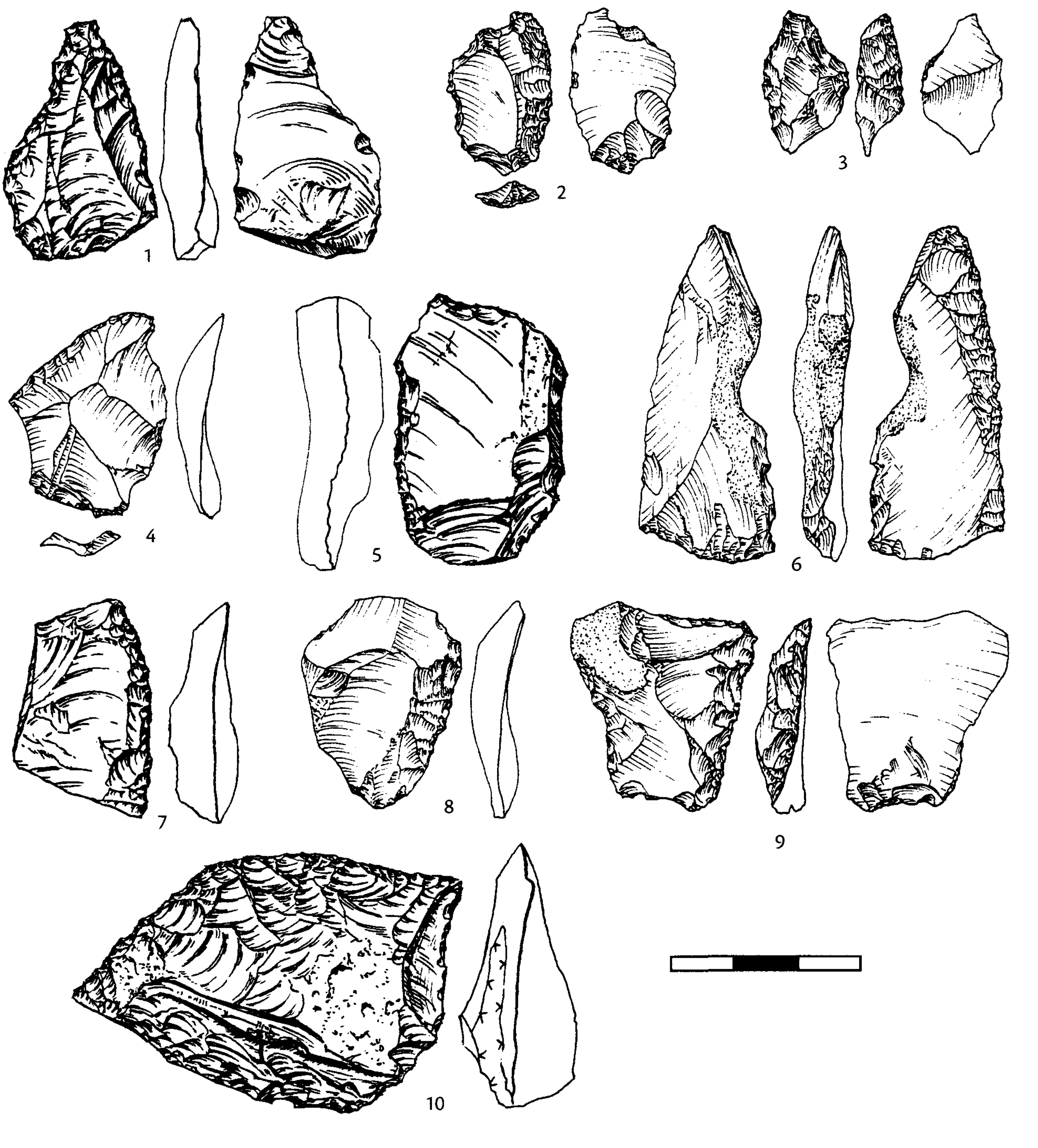


Figure 20-8—Karabi Tamchin Level IV/2 tools: *1*–amorphous shaped convergent scraper; *2*–lateral convex scraper on chip; *3*–tip fragment of convergent scraper; *4, 10*–transversal-oblique convex scrapers; *5*–lateral convex scraper; *6*–lateral convex scraper on blade; *7*–lateral convex scraper on flake; *8, 9*–lateral straight scrapers.

scrapers; the third resulted from the rejuvenation of a convergent scraper (Figure 20-8: *3*).

The notched tool is an exhausted lateral notch on a broken flake with a truncated-faceted distal end.

In sum, 87.1% of the unifacial tools have dorsal retouch, 6.4% are naturally backed, and 3.2% are truncated-faceted. In addition, 16.1% have ventral thinning, all but one basal.

Tool Fragments

Of the tool fragments fragments, one has alternate and one has bifacial retouch. All the others have dorsal retouch (Table 20-10).

Retouched Pieces

Thirteen retouched pieces are on regular flakes, 2 on transverse flakes, and 2 on chips. The regular flakes include 2 with alternating retouch, 1 with ventral retouch, and the rest with dorsal retouch (Table 20-10). One each of the dorsally retouched flakes is on yellow chert and grey chert. Both transverse flakes are flint and have dorsal retouch. One chip is flint with dorsal retouch, the other is yellow chert and is ventrally retouched. The bilaterally retouched pieces include 3 flakes, 1 overpassed blade, and 3 chips. All bilaterally retouched pieces are flint. Most retouch is dorsal, with the exception of one ventrally and two alternately retouched flakes, as well as one alternately retouched blade. Both distally retouched pieces are made on flint flakes. One has dorsal retouch, the other ventral. The proximally retouched piece is on a yellow chert flake and has alternating retouch.

Level V

The tool assemblage from Level V includes 5 bifacial tools, 55 unifacial tools, 59 tool fragments, and 24 retouched pieces (Table 20-10).

Bifacial Tools

All bifacial tools are on flint and all are plano-convex. Each example has a different shape (Table 20-10). The simple convex bifacial tool is on a medium-sized plaquette (71 mm long, 46 mm wide, and 15 mm thick) and has a single convex working edge made by stepped retouch (Figure 20-9: *3*). The side of tool opposite the retouched edge is faceted by retouch. The sub-triangular-shaped bifacial tool (Figure 20-9: *1*) is on a small plaquette (40 mm long, 32 mm wide, and 15 mm thick). Two edges have stepped retouch. The basal end of the tool is broken. The leaf-shaped bifacial tool (Figure 20-9: *2*) is relatively small (29 mm long, 25 mm wide, and 10 mm thick). It is heavy exhausted and semi-bifacial; it could be defined as a reutilized unifacial convergent scraper.

The unidentifiable pieces comprise 2 pointed ends of bifacial tools. Both are exhausted and have almost equal dimensions. One is made on a plaquette (36 mm long, 31 mm wide, and 11 mm thick), while the other is on a flake (32 mm long, 30 mm wide, and 10 mm thick).

Unifacial Tools

The toolkit of unifacial tools, all dorsally retouched, consists mainly of scrapers and points of different types, with scrapers dominating (Table 20-10). Aside from 2 points on grey chert and 3 scrapers on yellow chert, all unifacial tools are made on flint.

Two of the sub-triangular points have their pointed tips proximally positioned (Figure 20-10: *4*), while the other is canted (*déjeté*). The canted point has invasive retouch, as well as a ventrally thinned pointed tip (Figure 20-10: *2*). These sub-triangular points are heavy exhausted. The crescent point is made on a transverse flake and is exhausted. The point tip is canted. The sub-crescent point (Figure 20-10: *5*) is on a grey chert blade, is exhausted, and its point is proximally positioned. The semi-trapezoidal points have invasive retouch, are on broken flakes, and are canted. The amorphous point (Figure 20-10: *9*) is on a grey chert trimming blade and is exhausted. Tip fragments include 4 small broken tips and 3 removals from the rejuvenation of points. One of the rejuvenation tips is proximal and has ventral thinning (Figure 20-10: *1*).

Unifacial scrapers are dominated by simple lateral types (Table 20-10). Transverse scrapers include 2 straight, 1 convex, and 1 wavy. One straight scraper on a broken flake has a plain back at the proximal end. Another straight exhausted scraper is on a chip. The convex scraper is on a transverse flake and is also heavily exhausted. The wavy scraper is made on a chip. The convex and the wavy transverse scrapers have proximal backing. Transverse-oblique scrapers include both straight (Figure 20-11: *7*) and convex types. The straight scraper is on a yellow chert flake, while the convex scraper is exhausted.

Straight lateral scrapers are made on 4 flakes, 3 chips, and 1 blade. One is on yellow chert. Two on flakes have cortex-covered backs (Figure 20-11: *3, 4*). Also, one is proximally thinned and distally truncated-faceted. Most of the lateral straight scrapers are invasively retouched (Figure 20-11: *5*). One chip-dimensioned straight scraper (Figure 20-11: *8*) is on brown chert and is exhausted, while two others are lightly retouched.

The convex lateral scrapers include 2 on flakes (Figure 20-11: *9, 10*), 1 on blade (Figure 20-11: *1*), 1 on chip, and 1 on a trimming flake (Figure 20-11: *6*). The latter is on yellow chert. The scraper on blade is exhausted and its distal end is truncated-faceted. The ones on the chip and the trimming element are lightly retouched, while those on flakes have invasive retouch. The concave scraper is on a transverse flake. It is exhausted and has a faceted back opposite the retouched edge. Wavy scrapers are made on 4 regular flakes, 1 chip, 1 overpassed flake, and 1 blade. Four have invasive retouch and 3 are heavy exhausted. One, on a regular flake (Figure 20-11: *11*), has a lateral truncated-faceted edge opposite the working edge. The example on a blade (Figure 20-11: *5*) is exhausted.

The double scrapers have various shapes: double-straight, double-convex (Figure 20-10: *8*), and straight-convex (Figure 20-10: *3*). The double-straight scraper is on a chip and has invasive retouch. Both double-convex scrapers are exhausted. One of these is made on a blade. The double-straight one is on flake and is distally truncated-faceted.

There are five different types of convergent scrapers (Table 20-10), most of which are exhausted. Both sub-crescent and semi-crescent (Figure 20-10: *7*) scrapers have proximal points and are made on regular flakes. The tip of the sub-crescent tool is ventrally thinned. Both the sub-rectangular and sub-triangular (Figure 20-10: *6*) scrapers are canted (*déjeté*). The sub-rectangular scraper is made on a chip, while the sub-trapezoidal scraper is made on regular flake. The tip fragment of a convergent scraper is too small to define its blank type.

The transverse denticulate is on a transverse flake and has an exhausted convex working edge. The double denticulate (Figure 20-11: *12*) has invasive retouch. It is on a broken flake and has a straight-concave shape. The endscraper is on a regular flake and could be defined as atypical. Its distal end has steep and stepped retouch, while its lateral edge has flat scalar retouch.

In sum, all unifacial tools are dorsally retouched. Five have backing: 1 is naturally backed and 4 have faceted backing. In addition, there are 4 tools with ventral thinning: 3 at the tip and 1 at the base. There are also 3 distally truncated-faceted and 1 laterally truncated-faceted pieces. The distal end of the basally thinned tool (lateral scraper) is also truncated-faceted.

Tool Fragments

There are 53 dorsally retouched, 2 ventrally retouched, 3 alternately retouched, and 1 bifacially retouched tool fragments. One alternately and two dorsally retouched pieces are yellow chert; all others are flint (Table 20-10).

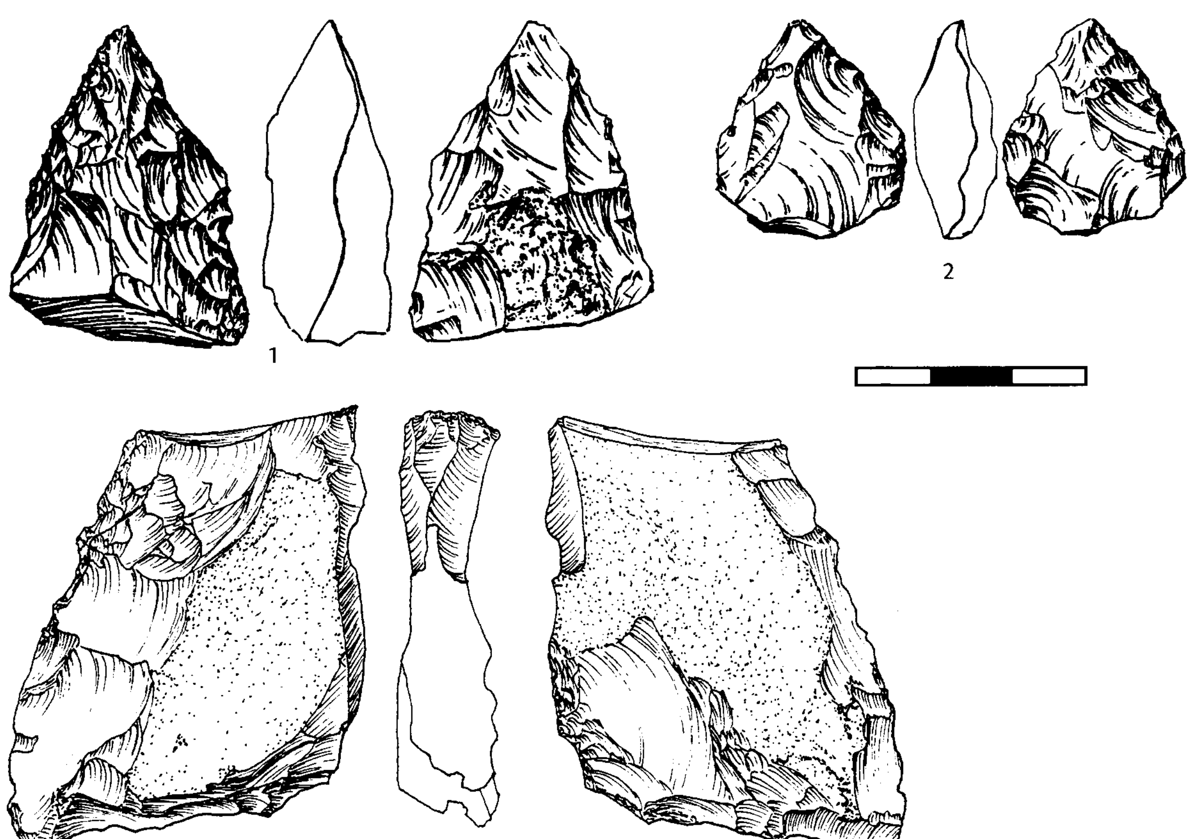


Figure 20-9—Karabi Tamchin Level V tools: 1–sub-triangular bifacial tool; 2–sub-leaf-shaped tool with semi-bifacial elaboration; 3–simple straight bifacial tool, with faceted back accommodation.

Retouched Pieces

The retouched pieces mainly have lateral retouch. Of the latter, 2 are on blades, 6 on regular flakes, 1 on a transverse flake, 1 on a crested flake, and 4 on chips. Both retouched blades are flint, one with dorsal and the other with ventral retouch. Only one regular flake has inverse retouch, all others are dorsally retouched. Two dorsally retouched flakes are yellow chert, while all others are flint. The transverse flake and the crested flake are flint and both are dorsally retouched. All laterally retouched chips are flint. Two of these have dorsal retouch, two others have alternating retouch (Table 20-10).

Bilaterally retouched pieces include 1 on blade, 2 on broken flakes, and 2 on chips. All are made on flint. Both edges of the bilaterally retouched blade have dorsal retouch. Among the retouched flakes, one has dorsal and another has alternate retouch. One of the chips has dorsal retouch and the other has alternating retouch. Distally retouched pieces, 1 flake and 2 chips, are all flint. Both distally retouched chips have dorsal retouch, while the flake has ventral retouch. The two pieces with proximally retouched ends exhibit dorsal retouch and are on flint. One of these is made on a transversal flake, another is made on a chip.

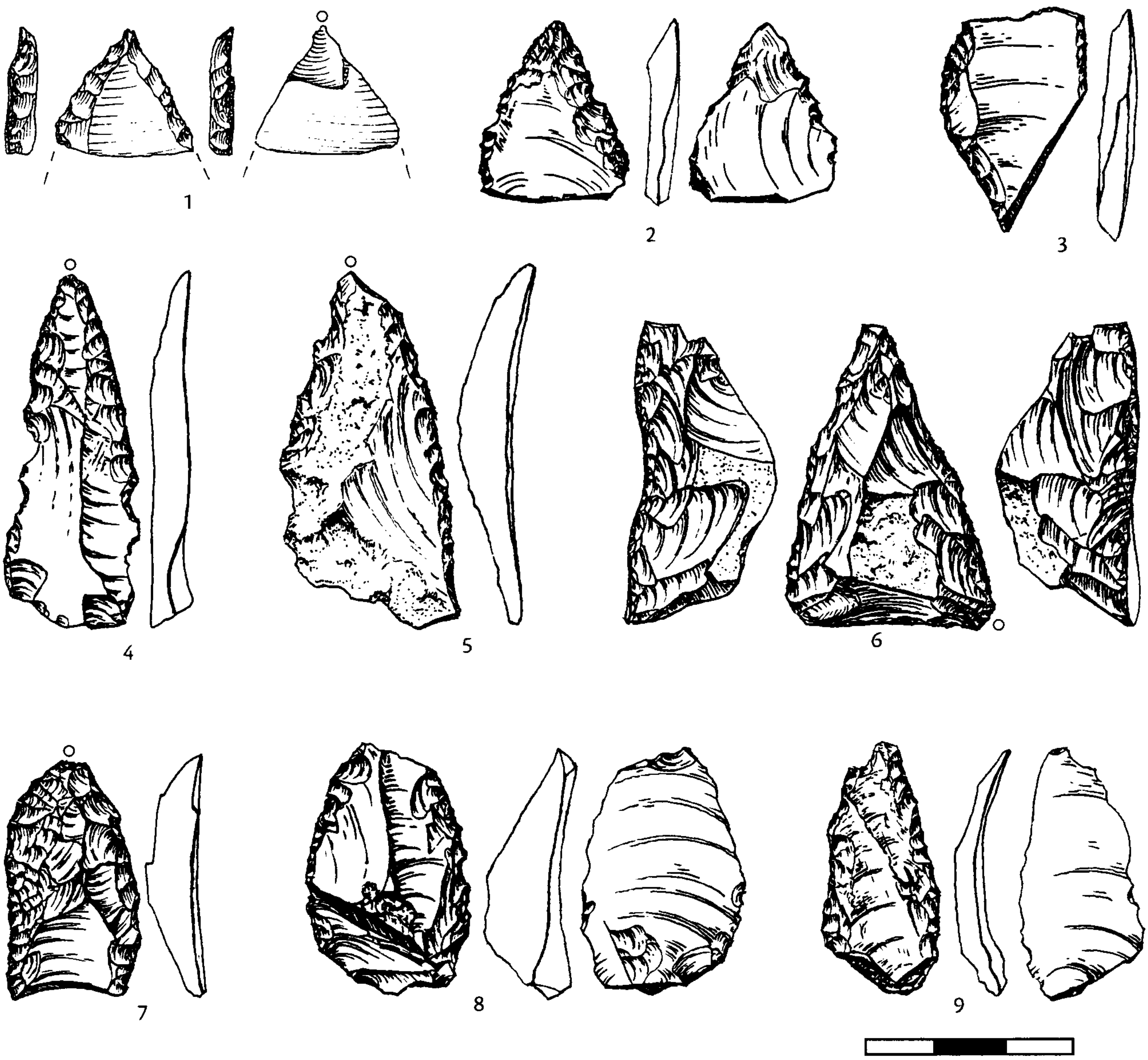


Figure 20-10—Karabi Tamchin Level V tools: 1–tip fragment of reversal (tool orientation is 180° from the technological orientation of its blank) point, tip thinned; 2–sub-triangular canted point, tip thinned; 3–double straight-convex scraper; 4–sub-triangular reversal point on blade; 5–sub-crescent reversal point; 6–sub-triangular canted scraper; 7–sub-crescent reversal scraper; 8–double-convex scraper; 9–amorphous shaped point.

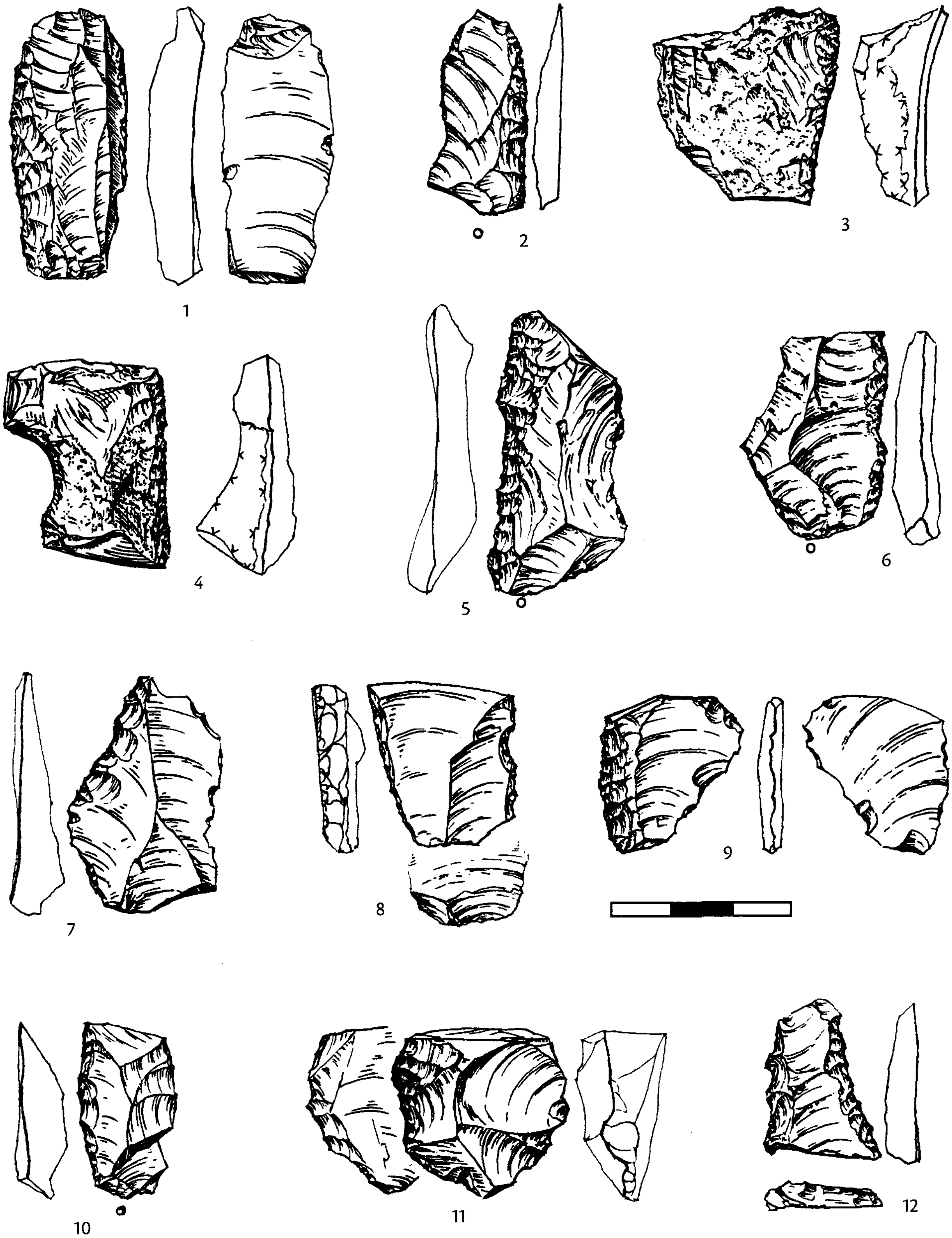


Figure 20-11—Karabi Tamchin Level V tools: *1*–lateral convex scraper, distally truncated-faceted; *2*–lateral straight scraper; *3*, *4*–lateral straight scrapers with natural back accommodation; *5*–lateral straight scraper; *6*–lateral wavy scraper; *7*–transversal-oblique straight scraper; *8*–lateral straight scraper; *9*, *10*–lateral convex scrapers; *11*–lateral convex scraper, laterally truncated-faceted; *12*–double denticulate tool.

Morphological Structure and Degree of Unifacial Tool Retouch

Level II/2

There are 7 points and 19 scrapers in Level II/2 with a combined 44 retouched edges (Table 20-11). Of these edges, 8 have light retouch, 6 have medium retouch, and 30 have heavily retouched edges. There are 1.7 retouched edges per tool (Table 20-12). The lightly retouched edges all have scalar retouch: 4 flat, 3 semi-steep, and 1 steep. Those with medium retouched edges have 2 with semi-steep scalar retouch, 2 with steep scalar retouch, and 2 with flat combined retouch. Among those with heavy retouched edges, 15 have stepped retouch (7 semi-steep and 8 steep), 8 have scalar retouch (3 flat, 4 semi-steep, and 1 steep), and 7 have combined retouch (2 flat, 4 semi-steep, and 1 steep). For all types of retouch, most are either semi-exhausted or are exhausted (Table 20-11).

Level III

Among the unifacial tools in Level III, there are 3 points and 18 scrapers (Table 20-10) that together (Table 20-11) have 32 retouched edges. Of these, 8 have light retouch, 10 medium retouch, and 14 heavy retouch. There is an average of 1.5 retouched edges per tool (Table 20-12). Among the lightly retouched edges, 7 have scalar retouch (6 flat and 1 steep) and 1 has flat combined retouch. Among those with medium retouched edges, 2 have flat scalar retouch, 4 semi-steep scalar retouch, 1 flat combined retouch, and 2 semi-steep combined retouch. Those with heavily retouched edges include 8 with stepped retouch (1 semi-steep and 7 steep), 1 with steep scalar retouch, and 5 with combined retouch (1 flat, 2 semi-steep and 2 steep). Combined, there are 4 not exhausted, 11 semi-exhausted, and 6 exhausted tools. As in the previous level, semi-exhausted and exhausted tools predominate (Table 20-11).

Level IV/2

There are 4 points and 26 scrapers in Level IV/2 with a total of 46 retouched edges, 20 of which have light retouch, 15 medium retouch, and 11 heavy retouch. There is an average of 1.5 retouched edges per tool. Among those with light retouch, 10 are scalar (7 flat, 2 semi-steep, and 1 steep) and 1 has flat combined retouch. Those with medium retouch include 3 with stepped retouch (1 flat, 2 semi-steep) and 12 with scalar retouch (4 flat, 7 semi-steep, and 1 steep). Among the heavily retouched edges, 13 are stepped (4 semi-steep and 9 steep), 6 are scalar (3 flat and 3 semi-steep), and 1 has combined flat retouch. As usual, semi-exhausted and exhausted tools significantly outnumber those that are not exhausted (Table 20-11).

Level V

Combined, the 15 unifacial points and 37 unifacial scrapers account for 80 retouched edges in Level V. Of these, 5 have light retouch, 25 medium retouch, and 50 heavy retouch. Again, there is an average of 1.5 retouched edges per tool. The light retouch is all scalar, 3 flat and 2 semi-steep. The medium retouch includes 2 with steep stepped retouch, 22 with scalar retouch (8 flat, 13 semi-steep, 1 steep), and 1 with semi-steep combined retouch. Among the heavily retouched edges, 29 have stepped retouch (18 semi-steep and 11 steep), 18 scalar retouch (7 flat, 10 semi-steep, and 1 steep), and 3 combined retouch (1 flat and 2 semi-steep). Again, the semi-exhausted and exhausted edges dominate (Table 20-11).

Table 20-12
Occupation characteristics of assemblages from Karabi Tamchin

	Level II/2	*Level III*	*Level IV/2*	*Level V*
Percentage of tools	54.4	54.6	67.2	66.5
Retouched edges : tools	1.7 : 1	1.5 : 1	1.5 : 1	1.5 : 1
Blanks[1] : cores	23.0 : 1	19.2 : 1	31.6 : 1	no cores
Blanks[1] : cores + bifacial tools	23.0 : 1	19.2 : 1	13.6 : 1	30.2 : 1
Tools on blanks[2] : cores + bifacial tools	12.3 : 1	9.4 : 1	8.3 : 1	15.8 : 1
Tools on blanks[2] : unretouched blanks	1.1 : 1	0.9 : 1	1.6 : 1	1.1 : 1
Density of artifacts[3] per cubic meter	41.2	47.6	48.8	98.0

[1]without tool fragments
[2]identifiable tools only
[3]all artifacts, excluding chips and chunks

Tool Treatment Elements

A large proportion of the tools in the four assemblages of Karabi Tamchin are heavily retouched, with multiply rejuvenated and modified working edges. Among flakes, blades, and chips, there are some trimming elements that were by-products of secondary tool treatment, as well as by-products tool edge modification. These include resharpening elements of tool edges and rejuvenation elements of pointed tips and bases.

These resharpening elements have faceted or plain platforms, with lipping, obtuse platform angles, numerous proximally positioned dorsal scars, incurvate or twisted lateral profiles, and expanding or irregular shapes. In most Middle Paleolithic studies, these are usually attributed only to bifacial thinning (Bordes 1961; Newcomer 1971; Schild and Wendorf 1977; Bradley and Sampson 1986; Demidenko and Usik 1993c; Chabai and Demidenko 1998). This attribution appears questionable, because such resharpening elements might come both from the thinning of bifacial tools and from renewing the edges of unifacial tools. Moreover, extensive resharpening of tool edges also took place in industries where bifacial thinning, as well as bifacial tools, are uncommon (Dibble 1988, 1991; Kuhn 1995). In practice, it is often too difficult to separate trimming elements from bifacial and unifacial tools if both kinds of tools are present in the toolkit. In fact, only the characteristics of platform preparation, when visible, may provide a relatively clear basis for separating them. It is important to note as well that some flakes and chips derived from obtuse supplementary core platforms might have characteristics close to resharpening elements.

Level II/2

There are 2 resharpening elements and 1 rejuvenation element in Level II/2. The resharpening elements are a flake and a chip. The resharpening flake is relatively large (39 mm × 32 mm × 6 mm) with a faceted platform 12 mm wide and, given its platform, might have been derived from the thinning of a bifacial tool. This flake was used as a blank for the preparation of a denticulate. However, neither bifacial tools nor a bifacial thinning strategy are known in this assemblage. Thus it is possible that this blank was scavenged from some open occupation of another industry, where bifacial tools were common. Moreover, it is on a grey flint with greenish patina, otherwise unknown in this level. The chip is medium-sized (11 mm × 11 mm × 4 mm) and has a plain platform, which might suggest its origin was in unifacial tool resharpening. The rejuvenation element is a medium-sized chip (8 mm × 16 mm × 3 mm) and was struck from the basal part of a unifacial tool.

Level III

There are 20 resharpening elements and 1 rejuvenating element in Level III. The resharpening pieces are comprised of 1 unretouched flake and 19 chips. The flake is not large (38 mm × 32 mm × 7 mm) and has a concave faceted platform that suggests it came from bifacial thinning, although neither bifacial tools nor a bifacial thinning strategy has been noted in this level. Obviously, it again may be the result of artifact scavenging. Another possibility is that this piece came from the production of a supplementary core platform, since it has no clear proximal retouch scars. The resharpening chips include 1 large chip, 9 medium chips, and 9 small chips. The largest chip (26 mm × 20 mm × 2 mm) has a plain platform 6 mm wide. Almost all medium- and small-sized chips have plain platforms; only one medium chip is faceted. Possibly, this chip came from a supplementary core platform.

The rejuvenation element is relatively large (35 mm × 20 mm × 12 mm), has a sharp pointed tip, and part of a laterally retouched tool edge. Typologically, it is a point tip fragment.

Level IV/2

There are 37 resharpening and 4 rejuvenating elements in Level IV/2. Among resharpening elements are 35 chips, 1 flake, and 1 blade. The flake is relatively small (28 mm × 32 mm × 5 mm), has a faceted platform, and was a blank for a double scraper. The blade also is small (36 mm × 14 mm × 4 mm) and has a faceted platform.

There are 3 large, 16 medium, and 16 small chips. Two large chips have faceted platforms and one has a plain platform. One of the former was used as a blank for a lateral scraper. Only one medium chip has a faceted platform; all others have plain platforms. One such chip is grey chert, while all others are flint. The striking platforms of small chips include 3 faceted and 13 plain platforms. Since bifacial tools are present in this level, resharpening elements that have faceted platforms might be by-products of bifacial tool thinning.

The rejuvenation elements include 2 pointed tips and 2 basal tool fragments. One point tip fragment (8 mm × 18 mm × 3 mm) has a relatively wide plain platform (15 mm × 4 mm). The other tip is also small (13 mm × 23 mm × 6 mm), has a narrow platform (0.8 mm × 0.7 mm), and is from a convergent scraper. Both basal fragments are small, and derive from unifacial tools, as do both pointed tips.

Level V

There are 51 resharpening and 6 rejuvenating elements in Level V. The resharpening elements include 4 flakes, 3 blades, and 44 chips. The largest, on yellow chert, is relatively small (35 mm × 25 mm × 5 mm), has a faceted platform, and was used as blank for a lateral scraper. Other flakes are unretouched, are smaller, and have plain platforms.

Two resharpening blades are whole and one is broken. The largest (37 mm × 18 mm × 4 mm) is grey chert, has a faceted platform, and was used as a blank for a unifacial point. The other complete blade (34 mm × 12 mm × 4 mm) and the broken one have plain platforms and show no traces of secondary retouch.

The resharpening chips comprise 8 large, 24 medium, and 12 small pieces. Among the large chips, 2 are grey chert, while all others are flint. One of these has a faceted platform, the other has a plain platform. The flint chips include 3 with faceted platforms and 3 with plain platforms. Among the medium-sized chips, 2 are grey chert and 22 are flint. Both chert chips have plain platforms, while 2 of the flint chips have faceted platforms. All of the small chips are flint and only one has a faceted platform; all others have plain platforms. Given the presence of bifacial tools in this level, resharpening elements that have faceted platforms might be expected as by-products of bifacial tool thinning.

The rejuvenating elements are flint and include 3 pointed tips and 3 basal parts. The pointed tips are small, the maximum dimensions being less than 20 mm. All are classified as unifacial point tip fragments, based upon tip sharpness. One basal fragment might be from a bifacial tool, while the two others probably came from unifacial tools.

Inter-Assemblage Comparisons

The lithic assemblages clearly can be divided technologically and typologically into two groups. The assemblages of Levels II/2 and III are based on a Levallois technology of core reduction, and lack bifacially flaked tools and their by-products. In contrast, the assemblages of Levels IV/2 and V have bifacial tools and no Levallois technology. Although cores and/or their by-products are present in Levels IV/2 and V, blank production for tool manufacture was based mainly on bifacial thinning by-products, rather than on regular core reduction.

The typological and technological characteristics of the Levels II/2 and III assemblages exhibit close affinities with the Western Crimean Mousterian (WCM), while the assemblages of Levels IV/2 and V are closest to the Crimean Micoquian (CM).

On the other hand, the Karabi Tamchin assemblages do have some peculiar typological and technological characteristics that make them distinct, both from the "classical" Western Crimean Mousterian and the "classical" Crimean Micoquian.

Western Crimean Mousterian Assemblages from Levels II/2 and III

Blanks for tool production in Levels II/2 and III were produced in a Levallois reduction strategy. Although most cores are small and exhausted, they exhibit unidirectional flaking surface scars and supplementary platforms used to control lateral and distal convexities during core reduction. Flakes have a predominance of unidirectional and unidirectional-crossed scar patterns in both levels. Also, there are a several Levallois blanks, as well as crested and *débordant* blanks. Such scar patterns and core shaping elements are expected from a Levallois core reduction strategy. Blanks with such scars were possibly produced from the parallel and unidirectional cores with supplementary lateral platforms. Blanks with bidirectional scars are relatively rare (7.3% and 4.6%), indicating rarer use of bidirectional cores.

These assemblages produced a moderate percentage of blades (Ilam = 25.0 in Level II/2 and Ilam = 21.7 in Level III), which is characteristic for the Western Crimean Mousterian (Chabai 1998b, 2000b). Distal profiles have high rates of blunt and hinged ends, which, combined, account for some 60% of all distal ends in both levels. These types of terminations, along with the low occurrences of lipped platforms, might have resulted from a prevalent use of hard hammer flaking.

Both assemblages exhibit almost the same blank shape frequencies, dominated by expanding and irregular shapes. Incurvate lateral profiles account for about half in each level and, moreover, twisted profiles are common. When these incurvate and twisted profiles are combined, they account for more than 70% of all profiles in both assemblages. The high percentage of trapezoidal/expanding shapes, in association with the high proportion of incurvate/twisted lateral profiles is expected when the technology is based on bifacial reduction, such as in the Micoquian of Starosele Level 1 (Marks and Monigal 1998:137). Obviously, such an explanation cannot be used for Levels II/2 and III at Karabi Tamchin because bifacial reduction is *not* characteristic for these assemblages. On the other hand, the Western Crimean Mousterian at Kabazi II Unit II has comparable lateral profile characteristics: a combination of incurvate/twisted profiles account for 53.6% of all profiles, although the percentage of flat profiles (40.1%) is much higher than at Karabi Tamchin (Chabai 1998c: tables 9-6, 9-15). In addition, rectangular shapes are predominant among both flakes (42.0%) and blades (51.7%) at Kabazi II (Chabai 1998c: tables 9-4, 9-13), while expending and irregular shapes are characteristic of Levels II/2 and III at Karabi Tamchin. The reason for these differences is probably due to the marked dissimilarity in distances to raw material for Kabazi II and Karabi Tamchin. At Kabazi II Unit II, the exploitation of raw materials was not restricted by distance to raw material and this is illustrated by the large dimensions of cores, debitage, and tools. The core reduction strategies at that site were based on strict control of blank shape by additional distal/lateral removals from supplementary platforms. Although Levels II/2 and III at Karabi Tamchin were based on a similar core reduction strategy, the site was remote from quality raw materials, as seen by the small size of transported raw material pieces and by the reduction of cores to full exhaustion.

Consistent rejuvenation of striking platforms reduced core length, so they became more wide than long. This resulted in an appreciable number of transverse blanks with expanding and irregular shapes. Transverse flakes account for 13 of 47 identifiable flakes in Level II/2 and 15 of 55 flakes in Level III. Thus, the predominance of irregular and expanding shapes in these levels might be directly connected with raw material shortage.

Levels II/2 and III have extremely high faceting indices (Table 20-13), higher than in other Western Crimean Mousterian assemblages. Also, the Levels II/2 and III assemblages are characterized by a relatively high tool to core ratio, in association with a relatively low blank to core ratio (Table 20-12), which might suggest a mixed pattern of on-site and off-site tool production. Additional evidence for tool import comes from artifacts made on local raw materials. In Level III, all artifacts made on yellow chert are tools, while there are neither debitage nor cores made on such material. It is possible that the degree of tool importation into Karabi Tamchin was much greater than at other sites because of its distance to quality raw material sources.

It also should be noted that a majority of unretouched blanks and tools in Levels II/2 and III are relatively small, while larger blanks and tools are common in Western Crimean Mousterian assemblages. Obviously, taking into account the paucity of flint, the predominately small blanks and tools might mean a much more extensive and intensive utilization of raw material and a much greater modification of tools than seen elsewhere.

Because of the small tool samples in these levels, the percentages of tool types have questionable meaning. Nevertheless, scrapers are dominant in each level: 61.3% in Level II/2 and 64.3% in Level III. The simple scrapers (lateral, transverse, and transverse-oblique) dominate, although they have some variability in shape. In Level II/2, 7 out of 8 simple scrapers have straight retouched edges, and only 1 has a convex working edge. In contrast, in Level III, 7 simple scrapers are convex, 2 are straight, and 1 is wavy. It is important to note that 2 of convex lateral scrapers in Level III are made on Levallois blanks.

TABLE 20-13
Karabi Tamchin technological indices

	Level II/2	*Level III*	*Level IV/2*	*Level V*
Ilam	25.0	21.7	18.2	20.5
IF large	75.5	69.2	55.3	39.0
IF strict	69.4	53.8	31.6	16.9
% Levallois blanks	3.6	4.4	0	0

Since double scrapers are rare, working edge shape distributions are meaningless. It is important to note that the one straight-convex scraper in Level II/2 is made on a Levallois blank.

Convergent scrapers have variable shapes but, again, small sample sizes make this variability uninterpretable at the type level. There are, however, two different patterns by level. In Level II/2, 3 of 8 convergent scrapers are canted. In contrast, all convergent scrapers from Level III are on-axis. It is possible that some of the canted scrapers were scavenged from some nearby Crimean Micoquian site.

There are more points in Level II/2 (22.6%) than in Level III (10.7%). As for the convergent scrapers, points in Level III are all distal, while one in Level II/2 is proximal. Denticulates, notched pieces, and other tools occur in very small numbers in each level but without patterning. There is one retouched piece in Level II/2 and in Level III that is on a Levallois blank.

Thus, the two tool assemblages from Level II/2 and Level III are very similar, although there are some differences in proportional occurrences (Tables 20-14 and 20-15), as well as in the shapes of convergent tools. Such differences might be related to distinct tool reduction models. The proportion of simple tools (one retouched edge) to complex tools (two or more retouched edges) is also much lower in Level II/2 than it is in Level III. On the other hand, WCM tool assemblages are characterized by a predominance of lightly retouched tool edges and it is very difficult to find any heavily retouched tool in some WCM assemblages (e.g., Kabazi II Unit II: Chabai 1998c). In the case of Karabi Tamchin Levels II/2 and III, most unifacial tools have invasive, heavily retouched edges. The ratio of the number of retouched edges per tool is 1.7 : 1 for Level II/2 and 1.5 : 1 for Level III. Obviously, the long distance to quality raw materials was the main reason

TABLE 20-14
Karabi Tamchin morphological structure of unifacial points and scrapers

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Simple tools	8	30.8	10	47.6	14	46.7	27	51.9
Double tools	3	11.5	2	9.5	2	6.7	5	9.6
Convergent tools	15	57.7	9	42.9	14	46.7	20	38.5
Total	26	100.0	21	100.0	30	100.0	52	100.0

TABLE 20-15
Karabi Tamchin morphological structure of points, scrapers, and bifacial tools

	Level II/2		*Level III*		*Level IV/2*		*Level V*	
	N	%	*N*	%	*N*	%	*N*	%
Simple, unifacial	8	30.8	10	47.6	14	41.1	27	47.3
Complex, unifacial†	18	69.2	11	52.4	16	47.1	25	43.9
Bifacial tools	–	–	–	–	4	11.8	5	8.8
Total	26	100	21	100	34	100	57	100

†The sum of double and convergent scrapers and points.

why tools from the Western Crimean Mousterian levels at Karabi Tamchin are much more heavily retouched than are the tools from other Western Crimean Mousterian occupations.

The tool assemblages of Levels II/2 and III exhibit, however, some differences in the degree of tool exhaustion. Semi-exhausted tools account for almost half of all tools in each level: 46.2% and 52.3%, respectively. The percentage of lightly retouched "fresh" tools in Level II/2 (11.5%) is much lower than in Level III (19.1%), while the opposite is true for exhausted tools.

Most points and scrapers in both levels have invasive retouch and are either semi-exhausted or exhausted. Moreover, tools with two or more worked edges account for more than half of all tools (65.2% in Level II/2 and 52.9% in Level III). If, as supposed, retouch intensity reflects how long tools were used, the high percentage of invasively retouched, exhausted tools, as well as the large proportion of complex tools, might suggest a greater degree of tool curation than found at other WCM sites. Such a strategy would be directly linked to distance from quality raw materials.

According to previous work, the Western Crimean Mousterian is subdivided into two developmental stages, based on differences in the technological strategies of primary flaking. There are no significant typological differences in tool assemblages correlated with these stages, however (Chabai 2000b).

To compare the WCM assemblages of Karabi Tamchin with other Western Crimean Mousterian assemblages, several occupations were selected to represent both stages of WCM development (Table 20-16). Stage 1 is based on the Levallois method (Shaitan-Koba upper level and Kabazi II Levels II/7F8–II/8) and Stage 2 is based on blade technology (Kabazi II Levels II/1A to II/7).

The small core samples and their exhausted state in both Levels II/2 and III make it difficult to define core types used in the WCM assemblages of Karabi Tamchin. Cores with supplementary platforms, however, as well as Levallois blanks, are present in both levels. Given that Levallois cores and blanks appear in Stage 1 occupations (Shaitan-Koba upper level and Kabazi II Level IIA/2) and disappear in Stage 2 (Level II/5 of Kabazi II), it is likely that the Karabi Tamchin assemblages belong within Stage 1. Based on the Levallois indices,

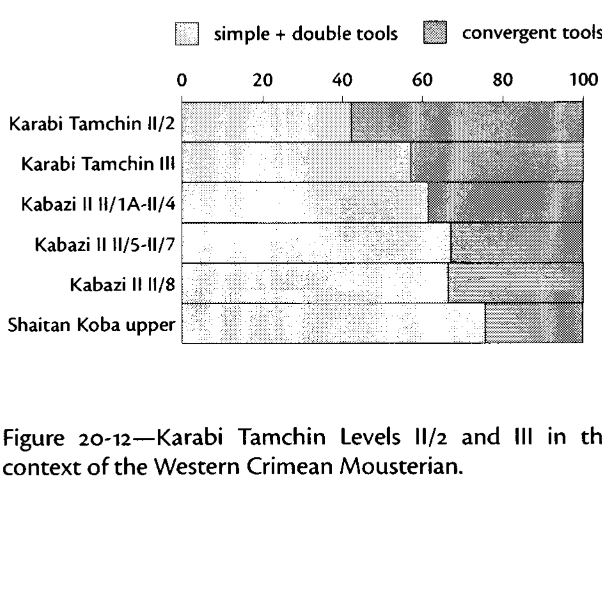


Figure 20-12—Karabi Tamchin Levels II/2 and III in the context of the Western Crimean Mousterian.

TABLE 20-16
Karabi Tamchin Levels II/2 and III in the context of the Western Crimean Mousterian†

	Karabi Tamchin L. II/2	*Karabi Tamchin L. III*	*Kabazi II L. II/1A-II/4*	*Kabazi II L. II/5-II/7*	*Kabazi II L. II/8*	*Shaitan Koba upper*
Simple+double tools	42.3	57.1	61.4	67.0	66.3	75.5
Convergent tools	57.7	42.9	38.5	32.9	33.7	24.4
Ilam	25.0	21.7	36.5	33.0	21.7	16.4
IF large	75.5	69.2	58.9	67.3	65.8	57.5
IF strict	69.4	53.8	32.4	44.5	47.6	41.8
% Levallois blanks	3.6	4.4	0	1.4	4.3	~10.0

†Data from Chabai and Marks 1998.

the Karabi Tamchin assemblages are most like the Stage 1 assemblages of Kabazi II Levels II/5 to II/8.

Typologically, Levels II/2 and III are similar to other Western Crimean Mousterian assemblages, although the toolkit of Level III has fewer points, while in Level II/2 points and convergent scrapers occur in relatively high proportions. On the other hand, tool samples from WCM levels of Karabi Tamchin are so small that proportional variations are probably meaningless.

Morphologically, Level III has a ratio of simple to convergent tools that is close to the WCM assemblages from Kabazi II and Shaitan-Koba (Table 20-16, Figure 20-12). Overall, the proportional occurrence of convergent tools increases throughout the WCM sequence. Taking into account the apparent technological position of Level III, its ratio of simple to convergent tools might suggest a relatively late place in the developmental sequence. As noted above, however, the higher percentage of convergent tools probably reflects the distance from raw material sources. Other differences, such as the high percentage of convergent tools (Table 20-16, Figure 20-12), the dominance of heavy invasive retouch, and the high percentage of semi-exhausted and exhausted tools, all can be explained as functions of raw material scarcity. This scarcity brought about a somewhat different pattern of raw material exploitation than seen at WCM sites situated closer to raw material sources.

Crimean Micoquian Assemblages from Level IV and Level V

The assemblages of Levels IV/2 and V have technological characteristics of primary flaking (Table 20-12) based on multi-platform and unidirectional/convergent cores without supplementary platforms, as seen in Level IV/2. Dorsal scar patterns indicate that some blanks could have been derived from such cores. The use of hard hammer flaking is common, seen by the low percentage of lipped blank platforms and the high proportion of hinged and blunt blank distal extremities. There are no signs of Levallois technology among the blanks, although Level IV/2 has a high percentage of both faceted platforms and blades (Table 20-17).

The blanks from Level V (no cores were found) have a much lower percentage of faceted platforms (Table 20-17). Again, the use of hard hammer flaking was predominant. Although the percentage of elongated blanks is relatively high (Table 20-17), most blades derived from a bifacial reduction strategy. No Levallois blanks were found in Level V.

It should be noted that the Crimean Micoquian assemblage of Starosele Level 1 also had relatively high blade and faceting indices (Table 20-17). This was explained as a function of the shaping and thinning of bifacial tools (Marks and Monigal 1998:130, 135). The same explanation might be used for Levels IV/2 and V at Karabi Tamchin. There is no evidence that the high percentage of blades came from a purposeful blade technology. Blade cores are completely absent in both levels. On the other hand, there is an appreciable number of trimming elements and bifacial tools in these assemblages. The use of by-products of bifacial tool reduction as blanks for unifacial tools is very characteristic for the Crimean Micoquian. Obviously, the paucity of raw materials at Karabi Tamchin logically indicates intensive exploitation of all blanks, including some chips and trimming elements.

Additional explanations for the relatively high faceting index in Level IV/2 could come from the tool assemblage. As noted above, some tools and blanks from Levels II/2 and III were imported into Karabi Tamchin from other occupations. Probably, the same economy of raw materials pertained during the Crimean Micoquian occupations. Again, additional evidence for tool importation comes from artifacts made on local raw materials. In Level IV/2 there is a unique piece of brown chert made into a tool. In Level V, two tools made on grey chert and two tools made on brown chert were found, but there were neither corresponding cores nor debitage of such cherts. Moreover, cores are absent in Level V, while a good number of tools are on blanks derived from core reduction.

All the assemblages have almost the same blank shape patterns. The predominant blank shapes are expanding and irregular; other types occur sporadically. Distal profiles are characterized by high percentages of blunt and hinged extremities that obviously resulted from hard hammer flaking.

About half of all lateral profiles are incurvate in each level, and twisted profiles are also common. When these incurvate and twisted profiles are combined, they account for more 70% of all profiles in each assemblage. The high percentages of trapezoidal/expanding shapes, in association with high percentages of incurvate/twisted lateral profiles, are expected when the technology is based on bifacial reduction, such as that of Starosele Level 1 (Marks and Monigal 1998:137). Obviously, the same explanation might be adopted for the assemblages of Levels IV/2 and V, which are Crimean Micoquian.

The blanks from Levels IV/2 and V have mostly unidirectional and unidirectional-crossed scar patterns, in almost equal proportions. The intensive ad hoc exploitation of multi-platform cores and the use of the by-products of bifacial thinning are characteristic of these assemblages. On the other hand, both the exploitation of multi-platform cores and the thinning of bifacial preforms in Levels IV/2 and V might have resulted in blanks with unidirectional and/or unidirectional-crossed scar patterns. The relatively high percentages of unidirectional and unidirectional-crossed scar patterns are common for many Crimean

Micoquian assemblages (e.g., Marks and Monigal 1998:139; Yevtushenko 1998b:290).

There are no Levallois blanks either as tool blanks or as unretouched blanks. There are, however, blanks expected from bifacial tool thinning in the debitage, as well as in the tool samples from Levels IV/2 and V. It is should be noted that several blanks with crested and *débordant* scar patterns occur in Levels IV/2 and Level V, but those blanks are not connected with the core reduction strategies of these levels. Blanks with crested and *débordant* scars came from the rejuvenation of bifacial tool edges. Moreover, one *débordant* blade from Level IV/2 is made on a greenish patinated dark grey flint that is unique for the level.

Most unretouched blanks and tools in Levels IV/2 and V are relatively small: obviously, the result of raw material scarcity.

Bifacial tools are present in small numbers in Levels IV/2 and V, but their proportional occurrences mean little. Nevertheless, the bifacial toolkits are similar. Almost all bifacially flaked tools from Levels IV/2 and V are plano-convex and are made on flint plaquettes. The complex tools, those with two or more retouched edges, dominate both assemblages. Bifacial tool forms are variable (Table 20-10), but some shapes occur in both levels. Backed bifacial tools are present in both assemblages.

The dominant tool class is the scraper in both levels: 74.3% in Level IV/2 and 61.7% in Level V. The simple scrapers (lateral, transverse, and transverse-oblique) from Level IV/2 and Level V have similar shapes (Table 20-10). The same is true for double and convergent scrapers, although the larger sample sizes have more variability (Table 20-10).

There are more points Level V (25.0%) than in Level IV/2 (11.4%). All points in Level IV/2 are tip fragments, however. Those from Level V exhibit considerable morphological variability (Table 20-10). Owing to small tool samples in both levels, the occurrences of other tool classes are sporadic.

Although the ratio of retouched edges to combined points and scrapers is 1.5 : 1 for both levels, the morphological structure of the unifacial toolkits (points and scrapers combined) shows some differences between levels (Table 20-14). The proportional occurrences of simple, double, and convergent tools are basically equal in Level IV/2, while in Level V, simple tools dominate. Obviously, such differences might be related to the distinct tool reduction models used in the two levels. On the other hand, it may merely reflect small sample sizes.

The overall morphological structure of the toolkits is quite similar (Table 20-15). Taking into account that bifacial tools are a little better represented in Level IV/2 (11.8%) than in Level V (8.8%), simple tools (a single retouched edge) and complex tools (two or more retouched edges) have almost the same proportions in each level.

Semi-exhausted tools occur in almost equal proportions (46.7% and 46.2%) in both levels (Table 20-11). There are, however, some differences in the proportions of tools that were not exhausted: 7.7% in Level V, as opposed to 20.0% in Level IV/2. There are no differences between assemblages in the kind of tools that were not exhausted. Most of these are simple tools: 5 of 6 in Level IV/2, and all in Level V. Evidently, convergent tools tended to be both more heavily retouched and more extensively used than were the simple tools.

Exhausted tools are relatively common, although there are some differences between assemblages. In Level V there are proportionately more (46.2%), than in Level IV/2 (33.3%). More than half of the exhausted tools in each level are convergent (Table 20-11).

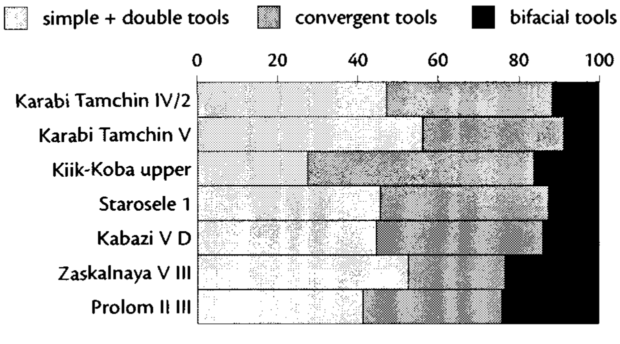


Figure 20-13—Karabi Tamchin Levels IV/2 and V in the context of the Crimean Micoquian.

TABLE 20-17

Karabi Tamchin Levels IV/2 and V in the context of the Crimean Micoquian†

	Karabi Tamchin L. IV/2	*Karabi Tamchin L. V*	*Kiik-Koba, upper*	*Starosele L. 1*	*Kabazi V L. D*	*Zaskalnaya V L. III*	*Prolom II L. III*
Simple+double tools	47.1	56.1	27.5	45.3	44.6	52.5	41.1
Convergent tools	41.2	35.1	56.2	41.5	41.3	23.8	34.4
Bifacial tools	11.8	8.8	16.3	12.3	14.1	23.6	24.4
Ilam	18.2	20.5	11.6	17.6	7.6	5.4	7.0
IF large	55.3	39.0	41.9	45.7	49.9	44.5	40.4
IF strict	31.6	16.9	21.9	42.7	24.5	26.7	26.0

†Data from: Chabai and Marks 1998; Stepanchuk 1993; Yevtushenko 1998b.

Thus, the majority of points and scrapers in both levels are invasively retouched, semi-exhausted, or exhausted. Complex tools account for more than half of all tools (62.5% in Level IV/2 and 52.1% in Level V). If the degree of tool retouch reflects the degree/duration of their use, then the high percentage of invasively retouched exhausted tools, as well as the large proportion of complex tools in each level, might point to a similar strategy of tool exploitation.

Typological variability within the Crimean Micoquian defines three facies: the Staroselian, the Kiik-Koba, and the Ak-Kaya. All have the same bifacial technology and similar tool-kits, differing mainly in the proportional occurrences of different tool classes (Chabai and Marks 1998:366–367). On the morphological level, there are larger distinctions among the proportional occurrences of bifacial tools, convergent tools, and simple tools, but even these represent continua rather than sharp breaks (Marks and Chabai in press).

In order to compare the Crimean Micoquian assemblages of Karabi Tamchin with other Crimean Micoquian assemblages, several occupations were selected to represent all facies (Table 20-17): Staroselian (Starosele Level 1 and Kabazi V Complex D), Ak-Kaya (Zaskalnaya V Level III and Prolom II Level III), and Kiik-Koba (Kiik-Koba upper level).

The comparison with the Karabi Tamchin assemblages indicates that Level IV/2 is closest to Starosele Level 1, while Level V is technologically similar to all Crimean Micoquian assemblages (Table 20-17). The typological characteristics and morphological structures of Levels IV/2 and V have similarities both with the Staroselian (Starosele Level 1, Kabazi V Complex D) and with the Ak-Kaya (Zaskalnaya V Level III, Prolom II Level III). The assemblage of Level IV/2 has a low percentage of points (11.4% of the restricted type list), which is characteristic for the Ak-Kaya, but has a high percentage of convergent tools (41.2%) and a low percentage of bifacial tools (11.8%), which are not characteristic of the Ak-Kaya. The assemblage of Level V has a high percentage of points (25.0%), a characteristic of the Staroselian, but the percentage of convergent tools (35.1%) is closer to the Ak-Kaya facies at Prolom II Level III (Table 20-17, Figure 20-13).

Thus, assemblages of Level IV/2 and Level V of Karabi Tamchin exhibit typological and morphological characteristics intermediate between the Staroselian and Ak-Kaya facies. Both of the Crimean Micoquian assemblages of Karabi Tamchin are clearly typologically different from the upper level of Kiik-Koba, in spite of the fact that Kiik-Koba Cave is relatively close to Karabi Tamchin and is likewise far from quality raw material sources. On the other hand, the tool assemblage of the upper level of Kiik-Koba has small tools and blanks, the small size of which had been explained as the result of a quality raw material shortage (Bonch-Osmolowski 1940). Obviously, typological distinctions should be found in different strategies of raw material exploitation, as well as in different occupational patterns between Karabi Tamchin and Kiik-Koba.

The Pattern of Raw Material Exploitation

All the assemblages at Karabi Tamchin exploited the same sources of raw material. The main material in each level was a fine-grained grey flint, with minor amounts of local chert. The closest outcrops of quality flint that might have been used are situated about 25–30 km north of Karabi Tamchin. Thus, Karabi Tamchin was further from raw material sources than other Middle Paleolithic sites on the Crimean Peninsula. Obviously, the shortage of quality raw materials was a serious problem for those occupying the site. This flint deficit is reflected by the following observations: (1) the percentage of tools is extremely high; (2) there are more tools than debitage; (3) the majority of blades, flakes, and tools are small; (4) all kinds of blanks, including chips, broken flakes, resharpening and trimming elements were used in tool production; (5) cores are rare and are small and exhausted; and (6) a good percentage of the bifacial and unifacial tools are also exhausted. In addition, the use of local coarse-grained cherts also reflects the shortage of quality raw material. Thus, although two different industries are present at Karabi Tamchin, both show the same effects of raw material scarcity.

Since there is little evidence of primary flaking in the Karabi Tamchin assemblages, the initial flint raw material reduction took place off-site. More than half of the flint blanks in each assemblage are without cortex. Although some of them do have a bit of dorsal cortex, there are few true primary elements. This indicates that, in all assemblages, imported pieces of raw material still had some cortex. The long distance to sources of flint required that pieces chosen for cores and bifacial preforms were relatively small. Obviously, core preforms and/or bifacial preforms were first prepared at flint outcrops and only then were transported to the site. The further reduction of such cores and/or preforms to make blanks for tool production took place on site.

In order to estimate the degree of primary flaking intensity, a ratio of all blanks to cores is used. For each assemblage at Karabi Tamchin, this ratio is fairly low (Table 20-12). Taking into account that Crimean

Micoquian assemblages used both blanks from core reduction and by-products of bifacial tool thinning in tool production, a ratio of all blanks to cores plus bifacial tools was calculated (Table 20-12). Despite the inclusion of both sources for blanks, the ratios are still low (Table 20-12). Thus, it is clear that cores and bifacial preforms produced few blanks.

The percentages of tools are extremely high in each assemblage (Table 20-12), as is the ratio of tools on blanks to cores plus bifacial pieces (Table 20-12). Given these indices, it is clear that a significant number of tools were made off-site. On the other hand, since in all assemblages a large proportion of regular retouched unifacial and bifacial tools are exhausted through resharpening and rejuvenation, it might suggest intensive and relatively long usage. Clearly, many such tools were left on-site, and additional tools were made on fresh blanks to replace exhausted ones. Logically, some of those new tools also might have been exported to other hunting stations.

There is a simple denticulate in Level II/2 and a simple concave scraper in Level IV/2 made on dark grey flint with greenish patina; each is unique for its level. These tools are invasively retouched, but their retouched edges have no patina, while both dorsal and ventral surfaces are covered by it. As a rule, such patina indicates an ancient age. On the other hand, it is important to note that the denticulate is made on a bifacial trimming flake and the scraper on a *débordant* blade. Bifacial thinning blanks are not part of the Levallois technology of Level II/2, while the *débordant* blade is not characteristic for the Micoquian technology of Level IV/2. Probably, both blanks were scavenged from some other occupations with different technologies. Given the distance to raw material sources, these pieces may indicate that "tool/blank scavenging" was used (Kuhn 1995). Thus, long-distance transport of raw materials suggests that lithic procurement strategies were likely embedded in the subsistence strategy.

All assemblages of Karabi Tamchin indicate low occupational density because of relatively small numbers of artifacts per cubic meter (Table 20-12). Thus, all levels appear to represent short-term occupations. Obviously, occupation of Level V, which has a higher density of artifacts, might have been either a relatively longer occupation or several different short occupations.

The Crimean Middle Paleolithic occupations have been divided into ephemeral stations, short-term hunting stations, short-term hunting camps, and base camps (Chabai and Marks 1998; Chabai et al. 2000; Marks and Chabai 2001). By definition, ephemeral stations reflect killing-butchering sites with limited core reduction activity and on-site and/or off-site tool production. Short-term hunting stations are differentiated from ephemeral stations mainly by the presence of hearths or other kinds of fire. Short-term hunting camps exhibit evidence for more varied activities than do hunting stations, as well as having a higher density of artifactual and faunal remains. There should be evidence of primary and secondary butchery of hunted animals (represented by several steppe and forest species), the use of fire, and a diversified production/use/discard sequence of lithic remains. Base camps, in fact, consist either of a series of short-term or long term hunting camps that are not stratigraphically distinct.

TABLE 20-18
Karabi Tamchin and Crimean Middle Paleolithic sites: lithic variability by occupation†

	Tools %	*Blanks : Cores*	*Tools : Cores*	*Density*	*Pattern of Occupations*
Karabi Tamchin Level II/2	54.4	23.0 : 1	12.3 : 1	41.2	short-term hunting stations
Karabi Tamchin Level III	54.6	19.2 : 1	9.4 : 1	47.6	
Karabi Tamchin Level IV/2	67.2	31.6 : 1	19.3 : 1	48.8	
Karabi Tamchin Level V	66.5	no cores	no cores	98.0	
Prolom II Level III	40.7	23.1 : 1	8.5 : 1	31.4	
Kabazi II Level II/1A-II/4	19.9	23.6 : 1	4.9 : 1	145.8	ephemeral stations
Kabazi II Level II/5-II/7	14.1	30.9 : 1	4.4 : 1	239.9	
Kabazi II Level II/7F8-II/8	14.8	18.3 : 1	2.7 : 1	232.8	
Shaitan Koba Level upper	12.4	29.8 : 1	3.8 : 1	313.1	short term hunting camps
Shaitan Koba Level lower	11.8	41.7 : 1	4.7 : 1	239.6	
Starosele Level 1	28.5	63.8 : 1	8.5 : 1	256.0	
Kabazi V Level D	12.8	96.5 : 1	18.4 : 1	56.7	
Kiik-Koba Level upper	16.0	95.2 : 1	15.2 : 1	>372.1	
Zaskalnaya V Level III	24.6	69.2 : 1	13.5 : 1	692.7	base camp (?)

†Data from Chabai and Marks 1998.

To compare the Karabi Tamchin occupations with those from other Crimean Middle Paleolithic sites, a number of different occupations were chosen, which have already been used for typological and technological comparisons (Table 20-18).

The occupations of Levels II/2 and III have the lowest artifact densities among the WCM assemblages (Table 20-18). Moreover, Levels II/2 and III have a much higher percentage of tools and the highest tool to core ratio, in comparison to Kabazi II Unit II and Shaitan-Koba upper and lower levels (Table 20-18). Obviously, both WCM assemblages from Karabi Tamchin reflect activities that differ from the other Western Crimean Mousterian assemblages.

For instance, all assemblages of Kabazi II Unit II are ephemeral stations close to a raw material source with on-site core reduction and on-site tool production. The assemblage of Shaitan-Koba upper level also has a lower proportion of tools and a higher density of artifacts. The assemblage of Shaitan-Koba lower level is similar, although the blank to core ratio is much higher than in the upper level (Table 20-18). However, Shaitan-Koba is situated in the Bodrak River Valley, which is extremely rich in quality flint, and both of its assemblages reflect on-site tool production from those nearby raw material sources.

The occupational characteristics of Levels II/2 and III appear similar to the assemblage from Prolom II Level III (Table 20-18), which has been defined as short-term hunting station (Chabai and Marks 1998: 364–365). It is important to note that Prolom II is situated relatively far from good quality flint (10–15 km) and so there was import of raw materials, as well as on-site and off-site tool production (Stepanchuk 1993a). Thus, the occupations of Karabi Tamchin Levels II/2 and III might be also be defined as short-term hunting stations that utilized long distance raw material transport. As such, they represent the first short-term hunting stations among known Western Crimean Mousterian occupations.

The assemblages of Levels IV/2 and V display occupational characteristics of short-term hunting stations, as noted for the Prolom II Level III assemblage. Also, the assemblage of Kabazi V Complex D, defined as a short-term hunting camp, has a similar artifact density and tool to core ratio, although the percentage of tools and the ratio of blanks to cores are significantly higher than in Levels IV/2 and V at Karabi Tamchin (Table 20-18). On the other hand, the distinction between terms such as short-term hunting station and short-term hunting camp have questionable meaning and seem to depend to a large degree on raw material proximity. The site of Kabazi V is situated 2–6 km from raw material, while quality raw materials were transported to Karabi Tamchin from 25–30 km away. Thus, both the Crimean Micoquian and the Western Crimean Mousterian assemblages of Karabi Tamchin site exhibit the same occupational pattern of short-term hunting stations.

The faunal remains do not conflict with the archeological data. The fauna from the Karabi Tamchin occupations included very small numbers of individuals of both steppe (horse, bovid, saiga, reindeer) and mountain forest (red deer, chamois) species (Burke, Chapter 16). Among the faunal remains, as well as among stone artifacts, the frequency of burned pieces indicates the presence of hearths or fireplaces during the occupations of Levels III, IV/2, and V. Burned bones are absent from Level II/2, but several flints exhibit traces of fire. The analysis of faunal remains indicates a late summer/autumn season for the Karabi Tamchin occupations. The taphonomic signatures of Levels II/2 and III are limited processing of bone, notably less evidence of burning, and a more marked presence of carnivores, which may indicate short-term, single-season human occupations. In Levels IV/2 and V, evidence of carnivore activity is more restricted and bone processing more intensive, reflecting either longer-term occupations or occupation during a different season. The relatively low density of artifacts per cubic meter in each level reflects the low density of site occupations. Obviously, these assemblages were left by small human groups over short periods. Thus, both the archeological and faunal data indicate that these occupations were seasonal short-term hunting stations, oriented to non-selective hunting, possibly encounter-based. Such a subsistence strategy was connected with highly mobile human activities. As shown for the Middle Paleolithic sites of Les Canalettes (France) and Borisovskoe Gorge (northwest Caucasus), both situated in mid-altitude mountain regions, the catchment area for successive occupations was about a 20–25 km radius (Meignen and Brugal 2001; Hoffecker and Baryshnikov 1998). If this interpretation is applied to Crimea, the Karabi Tamchin occupations must have been at the edge of such a catchment area, because raw material sources are 25–30 km distant. Several Middle Paleolithic sites, such as Adji-Koba, Kosh-Koba, Chagorak-Koba, and Buran Kaya III, are situated no more than 10–15 km from Karabi Tamchin. Some of these sites (Adji-Koba lower level, Kiik-Koba upper level, Buran Kaya III Layer B) have Micoquian assemblages typologically, technologically, and structurally similar to those from Levels IV/2 and V. It seems very possible that all these sites might represent an asynchronous chain of Micoquian hunting camps in the Crimean highlands.

Thus, all the Karabi Tamchin assemblages have similar patterns of raw material exploitation and occupational structure, although they belong to two different industries. It seems clear that the conditions of life in the mountain region, far from raw material sources, required a similar adaptation. It is important to note that the Crimean Micoquian assemblage of Kiik-Koba upper level, the situation of which is comparable to Karabi Tamchin, exhibits significant morphological and occupational pattern differences. Given its occupational characteristics, Kiik-Koba upper level might represent a base camp (Chabai and Marks 1998) or some specific kind of short-term hunting camp (Chabai et al. 2000). The associated faunal remains include a relatively long list of species, which were impacted to a significant degree by carnivore (hyæna) activity. The specific rockshelter conditions of sedimentation did not deposit sterile lenses between the remains of repeated hunting visits. Obviously, the high density of artifacts per cubic meter is a result of a series of short-termed hunting camps mixed by natural and/or artificial processes.

Conclusions

The Karabi Tamchin rockshelter is the first known stratified multi-level site in the Crimean highlands. There are four occupation levels, two each of Western Crimean Mousterian (Levels II/2 and III) and Crimean Micoquian (Levels IV/2 and V).

The identification of raw material sources available to prehistoric populations is often somewhat probabilistic in Crimean Middle Paleolithic investigations, because most sites are situated in the Internal and External Mountain Ridges, both of which are extremely rich in high quality flint. In the case of Karabi Tamchin, located in the Main Ridge of the Crimean Mountains where there are no flint sources, the closest outcrops of quality raw material are 25–30 km away. The local raw materials, such as chert, could not wholly satisfy Middle Paleolithic tool makers because of its relatively low quality. The remoteness of quality raw materials affected all lithic assemblages at the Karabi Tamchin site. The influence of long distance raw material transport is seen both in the organization of raw material exploitation and in the specific occupation pattern.

These studies at Karabi Tamchin finally provide a basis with which to reject the theory of the so-called "Kiik-Koba Mousterian culture" proposed by Gladilin (1976) and developed by Stepanchuk (1991, 1993b). According to this theory, the small size of tools was a specific cultural feature noted at several sites (Kiik-Koba upper, Prolom I upper and lower levels), which therefore reflected a "paleo-ethnological tradition." As shown by the typological and technological analyses of the Karabi Tamchin occupations, the industrial characteristics of the lithic assemblages, including tool size, are directly dependent upon proximity to raw materials. All assemblages exhibited small tool dimensions, but differed in typological characteristics from the Kiik-Koba upper level. Moreover, the assemblages at Karabi Tamchin are quite different from the Kiik-Koba, both typologically and technologically.

Both archeological and faunal investigation clearly show that all occupations of Karabi Tamchin are short-term season hunting stations, dependent upon raw material importation, and oriented to non-selective, possibly encounter-based, hunting.

Part III:
Chokurcha I

21

Chokurcha I: Introduction

Victor P. Chabai

The history of the investigations of the site of Chokurcha I and of its materials is most dramatic. Its first principal investigator, N. L. Ernst, was repressed by the political regime at the beginning of the 1930s, before he could finish the study of the materials he had excavated. The second principal investigator, B. I. Tatarinov, perished during the Second World War, again, before his study of the materials was complete. The field documentation, almost all faunal materials, and most of the artifacts from Chokurcha I were also lost during the war, although small artifact collections are in museums in Simferopol, Odessa, and Kiev. For about ten years after the war, the site was enthusiastically destroyed by local amateurs. During the mid-1950s, the site was well conserved under about 2 m of industrial debris when the area in which the site was located became a garbage dump.

The Chokurcha I investigators published only a few preliminary reports, describing the site setting, the stratigraphical overview, and providing some general impressions of the faunal and artifact assemblages, without reference to the stratigraphy (Zabnin 1928; Ernst 1929, 1934). In addition, the small portion of the faunal assemblage that was preserved in Leningrad and Moscow was published after World War II (Gromov 1961; Vereshchagin and Baryshnikov 1980).

As so often happens, in spite of the complete absence of information about industrial variability, stratigraphy, and chronology, the Chokurcha I material has often been specifically cited in broad syntheses of the region (e.g., Praslov 1984; Hoffecker 2002).

Setting and History of Investigations

The Chokurcha I rockshelter is situated in a limestone cliff in the Second Range of the Crimean Mountains, on the left bank of Malyi (Small) Salgir River. Now, it is in the Simferopol suburbs, but during the first half of twentieth century, it was close to the Tartar village of Chokurcha. The rockshelter is located at the base of a 25–30 m cliff of soft Middle Eocene nummulitic limestone and is 8 m above the present river valley. The distance from the rockshelter back wall to the river is 75 m (Ernst 1934:186–187). A relatively large semi-crescent-shaped, flat platform is situated in front of rockshelter. The diameter of this platform is about 30 m: that is, the edge of this platform is 40 m from the present river. Before the excavations, Chokurcha I was 7 m wide, 4.5–5 m deep, and 1.75 m high (Ernst 1934:186). If the original width and depth dimensions reported by Ernst are accurate, the height of the roof was increased up to 4 m after the removal of rockshelter deposits. At bedrock, the rockshelter had an area of a little more than 40 m^2.

The primary historical source for the investigations at Chokurcha I is the preliminary article of N. L. Ernst (1934). This article provided little information about the development of his excavation strategy, discussion of the meaning of the faunal and artifact assemblages, or what changes might have taken place throughout the occupations. It did, however, present preliminary analyses of the site's stratigraphy and its fauna and artifact assemblages.

In 1927, a local amateur archeologist, S. I. Zabnin, dug a sondage inside the rockshelter and found rich archeological materials (Zabnin 1928). During four field seasons, from 1928 until 1931, the site was excavated by N. L. Ernst, a lecturer at the Simferopol Pedagogical Institute, together with S. I. Zabnin and a professor of geology, P.A. Dvoichenko. As reported in 1934, they excavated 120 m^2 of sediments (Ernst 1934). In fact, however, they exposed about 195 square meters (Figure 21-1a): it appears that Ernst counted only the squares in which culture-bearing deposits were found. At the same time, not all exposed squares were excavated to bedrock. With the exception of a 7 m^2 "control area," they removed all the sediments from inside the rockshelter. B.I. Tatarinov's excavations in the late 1930s exposed no more than 12 m^2 on the southern edge of the previous excavations and within the previously excavated area.

In Ernst's published preliminary stratigraphic observations (Ernst 1934:187–189), he subdivided the Chokurcha I stratigraphic sequence into five layers (Figure 21-2). The maximum thickness of deposits, ca. 5 m, was found in rows 13 and 14. The first (upper) layer contained Holocene sediments, while Layers 2, 3, 4, and 5 contained Pleistocene deposits. N. L. Ernst distinguished four horizons within Layer 1. He noticed that the first (upper) horizon of Layer 1 included artifacts from the "Russian period" back to the fifteenth century. The second horizon of Layer 1 contained ceramics of Medieval Byzantine times, the third had Late Scythian material, including two burials, while the fourth horizon was defined as belonging to the Kizil-Koba culture of the Late Bronze/Early Iron Ages. Nothing was found stratigraphically between the Late Bronze Age occupation and the Middle Paleolithic occupations of Layer 2. At the same time, it appears that during the Bronze/Iron Age occupations, the rockshelter and some of the platform area were flattened by their inhabitants: at least, it is obvious that the upper part of Layer 2 was cut out (Figure 21-2).

Ernst thought that the "bright yellow" Pleistocene deposits of Layers 2, 3, and 4 had the same content and structure. The only difference he saw was in the amount of ash content. He noted, "Layer 3 was a little darker than Layer 2, while Layer 4 was darker than both Layers 2 and 3, because of intensive exploitation of fireplaces by the prehistoric inhabitants of the cave" (Ernst 1934:189) and this served as the basis for the subdivisions. There were two 1 to10 cm-thick sub-levels of "cemented silt" that separated Layer 2 from Layer 3, and Layer 3 from Layer 4. The cemented silt sub-levels were found inside the rockshelter, but outside they were not so pronounced, or not present at all. The origin of the cemented silt was explained as the result of low energy water processes. An additional difference between the rockshelter and the platform area was noticed: there were more big limestone blocks outside the rockshelter than inside. One of them, found "on the border between Layers 3 and 4," was a solid 1.75 m-thick block of limestone, which covered about 50 square meters of the site area (Ernst 1934:189, 190). Layer 5 was different from the overlying deposits: it contained only white limestone gravel. Neither bones nor artifacts were found in Layer 5.

Based on the 50 m^2 block and the cliff wall configuration, Ernst decided that the Chokurcha I shelter had a quite different shape before the series of rockfalls which destroyed it. He thought that Chokurcha I was a cave with a "relatively narrow entrance, which was not directly exposed to the north" (Ernst 1934:194).

The faunal remains recovered during these early excavations were mainly saiga, horse, bovid, and mammoth. *Hyæna spelaea*, *Ursus spelaeus*, *Rhinoceros tichorhinus*, *Cervus megaceros*, *Cervus elaphus*, and *Vulpes* sp. were also present. Saiga and horse were said to be well represented in all Pleistocene layers. Hyæna was found in Layer 2, while mammoth

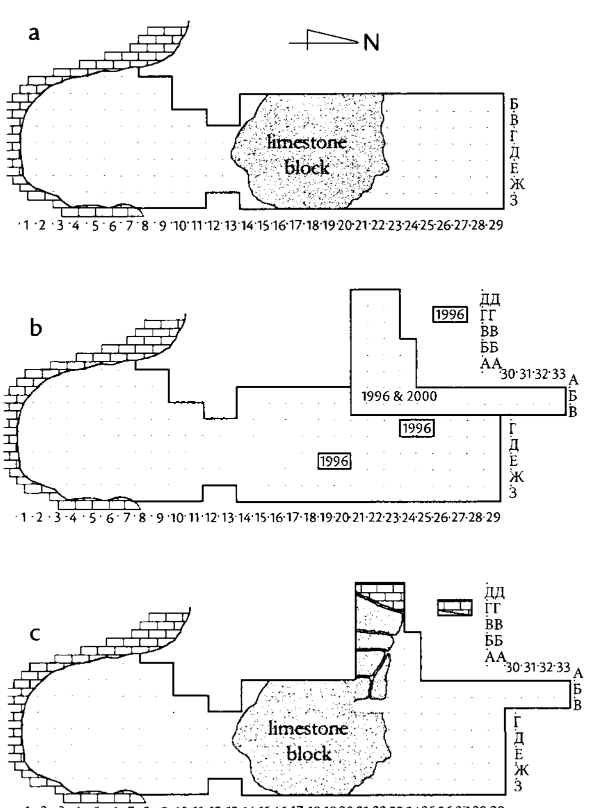


Figure 21-1—Plans of the excavated areas at Chokurcha I: *a*–the area excavated by N. L. Ernst; *b*–the areas excavated during the 1996 and 2000 field seasons in addition to Ernst's excavation; *c*–the configuration of the back wall and rockfall.

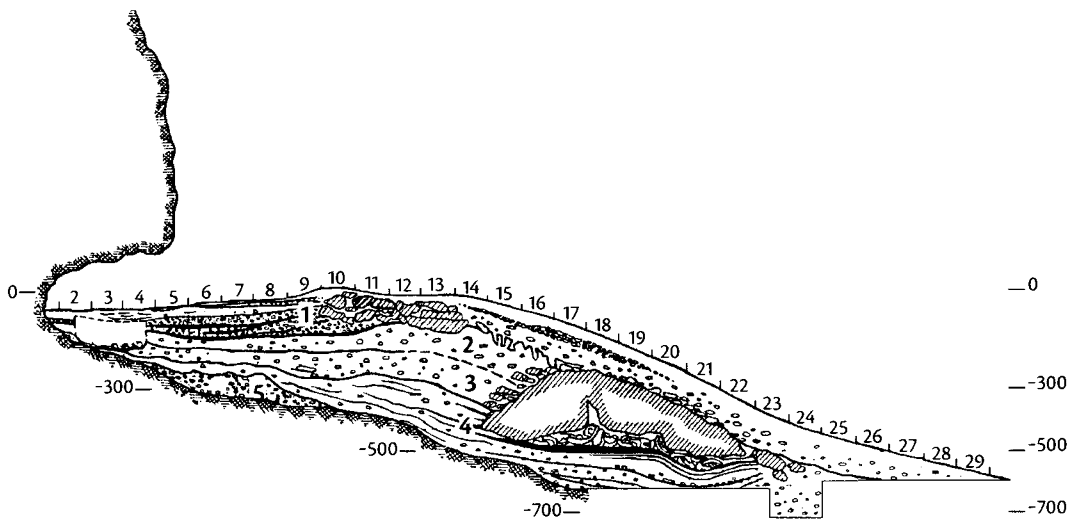


Figure 21-2—Chokurcha I stratigraphical section along the line B/Γ from the 1928–1931 excavations.

remains were most numerous "on the border between Layers 3 and 4" (Ernst 1934:190–191). These mammoth remains at the Layer 3/4 interface were composed of a pile ("heap") of fragmented bones, skulls, and tusks. This 80 cm-thick pile covered about 18 m² of the site. The bone, skull, and tusk fragments belonged to twenty individuals. The tusks and mandibles were spatially separated from the skulls, as were the long bone epiphyses. The majority of long bone fragments exhibited clear cut marks. All skulls were pierced. No map of this concentration is available. A. P. Chernysh and V. P. Liubine interpreted this concentration as a "dwelling structure" similar to that of Molodova I (Chernysh 1965; Liubine 1970).

In spite of the preliminary nature of Ernst's article, some useful information was provided about the lithic artifacts. Ernst reported about one thousand tools from all Pleistocene layers. He mentioned that the percentage of tools was very high; "the assemblages of Layers 2 and 3 consist almost entirely of finished pieces," while "in Layer 4 both tools and debris were found" (Ernst 1934:196, 201). The tools were manufactured on a high quality black and grey flint and, sometimes, on flint pebbles. The bifacial tools composed about 24% of the tool assemblage, but only a few handaxes were found. The scraper shapes were variable and "do not show characteristic types" (Ernst 1934:196). The scrapers ranged from 2 to 9 cm in length. The bifacial points tended to be laurel leaf-shaped with a length : width ratio of 10 : 5.5. The unifacial points included both symmetric and asymmetric shapes, which very often had thinned bases. The size of unifacial points varied from 3 cm to 12 cm. Ernst especially noticed both unifacial and bifacial "triangular tools," with three more or less straight retouched edges. Usually, the length of these triangular edges was 3–4 cm and very rarely reached 5 cm. This type accounted for about 5% of the tool assemblage (Ernst 1934:199). Also, he recognized crescent-shaped tools, which had been previously described. These had two converging retouched edges: one straight, the other convex. Along with flint tools, Ernst reported the presence of pebble hammerstones, bone retouchers, and bone awls (Ernst 1934:195, 202–203).

Within the framework of a cultural-chronological paradigm, the characteristics of the tool-kit led Ernst to compare Chokurcha I with such sites as Kiik-Koba, Ilskaya, La Micoque, and Ehringsdorf (Ernst 1934).

Unfortunately, more detailed information about the previous investigations of Chokurcha I is not available. It is not clear what kind of excavation procedures were employed by Ernst, but it is not terribly important because, in any case, the materials from his excavations are lost. On the other hand, it is clear that the "layers" recognized by Ernst reflected both geological and archeological processes. Moreover, these "layers" were not archeologically homogeneous, as seen in the description of the Holocene Layer 1 horizons. There is no published information about the subdivision of the Pleistocene Layers 2, 3, and 4 into horizons or levels. Most likely, each of these 1 meter-thick layers contained several occupational episodes. At least, the site section profile, along the B/Γ line, shows that Layer 4 consists of numerous ashy lenses (Figure 21-2). Because the layers have both archeological and geological content, the term "unit" will be used from now on. This means that Layer 4 of Ernst's excavations is equivalent to Unit IV of the 1996 and 2000 excavations.

Excavation Strategy and Methods of the 1996 and 2000 Field Seasons

The 1996 field season at the Chokurcha I rockshelter and the platform in front showed that all deposits 3 m or more above the datum used by Ernst no longer exist. There were no Pleistocene sediments left in the eastern part of the platform. Also, the rockshelter was empty. This meant that there was no chance to find even remnants of Layers 1, 2, and 3 of Ernst's excavations. The sondages and trench (Figure 21-1b) in the western part of the rockshelter platform revealed that more or less undisturbed Pleistocene sediments were partially preserved under the limestone blocks in 14 squares: 21ББ, 21А, 21Б, 21В, 22ББ, 22А, 22Б, 22В, 23ББ, 23А, 23Б, 23В, 24ББ, and 24А. Unfortunately, it did not mean that there was a 14 m^2 excavation area. The numerous holes made by local amateurs in the walls of this excavation block reduced this area at least by half.

The lower part of the newly exposed limestone block in square 21В has the same elevation (-500) as the limestone block in the border of squares 21Г and 21В in Ernst's stratigraphic section (Figures 21-1c, 21-2, 21-3). It is therefore apparent that the preserved portion of the Pleistocene sediments seen in the recent excavations belong to Layer 4 of Ernst's stratigraphic subdivision, or Unit IV in the newly adopted nomenclature. During the 1996 and 2000 field seasons, this limestone block was found in squares 21ДД, 21ГГ, 21ВВ, 21ББ, 21А, 21Б, 22ГГ, 22ВВ, 22ББ, 22А, 22Б, 23ВВ, and 23ГГ, while the back wall was exposed in squares 21ДД, 22ДД, 23ДД, 23ГГ, 26ГГ, and 27ГГ (Figure 21-1c). The connection between the "western back wall" and the limestone block rockfall exposed by Ernst and in the 1996 and 2000 field seasons is obvious.

The excavation procedure was based on methods previously adopted for carpet-like occupations (Chabai 1998b) and three-dimensional mapping at a scale of 1 : 10 cm was employed. All sediments were successively processed through 5 mm and 1.5 mm screens. Because of the soft sediments, brushes were the main, and sometimes the only, tool used during the excavations of Unit IV.

Stratigraphy

The stratigraphic sequence exposed in 1996 and 2000 contains about 2 m of Pleistocene deposits, divided into Units IV and VI (Figure 21-3). Unit V was found by Ernst within the rockshelter, but it is missing in the new excavation area. The maximum thickness of the soft sediments is about 1.5 m, subdivided into 22 layers within Units IV and VI. Most of the fine sediments in these layers were fluvial, while the larger fraction was mainly derived from local limestone exfoliation with some water-transported limestone gravel.

Layer III-IV is the limestone blocks, which probably separated the old geo-archeological Layers 3 and 4. The lower parts of these limestone blocks were exfoliated.

Layer IV-A is light grey sediment composed of clay, sand, and medium-sized (5–10 cm in maximum dimension) limestone fragments. Some of the limestone pieces are water rounded, but most are angular *éboulis*. The thickness of Layer IV-A varies from 5 to 14 cm. This layer contains some evidence of human occupation.

Layer IV-B is dark grey sediment consisting of sand and clay components. Small pieces (less than 5 cm in maximum dimension) of limestone *éboulis* were also found. The thickness of Layer IV-B is about 8 cm. The dark color of this layer is explained by the numerous ashy lenses in its middle part. The thickness of these lenses is about 1–2 cm. They are not continuous and do not have clear plans or profiles. Artifacts and bones stratigraphically correspond with these ashy lenses.

Layer IV-C is yellow-brown sediment of sand, clay, and small pieces of limestone. The limestone gravel includes both angular *éboulis* and rounded gravel. It is archeologically sterile. The thickness of Layer IV-C varies from 5 to 12 cm.

Layer IV-D is brown and composed of clay, silt, and small pieces of limestone, both angular *éboulis* and rounded gravel. The thickness of Layer IV-D is 1 to 5 cm. Some artifacts and fauna were found.

Layer IV-E is similar to Layer IV-D but it is lighter in color and is archeologically and faunally sterile.

Layer IV-F is grey sediment of sand and clay, with some small angular *éboulis*. The thickness of Layer IV-F varies from 6 to 10 cm. Numerous artifacts and bones were found.

Layer IV-G is yellow sand with a little clay and small to medium-sized pieces of limestone. The thickness of Layer IV-G varies from 1 to 12 cm. Some "ashy" lenses occur within this layer but their thickness does not exceed 1 cm. The artifacts and fauna in this layer were not associated with these ashy lenses. Most likely, these lenses are of natural origin: perhaps, they are lenses of organic material transported by alluviation.

Layer IV-H is grey sediment composed of sand, clay, and small/medium-sized rounded limestone gravel. The thickness of this layer varies from 1 to 10 cm. There are no artifacts or bones present.

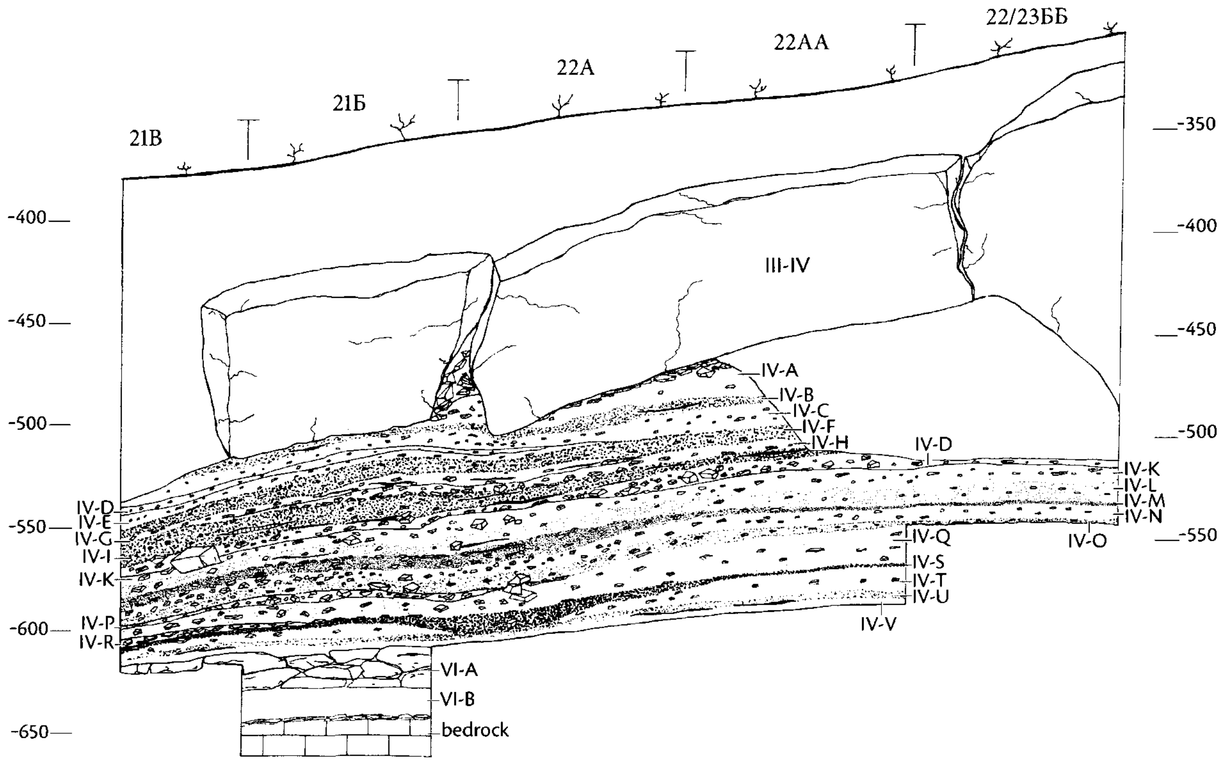


Figure 21-3—Chokurcha I stratigraphical section along squares 21B, 21Б, 22A, 22AA, 22/23ББ from the 1996 and 2000 excavations.

Layer IV-I is dark grey sediment of clay, sand, and small rounded limestone gravel. The thickness of this layer varies from 5 to 12 cm. There are two levels of ashy lenses with artifacts and bones. The thickness of each lens is about 1 to 2 cm.

Layer IV-J is light yellow sand with small/medium-sized rounded limestone gravel. The thickness of Layer IV-J is 5 to 15 cm. It is archeologically and faunally sterile.

Layer IV-K is light grey sediment of clay, sand, and medium/small-sized limestone gravel and *éboulis*. In addition, a few relatively large limestone pieces (20–30 cm in maximum dimension) were found. This layer varies from 10 to 4 cm in thickness. Some artifacts and fauna were recovered.

Layer IV-L is grey sediment with clay and sand components, and small and medium-sized limestone gravel and *éboulis*. The thickness of Layer IV-L is 4 to 11 cm. This layer contains two slightly ashy lenses with artifacts and fauna. The thickness of each lens is about 1 cm.

Layer IV-M is dark grey sediment composed of clay, sand, and a great deal of small to medium-sized limestone gravel and *éboulis*. The thickness of Layer IV-M varies from 2.5 to 10 cm. Some artifacts and fauna were found.

Layer IV-N is light grey sediment with clay, sand, and a lot of small to medium-sized limestone gravel. The thickness of the layer varies from 4 to 10 cm. Some artifacts and fauna were recovered.

Layer IV-O is dark grey, almost black, sediment composed of clay, sand, and many rounded small to medium-sized limestone gravels. The thickness of Layer IV-O varies from 3 to 12 cm. The dark color can be explained by its plentiful organic remains, including ash and burned bones. Numerous artifacts were recovered.

Layer IV-P is light grey sand with some limestone gravel and *éboulis* of different sizes. Some artifacts, as well as a few bones, were recovered.

Layer IV-Q is light grey sediment of clay, sand, different sizes of limestone gravel, and a few pieces of *éboulis*. The thickness of Layer IV-Q varies from 6 to 18 cm. Some artifacts and faunal material were found.

Layer IV-R is grey sand with small/medium-sized limestone gravel and *éboulis*. The thickness of the layer is 1 to 4 cm. It is archeologically and faunally sterile.

Layer IV-S is dark grey sediment, almost black, of sand, clay, and small-sized limestone gravel. The dark color is due to a high organic content, which is mainly ash. Some artifacts and fauna were recovered.

Layer IV-T is grey sand and contains limestone gravel of various sizes. The thickness of this layer varies from 1 to 12 cm. A few artifacts were recovered.

Layer IV-U is dark grey clay with small limestone gravel. The thickness of the layer is 5 to 7 cm. A few ashy lenses with some bones and artifacts were found in this layer. The thickness of each lens is less than 1 cm.

Layer IV-V is grey sand with small limestone gravel. The thickness of this layer is 3 to 10 cm. A few bones and artifacts were recovered.

Layer VI-A is a solid horizon of limestone gravel. The thickness of the layer is about 20 cm. Not a single artifact or bone was recovered.

Layer VI-B is yellow sand without limestone gravel. The thickness of this layer is about 12 to 14 cm. Neither artifacts nor bones were recovered. In addition, the same sand was found in a sondage in squares 35–38Б, situated at the edge of the Chokurcha I platform. The thickness of the sand in squares 35–38Б is at least 2.5 m (from -7.50 m to -10.00 m below datum). Unfortunately, there is no direct connection between the stratigraphic sequence of the sondage and the 1996/2000 excavation area, because along lines 25–34, Pleistocene sediments were absent (see Figure 21-1).

Bedrock was exposed in square 21Б at a depth of ca. -6.50 m below datum.

Apparently, the area excavated during the 1996 and 2000 field seasons is connected stratigraphically to the collapsed western part of the existing rockshelter since all the recently exposed layers have a similar west to east inclination (from the back wall of rockshelter to its entrance). It is also likely that the rock fall of Layer III-IV is related to the buried western wall, but not to the existing southern rockshelter. All of these observations support Ernst's hypothesis that the Chokurcha I rockshelter was originally much larger and different from its current configuration (Ernst 1934:187). If so, it means that area excavated in 1996 and 2000, as well as some of the platform area, were within the rockshelter and protected from colluviation.

Thus, about 1.5 m of sediments resulted from at least two major depositional events: alluviation and exfoliation of the ceiling and walls of the rockshelter. The alluviation is clearly seen by layers of sand (Layers IV-G, IV-J, IV-P, IV-R, IV-V, and VI-B), clay (Layer IV-U), and rounded limestone boulders (Layer VI-A). The exfoliation of the limestone roof and walls is seen by variably sized *éboulis* found in most layers, as well as by limestone blocks (Layer III-IV) from the collapsed roof of the rockshelter. The deposits of Layers IV-A through IV-F, Layers IV-H, IV-I, IV-K through IV-O, IV-Q, and IV-S probably resulted from both alluviation and exfoliation. Only Layer VI-A contains evidence of high-energy water: relatively large limestone blocks that are significantly rounded and that probably moved some distance. The accumulation of the sand layers, with the possible exception of Layer VI-B, resulted from low-energy alluviation.

The layers of Unit IV produced no rounded artifacts or bones. Some occupations within the sandy layers contain almost undisturbed structures, such as fireplaces. The color of the sandy layers varies from yellow to grey. This variation was caused by the amount of organic material present, which was the result of either human activity (fire?) or natural processes. In the latter case, it might have been caused by water transport.

In sum, the depositional history of the lower part of the Chokurcha I stratigraphic sequence might be described in following terms. The first documented stage of rockshelter evolution can be correlated with high energy alluviation that built up at least 30 cm of rockshelter deposits (Layers VI-A and VI-B). Most likely, the same kind of alluviation created more than 2.5 m of sand on the present day river terrace (sondage in squares 35-38Б). Thus, the deposits of Layers VI-A and VI-B were the part of Malyi Salgir riverbed. The second stage is characterized by alternating low-energy alluviation and rockshelter ceiling and wall exfoliation (Unit IV). During this second stage, the Chokurcha I rockshelter was inhabited by hominids. How long the rockshelter was affected by alluviation is unknown. According to Ernst, the sub-levels of cemented silt between Units II and III and between Units III and IV resulted from low-energy water processes (Ernst 1934:189). Yet, the origin of these sub-levels might be interpreted in two different ways: first, these lenses originated from flooding, and second, these lenses might be the result of cascading water from the plateau and cracks in the limestone roof of rockshelter. The second interpretation appears most plausible because the size of the area covered by cemented silt sub-levels and its position are almost wholly within the extant rockshelter. There were no cemented sub-levels on most of the platform area (Ernst 1934). Nor were "cemented silt"-type areas found in the 1996 and 2000 excavations. So, the low-energy alluvial process at Chokurcha I took two forms: pure sandy layers and sandy mixed with clay and limestone gravel. Alluviation was more frequent at the beginning of sedimentation at Chokurcha I rockshelter than it was later. If only sand and clay layers are considered alluvial, there are six episodes of flooding in Unit IV. Moreover, five of them happened during the deposition of the lower 50 cm of Unit IV. Thus, the Chokurcha I rockshelter was more affected by alluviation during the beginning of second depositional stage than during the later stage.

To some extent, depositional analogies to Chokurcha I might be seen at Starosele, Siuren I, Buran-Kaya III, and, probably, Prolom II (Marks et al. 1998; Demidenko et al. 1998; Monigal Chapter 1; Kolosov 1986). All of these localities are rockshelters close to present day valley bottoms and at all of them the initial, uninhabited stages of deposits were alluvial. At the same time, these sites have no documented alluviation either during or between the human occupations. A series of alluviations was documented in the lower part of the Kabazi II sequence (Chabai in press). On the other hand, at Kabazi II, the human occupation surfaces were destroyed by these flooding episodes.

Thus, from a geological point of view, the Chokurcha I rockshelter is unique in Crimea, in that deposition was based on a combination of two major factors: the exfoliation of soft limestones and low energy alluviation. The combination of these factors produced a sufficient amount of sediments to quickly bury the remains of the human occupations, as well as to build up the sterile layers between them.

Chronology

In spite of numerous samples taken for ESR and AMS dating, only one date from Level IV-O is available. It is on bone, $\delta^{13}C = -19.8\%$, age >45,400 uncalibrated BP (OXA-10877). Two additional samples from Levels IV-B and IV-M failed to produce AMS dates due to their low collagen content. Dosimetry was conducted at the site by McMaster University and four samples (from Levels IV-B, IV-F, IV-M, and IV-O) were submitted for ESR, but these dates were still unavailable at the time of this writing.

Analyses of the snail and rodent remains indicate open steppe landscapes around the site during the formation of the Unit IV deposits (Mikhailesku Chapter 19; Markova Chapter 23). The rodent assemblage does not contain any boreal species. Such an environment is characteristic of conditions during the stadial between the Moershoofd and Hengelo Interstadials. In Crimea, this stadial was characterized climatically as the mildest, whereas the stadials preceding and succeeding it had harsher continental climates (Markova 1999; Gerasimenko 1999; Mikhailesku 1999). The Early Glacial Stadial is characterized by a humid and cold climate, with relatively widespread forested areas (Gerasimenko 1999). Furthermore, one of the most significant erosional down-cutting of river valleys took place during Moershoofd (Gerasimenko 1999; Chabai 1999). It is therefore probable that the Chokurcha I Unit IV sediments were deposited during the stadial between the Moershoofd and Hengelo Interstadials.

The Archeological Sequence and Occupation Characteristics

Twenty occupational levels were discovered within Unit IV. The majority of them contain clear occupational surfaces, some even contain structures. Yet, a few of these occupations may be questionable. Additionally, some traditional characteristics adopted for descriptions of occupational surfaces are meaningless in the case of the Unit IV levels. For example, artifact densities in Middle Paleolithic Crimean sites usually range from a few hundred to a few thousand pieces per cubic meter of artifact-bearing deposits. Only two of the twenty excavated levels here contain more than one hundred artifacts (without chips and chunks), and none of the occupation levels contain even a half of one cubic meter of artifact-bearing deposits.

Level IV-A contained artifacts and faunal materials from the upper and middle part of Layer IV-A (Figure 21-3). Level IV-A fauna and artifacts did not constitute a clear surface: rather, they were spread vertically over 5 to 8 cm. Average artifact density was 233 pieces per m^3.

Level IV-A2's occupation was situated in the lower part of Layer IV-A and was a clear carpet-like surface of bones and artifacts. The thickness of Level IV-A2 was determined by the thickness of a single bone or artifact. In fact, bones and artifacts of Level IV-A2 compose a thin carpet-like surface. It is difficult to evaluate the true amount of sterile sediments between Levels IV-A and IV-A2 due to the extremely low density of both bones and artifacts. The lowest elevations of Level IV-A were only 2-3 cm above the artifact/bone elevations of Level IV-A2. The artifact density was 200 per m^3. The artifact/bone distributions of both Levels IV-A and IV-A2 were limited to squares 22A, 22AA, 23A, and 23AA. The total area of these levels covered by artifacts was less than one square meter.

Level IV-B fauna and artifacts occurred in a 1 to 3 cm-thick ashy lens in the lower to middle part of Layer IV-B. The artifacts and bones here lie in thin carpet like surfaces within this lens (Figure 21-4a). The sterile sediments between Levels IV-A2 and IV-B were about 3–4 cm thick. The density of artifacts was 489 per m^3.

An elongated ovoid pit with abrupt, almost straight walls was discovered in this level (Figure 21-4a, b). The maximum dimensions of the pit were 28 cm in length, 9 cm in width, and 14 cm in depth. One straight scraper, one flake, three chips, and three small

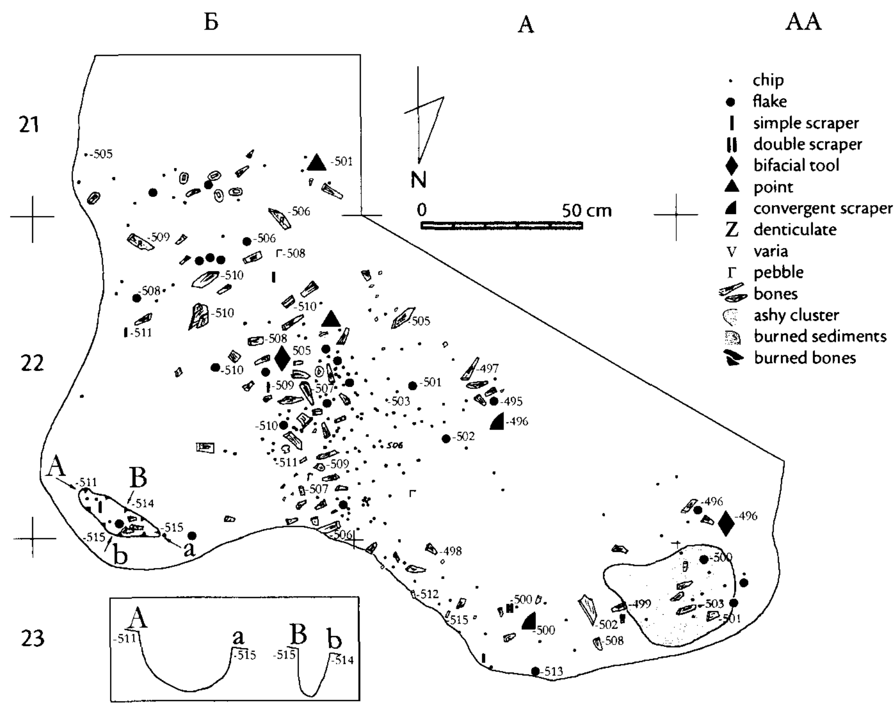


Figure 21-4—Chokurcha I: plan of excavations in Level IV-B, with cross-section of the pit in square 22Б.

pieces of bone tube fragments were recovered from the upper/middle part of the pit, while there was nothing at the bottom. The material from the pit, then, was all mundane, containing nothing special that might have been purposefully "hidden."

There was a dense cluster of ash in squares 23A and 23AA. This cluster had an irregular, close to ovoid shape with the maximum dimensions of 41 cm in length, 35 cm in width, and 0.5 cm in depth. It is quite possible to attribute this ashy cluster to an ephemeral fireplace. At the same time, the sediments below this "fireplace" were not burned, as is typical of other Crimean Paleolithic fireplaces. It might have been either a very ephemeral fireplace or an ashy cluster created by natural processes.

Level IV-D was situated in Layer IV-D and did not have a clear surface. Both fauna and artifacts were distributed vertically through the whole 1–5 cm thickness of Layer IV-D. The density of artifacts was about 150 artifacts per m^3.

Level IV-F occurred in the upper to middle part of Layer IV-F and was separated from Level IV-D by 11 to 14 cm of sterile sediments. The faunal material and artifacts of this level formed two ashy clusters. The first was found in squares 21–22B, 21–23Б, 22–23A and covered about 2.5 m^2. The second cluster of bones and artifacts was found in squares 23–24AA and 23ББ and covered about 1 m^2 area. Each of the clusters was about 2–3 cm thick. The density of artifacts in Level IV-F was 610 per m^3.

Level IV-G occurred in the upper part of Layer IV-G. Bones and artifacts were discovered in squares 23–24AA. The geological Layers IV-F and IV-G in these squares were very thin (about 2 cm each) and, in fact, there were no sterile sediments between the occupations of Levels IV-G and the second cluster of Level IV-F. The two archeological Levels IV-G and IV-F were subdivided because of the different color and structure of the geological Layers IV-G and IV-F. It is possible that Level IV-G and the second cluster of Level IV-F represent a single occupation, which began just after the deposition of Layer IV-G.

Level IV-I was found in the upper/middle part of Layer IV-I and was a ca. 3 cm-thick lens densely packed with artifacts, fauna, ash, and burned bones. The thickness of the sterile sediments separating Level IV-I from Levels IV-G and IV-F varied from 5 to 8 cm. Level IV-I was uncovered over an area of about 4.5 m^2. The density of artifacts was 1,119 per m^3.

Just under the Level IV-I ashy lens, in squares 22A, 23A, and 24A, three clusters of burned sediments were found. All of had roughly the same rounded shape and roughly the same maximum dimensions of 35 to 40 cm in diameter and 0.5 to 1 cm in thickness. These clusters of burned sediment might be interpreted as the remains of fireplaces. The upper parts of these possible fireplaces were not recognized because of the extreme ashy content of the sediments in Level IV-I.

Level IV-I2 was found in the lower part of Layer IV-I. It was separated from the uppermost Level IV-I by 4 to 6 cm of sterile—but still ashy—sediments of Layer IV-I. The Level IV-I2 artifacts and fauna formed a clear carpet-like surface. The thickness of this "carpet" was equal to the thickness of a single bone or artifact. Level IV-I2 was found in squares 21–22Б and 21B. It was probably only the periphery of this occupation. The artifact density was 1,000 pieces per m³.

Level IV-K was found in the upper part of Layer IV-K and was separated from the uppermost occupation of Level IV-I2 by 5 to 15 cm of the sterile sand of Layer IV-J. The artifacts and fauna from Level IV-K formed a thin carpet-like surface. The density of artifacts was 140 per m³.

The most pronounced concentration of artifacts and bones was discovered in square 24AA (Figure 21-5). The same square also contained an amorphous 1 cm-thick cluster of ash and burned bones. The maximum dimensions of this ashy cluster were 118 cm in length, 73 cm in width, and 0.5 cm in thickness. Just below the ashy cluster were two adjoining clusters of burned sediments, one rounded and one ovoid in shape. The maximum dimensions of the rounded cluster were 41 cm in diameter and 0.5 cm in thickness. The maximum dimensions of the ovoid burned sediment were 23 cm in length, 15 cm in width, and 0.5 cm thickness. This structure might be interpreted as a fireplace that was somewhat enlarged and modified by natural processes.

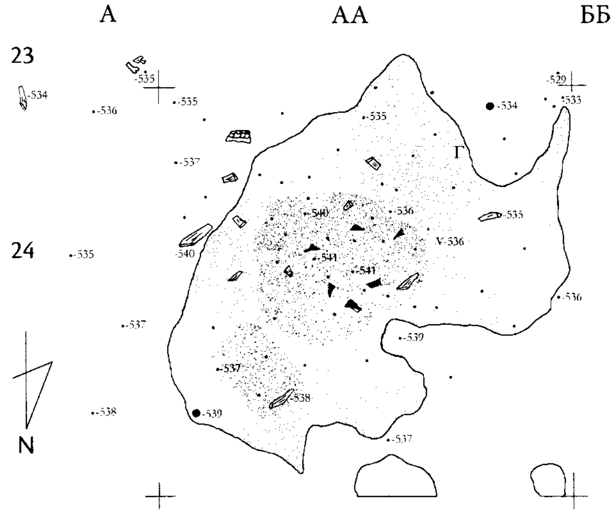


Figure 21-5—Chokurcha I: plan of excavations in Level IV-K, square 24AA.

Level IV-L occurred in the upper part of Layer IV-L. The carpet-like surface of artifacts and bones was part of a slightly ashy 1 cm-thick lens that covered an area of ca. 1.5 m² in squares 21–22B and 21–23Б. The Level IV-L artifacts were separated from the overlying Level IV-K by 6 to 7 cm of sterile deposits. The density of artifacts was 467 pieces per m³.

Level IV-L2 comes from the middle/lower part of Layer IV-L. The artifacts and bones occurred as a carpet-like surface in a slightly ashy lens about 1 cm thick. The lens was found in squares 21–23B, 21–23Б, and 23A. The total excavated area of Level IV-L2 was about 3 m². It seems that only a peripheral part of the Level IV-L2 distribution was excavated in 1996 and 2000. The rest of it, to the north and east, was excavated and destroyed long ago. The sterile deposit between Levels IV-L and IV-L2 was 3 to 4 cm thick. The density of artifacts in Level IV-L2 was 367 per m³.

Level IV-M originated from the upper and middle part of Layer IV-M. The level was represented by a solid, 2 cm-thick ashy horizon. The sterile sediments between Level IV-M and IV-L2 varied from 4 to 14 cm in thickness. The excavated area of Level IV-M was about 7 m². The density of artifacts was 800 pieces per m³.

A combination of an ashy concentration with burned bones cluster and a burned sediment cluster was discovered in square 23A (Figure 21-6). The burned sediments were situated just under the ashy cluster. The maximum diameter of the ashy cluster was 44 cm, while the diameter of burned sediments was 25 cm. The combined thickness of both clusters was less than 1 cm. Most likely, this cluster combination is the remnants of a fireplace. The difference between the maximum diameters of the two clusters might be evidence of some sort of destruction of the upper part of the fireplace. Three smaller clusters of ash and burned bones were also found in squares 22A and 22Б.

Level IV-N occurred in the upper part of Layer IV-N. A few artifacts and bones were uniformly distributed through the 4–10 cm-depth of Layer IV-N. These artifacts and bones were uniformly distributed over about 7 m² of the Level IV-N area.

Level IV-O was discovered in the lower part of Layer IV-O. The level was a 3 cm-thick ashy horizon, with a homogeneous distribution of bones and artifacts over all of the excavated 8 m². It was difficult to evaluate the thickness of the sterile sediments between Levels IV-O and IV-N because the latter was not a clear level. The density of artifacts was 700 pieces per m³.

Four ash/burned bone clusters were discovered in squares 23A, 24A, 23AA, and 24AA. They had irregular rounded shapes. The biggest had a maximum dimension of 46 cm in diameter and 0.5 cm in depth. The other ash/burned bone clusters were about the same size: 10 to 13 cm in diameter and less than 0.5 cm in depth.

Level IV-P was recognized from a few artifacts and bones in the sandy sediments of Layer IV-P. One tool, one flake, and thirteen chips were uniformly distributed throughout the 1 to 7 cm thickness of this layer and occurred over ca. 8 m² of excavations.

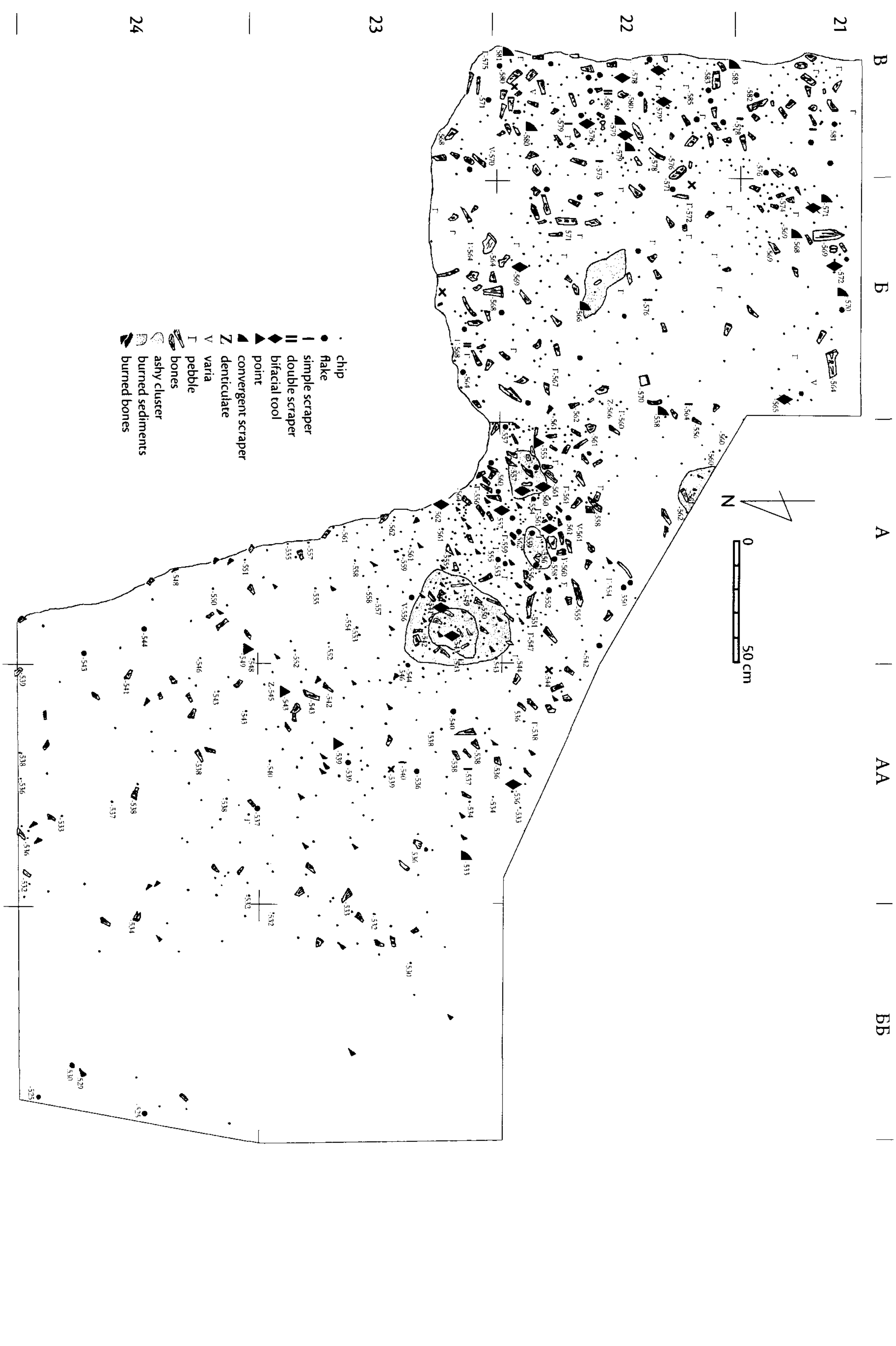


Figure 21-6—Chokurcha I: plan of excavations in Level IV-M.

Level IV-Q was a thin carpet-like distribution of bones and artifacts in the lower part of Layer IV-Q. The thickness of Level IV-Q was equal to the thickness of a single bone or artifact. The density of artifacts was about 280 items per m^3. Almost all artifacts and bones were situated at the border between the recent excavations and the old excavated area. That is, only the periphery of Level IV-Q was excavated during the 1996 and 2000 field seasons.

Level IV-S had the thickness of a single artifact or bone, and was a carpet-like occupation in Layer IV-S. Level IV-S was separated from the overlying Level IV-Q by 5 cm of the sterile sand of Layer IV-R. The density of artifacts was 167 per m^3.

Levels IV-T, IV-U, and IV-V were recognized on the basis of a few artifacts that were evenly distributed in Layers IV-T, IV-U, and IV-V.

Conclusions

There were three types of occupations at Chokurcha I. The first type is a very thin, carpet-like occupation, with a thickness equal to that of a single artifact or bone. This is the case for Levels IV-A2, IV-B, IV-I2, IV-K, IV-L, IV-L2, IV-Q, and IV-S. The second type is a relatively thick lens, up to 4 cm, of densely packed artifacts and fauna, which was seen in Levels IV-F, IV-I, IV-M, and IV-O. The third type has a uniform distribution of artifacts throughout the entire thickness of the geological layer, as in Levels IV-A, IV-D, IV-N, IV-P, IV-T, IV-U, and IV-V. There is no correlation between the type of sediments and the type of occupation. Both carpet-like deposits (IV-S) and artifacts uniformly distributed throughout the thickness of a layer (Levels IV-P, IV-T) were found in pure sand deposits. All three possible kinds of occupations—carpet-like (Levels IV-A2, IV-B, IV-I2, IV-K, IV-L, IV-L2, IV-Q), thick lens (IV-F, IV-I, IV-M, IV-O), and uniformly distributed (Levels IV-A, IV-D, IV-N) were found in deposits of mixed sands, clays, and limestone gravels.

There was no correlation between the preservation of artifacts and bones and the geology of the layers. The surfaces of bones and artifacts are consistently in excellent condition with neither water rounding nor weathering in both the mixed and sandy geological layers, as well as all three kinds of occupations. Artifacts in a vertical position were also very rare. On the other hand, the fireplaces were not well preserved. The upper ashy parts of fireplaces were slightly shifted in relation to the underlying burned sediments. The extent to which the ashy content associated with occupations resulted from human activity—as opposed to natural processes—is ambiguous.

It is difficult to evaluate the significance of the different artifact densities for so small an area. Artifact densities vary from 140 per m^3 for the carpet-like Level IV-K to 1,118.5 per m^3 for the thick lens of Level IV-I. On average, artifact density for the carpet-like levels was never more than 500 per m^3, while for thick lens levels, the artifact density was never less than 600 per m^3. These numbers do not mean that the higher densities equate with relatively longer occupations or even a greater range of activities of the same-sized groups as compared to occupations with low artifact densities. Even for carpet-like occupations, it is risky to state that they reflect a single visit. For example, both burned and unburned bones were found in the burned sediment cluster belonging to the carpet-like Level IV-K. It is also quite possible that thin carpet-like surfaces are merely peripheral areas of thick lens occupations. Most likely, the thick lens occupations reflect numerous different occupational episodes. In any event, fireplaces and clusters of burned sediments were always found just under thick lens deposits. That is, the clusters of burned sediments are evidence either of an initial occupational episode or the beginning of a single, longer occupation.

In sum, the occupation levels of Chokurcha I Unit IV, due to rapid sedimentation, are characterized by excellent preservation of both artifacts and fauna (Patou-Mathis, Chapter 22; Markova, Chapter 23), as well as by little, if any, post-occupational disturbance.

22

Archeozoological Analysis of Large Mammals of Chokurcha I Unit IV

Marylène Patou-Mathis

The bone material of Chokurcha Unit IV is not abundant given the depth of the deposit and excavated area; the number of faunal remains varies from 38 to 2,717 depending on the level. The richest levels of Unit IV are IV-M, IV-O, IV-I, IV-F, IV-B, and IV-Q (Figure 22-1). Since there is significant bone fragmentation, the total number of identifiable remains is very low—less than 20% (Figure 22-2). The estimate for the number of individuals for identified species in each level indicates that there is a dearth in bone material for all levels. The number of individuals in each level is also fairly low, ranging from one to twelve. The numbers of individuals are most abundant in Levels IV-F and IV-O, followed by Levels IV-I, IV-Q, IV-M, and IV-K (Figure 22-3). Non-human taphonomic agencies (climato-edaphic, carnivores...), with the exception of a couple of levels, are only slightly responsible for this poor state of preservation (*cf. infra*). Rather, human agency is preponderant. The state of the faunal assemblages is due to human activities such as catching and processing of game. Certain animals were dismembered outside of the rockshelter, for others, only a few pieces of their carcasses were brought back to the shelter (*cf. infra*). In addition, the site was occupied

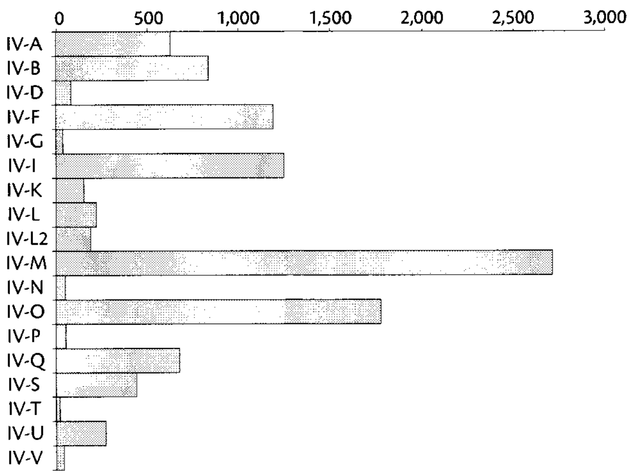


Figure 22-1—Chokurcha I Unit IV: total number of remains in each level.

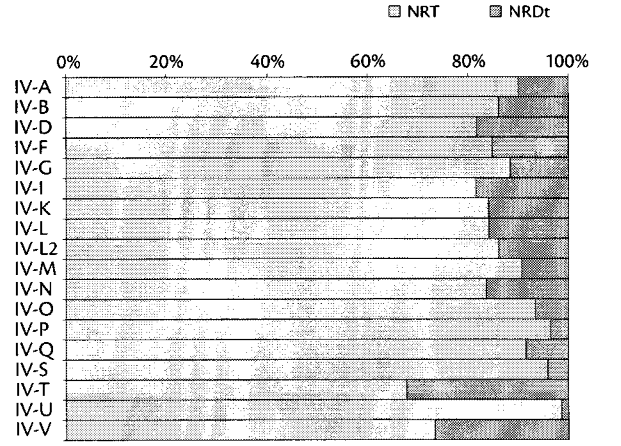


Figure 22-2—Chokurcha I Unit IV: ratio of total identified remains (NRDt) to total number of remains (NRT) in each level.

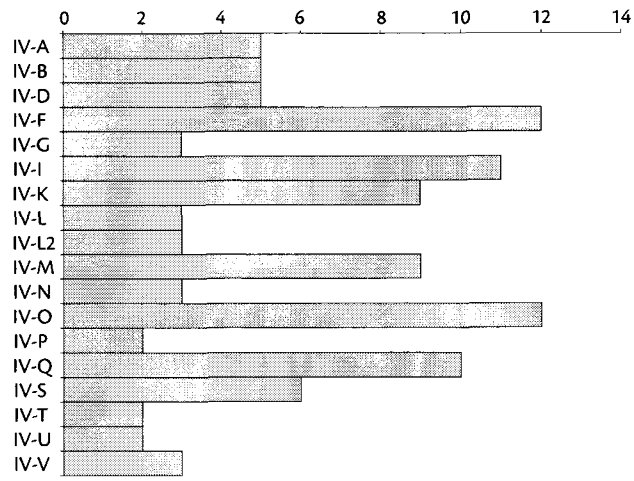


Figure 22-3—Chokurcha I Unit IV: minimum number of individuals by combination (MNIc) in each level.

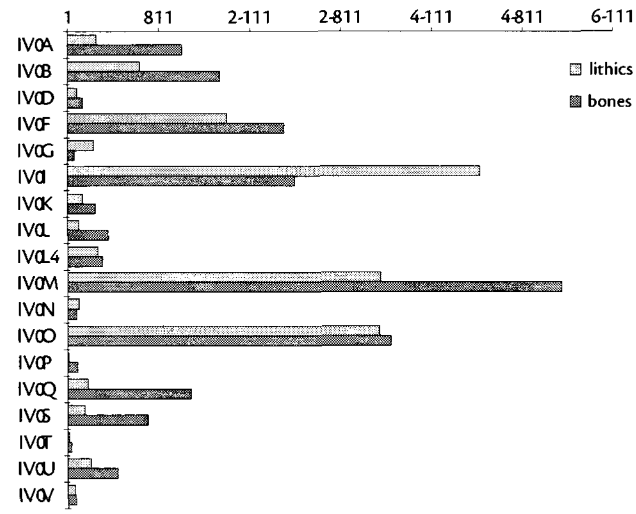


Figure 22-4—Chokurcha I Unit IV: relationship between lithics and fauna (total number of remains) in each level.

repeatedly, probably by very few people, and these occupations were very brief.

The comparison between the quantities of lithic remains and faunal remains in each of the levels shows identical variations, with the exception of Level IV-L (Figure 22-4). Levels IV-I, IV-M, IV-O, and IV-F are archeologically the richest (Chabai, Chapter 24). It should be noted that in Level IV-Q, the faunal remains are relatively abundant (676), but the lithic material is relatively scarce (123 pieces, of which only 7 are tools).

Paleoecology

During the analysis of material from Unit IV of Chokurcha, fourteen species of large mammals were identified, including nine species of ungulates, four of carnivores, and one lagomorph.

Saiga antelope (*Saiga tatarica*) is the only species that appears in all of the levels (Figure 22-5). It is also the most abundant species, except in Levels IV-M, IV-N, IV-Q, and IV-S, where *Equus hydruntinus* dominates. Woolly mammoth (*Mammuthus primigenius*) is present in the upper levels until Level IV-O (although it is absent in Level IV-N, Figure 22-5). *Equus hydruntinus* was identified in Levels IV-C through IV-S (except in IV-G, IV-L, and IV-L2, Figure 22-5). Bison (*Bison priscus*) was identified in five levels: IV-A, IV-I, IV-M, IV-O, and IV-Q. Remains of woolly rhinoceros (*Coelodonta antiquitatis*) were found in Levels IV-F, IV-I, IV-K, IV-M, and IV-O. Red deer (*Cervus elaphus*) is only present in Levels IV-I, IV-Q, and IV-S. A few pieces of reindeer (*Rangifer tarandus*) were discovered in Levels IV-L, IV-L2, and IV-T. In Level IV-A, two bones belonging to a horse (*Equus* (*caballus*) *sp.*) were found.

Among the carnivores, which are infrequent, wolf (*Canis lupus*) was identified in Levels IV-F, IV-I, IV-K, IV-M, and IV-V. Steppic fox (*Vulpes corsac*) was present in Levels IV-I, IV-O, and IV-S. Level IV-O had

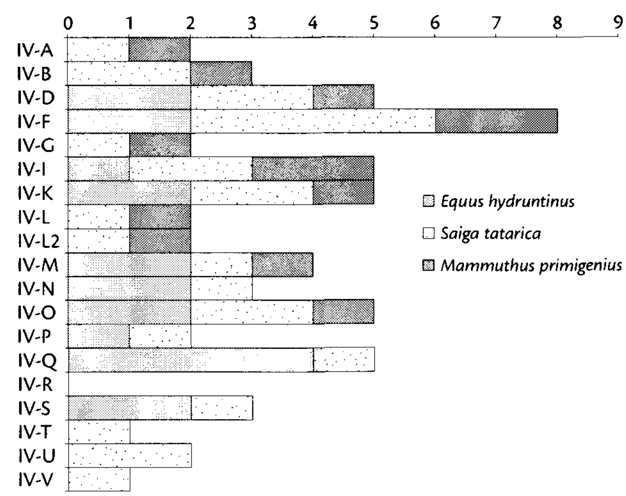


Figure 22-5—Chokurcha I Unit IV: variation of *Saiga tatarica*, *Mammuthus primigenius*, and *Equus hydruntinus* (in MNIc) in each level.

remains of a steppic polecat (*Putorius eversmanni*) and Level IV-Q had one hyæna (*Crocuta crocuta*) bone.

For lagomorphs, only the European hare (*Lepus europaeus*) was identified. It was present in Levels IV-M, IV-O, and IV-S.

Remains of birds were found in Levels IV-F (3), IV-O (13), IV-Q (2), IV-S (2), and IV-V (1). Based on their size, these belong to at least two species, one of which is the size of an eagle or vulture. Remains of rodents were discovered in Levels IV-B (1), IV-F (7), IV-O (7), IV-Q (1), and IV-S (1) (See Markova, Chapter 23). In Level IV-O, a bone of a toad, *Bufo viridis*, was identified.

There is little variance either qualitatively or quantitatively in the composition of the faunal spectrum among the levels, The most frequent suite of animals is composed of saiga antelope, mammoth, and hydruntinian horse. Given the types of identified species, all of the levels were deposited during a period when the environment was open and steppic and the climate was cold and dry. Taphonomic analyses confirm the low level of humidity, where damage to the bones from flowing and percolating water is rare (see below). At the same time, there are indications of an increase in humidity and temperature in the lower levels (from Level IV-V through Level IV-O, *cf. infra*). The number of saiga antelope remains increases beginning in Level IV-I (up to IV-A) and those of *Equus hydruntinus* increase from IV-M through IV-Q. Additionally, in the lower levels, there is an absence of mammoth and the presence, in Levels IV-S and IV-Q, of amphibians.

Taphonomic Analysis

Although the bone material from Unit IV is very fragmented, in most cases the original surfaces are intact. On some of these, extrinsic marks have been identified; these are due to different taphonomic agencies: climato-edaphic, non-human biological, and human.

Climato-Edaphic Damage

Climato-edaphic damage to the bones (scaling, dissolving, iron oxide and manganese deposits, and the presence of frayed and split splinters) was caused by two agencies: weathering and percolation (Figure 22-6). These agencies generally had little influence on the bone assemblages, except in Levels IV-Q and IV-T (accounting for 10% of the remains), followed by Levels IV-I and IV-K (accounting for more than 5% of the remains). The faunal remains were protected from the elements by the rockshelter, and the climate at that time was dry. Percolation is most marked in Levels IV-Q and IV-T (on more than 10% of the remains), which indicates a slight increase in humidity (*cf. supra*).

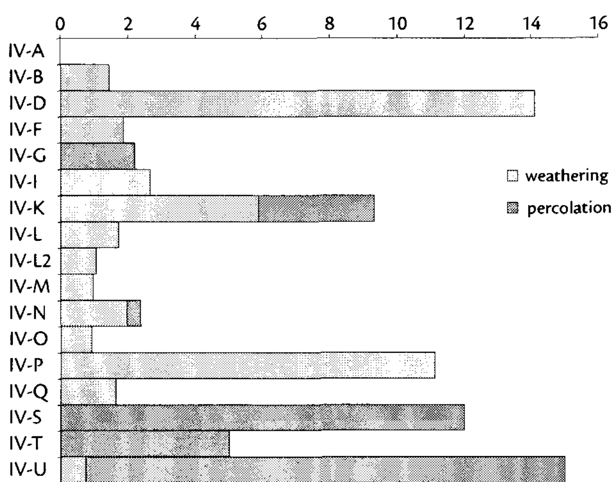


Figure 22-6—Chokurcha I Unit IV: percentage of remains within each level with climato-edaphic damage.

Damage from Non-Human Agencies

Plants

Damage from plant rootlets (vermiculation) was observed on only 12 bones. These were found in 5 levels: IV-D, IV-F, IV-O, IV-P, and IV-V (Figure 22-7). This low occurrence of damage by plants is due to the fact that the site is a rockshelter, that the climate at that time was dry (*ergo* poorly vegetated, see above), and/or that the rate of sedimentation was rapid.

Post-depositional Movement and Trampling

Scratches from post-depositional damage (formed when bones are shifted on the ground) and micro-splintering from trampling were noted on only 20 bone pieces. These were found in Levels IV-A, IV-B, IV-F, IV-I, IV-M, IV-N, IV-O, IV-P, IV-Q, and IV-S (Figure 22-7). This rarity might be due to low foot traffic within the rockshelter and/or that the deposits were rapidly covered by sediments. This type of damage may be due to non-human or human agencies.

Carnivore Damage

Small carnivores left traces of their passing (tooth marks) on only 26 bones: in Levels IV-B, IV-F, IV-I, IV-O, IV-Q, IV-S, IV-T, and IV-U (Figure 22-7). On the other hand, damage from hyæna is visible on

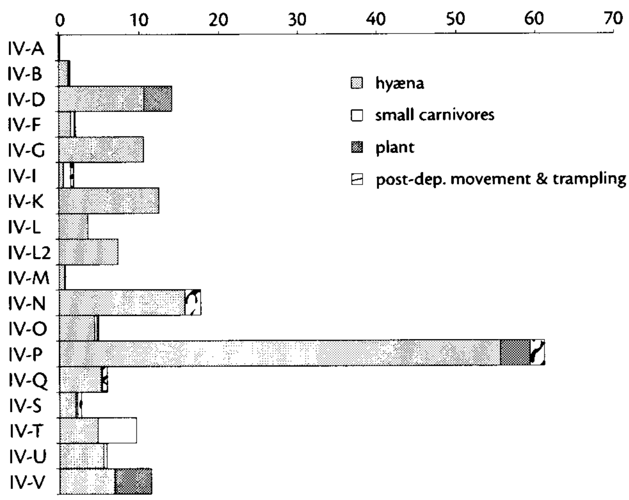


Figure 22-7—Chokurcha I Unit IV: percentage of remains within each level with biological non-human damage.

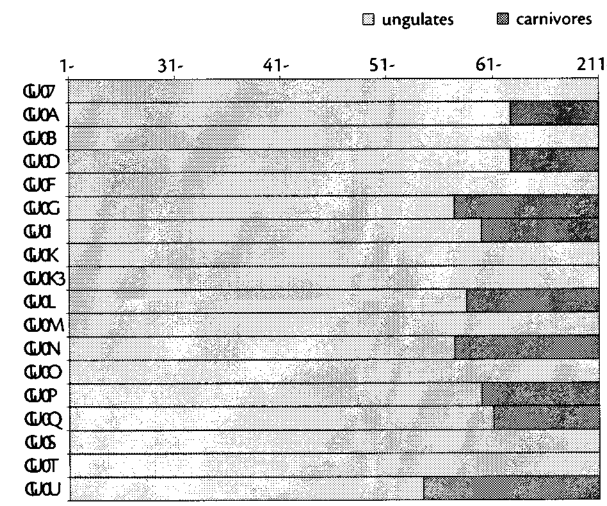


Figure 22-8—Chokurcha I Unit IV: ratio of carnivores to ungulates (MNIc).

bones in all of the levels except IV-A (Figure 22-7). Proportional to the number of remains in each level, hyæna damage was most significant in Levels IV-P, IV-N, IV-K, IV-D, IV-G, IV-L2, IV-V, IV-U, and IV-Q (on more than 5% of the remains). Coprolites were found in Levels IV-B and IV-O and attest to more extended stays in the rockshelter by the predator.

For all of the levels combined, this non-human taphonomic damage is relatively minor if the total number of faunal remains is taken into account. Non-human biological agencies are more significant in Levels IV-D, IV-G, IV-K, IV-N, IV-P, and IV-V. Other than Level IV-K, all of these levels had very few bone remains, which may be significant. Additionally, the number of carnivore remains is low (see above). Most significant to the state of preservation is the regular visit of hyænas to Chokurcha. Given, however, the number of remains attributed to this animal (only 1 bone: Level IV-Q) and the number of bones showing modifications from this carnivore, its role in the origin and history of the bone assemblages in most of the levels was modest. The ratio of carnivores to ungulates also highlights the rarity of the former in these assemblages (Figure 22-8). The Chokurcha rockshelter cannot, therefore, be considered to have ever been used as a carnivore den.

Anthropic Damage

Percussion Impact

One hundred twenty four bone chips display evidence of blows made by humans on green bone in the form of flakes, splintering, or points of impact. These are relatively abundant in Levels IV-P, IV-L2, IV-Q, and IV-L (on more than 2% of the remains) and are absent in the levels with small bone assemblages (IV-D, IV-G, IV-N, IV-T, and IV-V; Figure 22-9).

Butchery Striae

The presence of cut marks made during carcass butchery was noted on 34 bones in Levels IV-A, IV-B, IV-F, IV-I, IV-L, IV-L2, IV-M, IV-O, IV-Q, and IV-S (Figure 22-9). They are relatively more abundant in Levels IV-I, IV-L2, and IV-F (on more than 0.5% of the remains).

Retouchers

Seventy-five bones have scratches and impressions on their external surfaces. These were identified in Levels

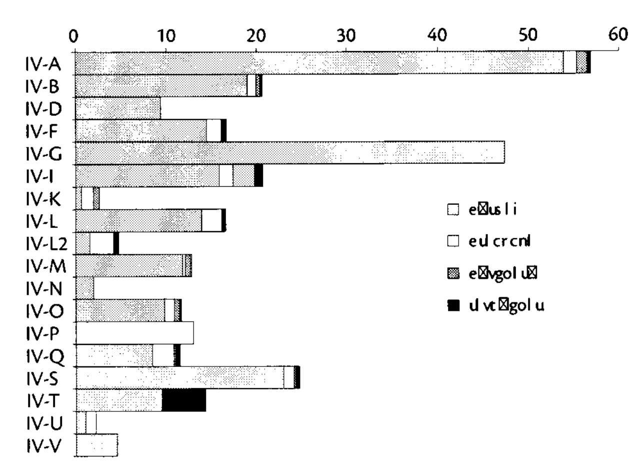


Figure 22-9—Chokurcha I Unit IV: percentage of remains within each assemblage with anthropically caused damage.

IV-A, IV-B, IV-F, IV-I, IV-K, IV-M, IV-O, IV-Q, IV-S, and IV-T (Figure 22-9). They can be considered as retouchers used for lithic knapping, although it should be noted that Chabai (Chapter 24) recognized only well-used examples, and, so, fewer of them. They are plentiful in Levels IV-T, IV-I, and IV-A (more than 1% of remains).

Burned Bones

More than 1,589 burned bones were discovered in Chokurcha Unit IV. They are present in all levels, with the exception of Level IV-P (Figure 22-9). They are particularly abundant in Levels IV-A, IV-G, IV-S, IV-I, and IV-B (more than 15% of remains). The use of bone as fuel reinforces the hypothesis of a cold and dry climate where arboreous vegetation was rare in the vicinity of the site.

As a whole, anthropically caused damage is relatively frequent and sometimes abundant, notably in Levels IV-A, IV-G, IV-S, IV-I, and IV-B (more than 20% of remains). This damage is mostly burning, which accounts for more than 87% of the total number of remains with anthropic damage. Other types of anthropic alteration abound in Levels IV-P, IV-I, IV-A, IV-L2, and IV-Q (on more than 3% of remains).

For all of the remains showing extrinsic damage, it is those with damage by anthropic agency that predominate in most of the levels (Figure 22-10), notably in Levels IV-A, IV-S, IV-I, IV-B (on more than 20% of remains), and in Levels IV-F, IV-L, IV-M, and IV-O (on more than 10% of remains).

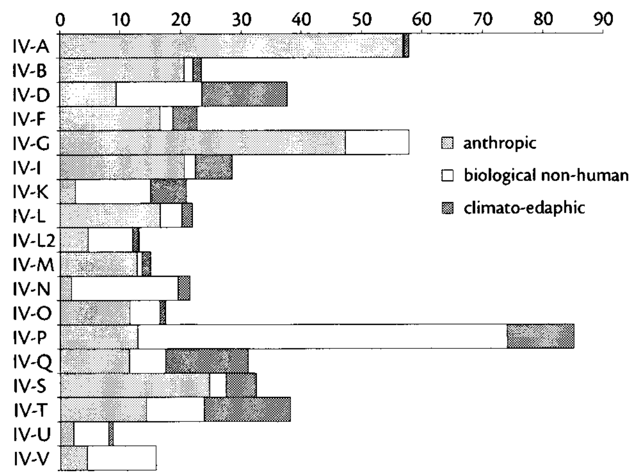


Figure 22-10—Chokurcha I Unit IV: percentages of remains in each level with climato-edaphic damage, biological non-human damage, and anthropic damage.

Paleoethnographical Analyses

Only Levels IV-A, IV-B, IV-F, IV-I, IV-M, IV-O, and IV-Q have enough identifiable bones as well as large enough lithic assemblages to advance hypotheses about the subsistence behavior of the Chokurcha Unit IV inhabitants.

Level IV-A

The bone assemblage from Level IV-A is small, with only 11.2% identifiable elements (Table 22-1). There is considerable fragmentation of the material and a scarcity of bones is evident (NRDt ÷ MNIc = 14; MNE ÷ MNIc = 2.4; and NRDt ÷ MNE = 5.8). No carnivore damage was observed in the assemblage; these low indices are entirely due to the role of humans *vis-à-vis* their game. In addition, damage from climato-edaphic agencies is very rare (see above).

Four species were identified in Level IV-A. There are no carnivore remains (Table 22-1). Saiga antelope (*Saiga tatarica*), the most abundant species in number of remains, is represented by cranial bone fragments, a hemi-mandible, an upper right premolar, and fragments of long bones (humerus, radius, metapodium). These belong to a single individual: a very old adult. A young woolly mammoth (*Mammuthus primigenius*) is represented by a few tooth and tusk fragments only. A young bison (*Bison priscus*) was identified by a decidual tooth, while an adult was identified by fragments of a tibial diaphysis. A horse (possibly adult) is represented by two tibia fragments. There are nine long bone fragments belonging to a large-sized species (bison and/or horse). Level A was deposited in a steppic environment during a period of cold and dry climate. This is further confirmed by five bones or 0.8% of the total number of remains showing damage from climato-edaphic agencies. The alteration of these bones can only be attributed to weathering.

There are an additional 559 bone fragments unidentifiable to species, of which 31 are cranial elements, 30 either rib or cranial bones, 13 ribs, and 485 long bones. These belong to large, medium, and small-sized species (Table 22-1). The bone size class II (fragments 2–5 cm in maximum dimension) is predominant.

Two diaphyseal fragments of tibia, representing a bison and a horse, carry striations caused by defleshing (0.3% of NRT). External splintering on 4 pieces (2 long bones, 1 bison tibia, and 1 fragment belonging to either bison or horse) is evidence of breakage caused by humans, as is internal splintering on 1 piece (saiga metapodium), and by 6 "flakes." These 9 pieces

TABLE 22-1
Chokurcha I: fauna of Level IV-A

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus (caballus) sp.	2	1	1	1	adult *sensu lato*
Bison cf. priscus	5	3	1	2	young/adult *sensu lato*
Equus/Bison	9	1	–	–	
Mammuthus primigenius	9	2	1	1	young
Saiga tatarica	45	6	1	1	very old
Total ungulates	70	13	4	5	
Total carnivores	–	–	–	–	
Total determinate (NRDt)	70	13	4	5	
Size large/medium	10	–	–	–	
Size medium	14	–	–	–	
Size medium/small	188	–	–	–	
Indeterminate	347	–	–	–	
Total indeterminate (NRI)	559	–	–	–	
Total (NRT)	629	>>13	4	5	

NR = number of remains; MNE = minimum number of elements; MNIf = minimum number of individuals by frequency; MNIc = minimum number of individuals by combination

represent 1.4% of the total number of remains (NRT). Three-hundred thirty nine bones, mostly metaphyseal fragments of long bones under 5 cm in length (averaging 2 cm), are completely burned (black or grey in color). These represent 53.9% of the total number of remains. Eight retouchers were identified (1.3% NRT), of which 7 are diaphyseal fragments of long bones (tibias, metacarpals…) from bison and/or horse. One was made on a rib fragment of a small to medium-sized animal (possibly saiga). Marks on these bones are always perpendicular to the longitudinal axis. Six of these have only one zone of use and two show two zones of use (with one zone more damaged than the other). Two of these retouchers also have scraping striations (made before the item was used as a retoucher) at the same place in the zone as the retouching marks. These retouchers are variable in size; length ranges between 146.8 and 55 mm, width between 45 and 23 mm, and the elongation index (L/W) between 56.3 and 21.3. In sum, anthropic modifications were seen on a total of 358 remains (57.1% NRT) in Level IV-A.

The prehistoric occupants of Level IV-A brought a saiga antelope back to the site, which they probably dismembered in front of the shelter, plus parts of two bison, a horse, and a young mammoth (possibly only the head). It is rather difficult to know, especially for the latter three species, whether these animals were hunted or whether their fresh carcasses were scavenged. The bison and horse remains were, however, from meat rich parts. The humans consumed the meat, the long bone marrow, used certain bones as tools, and some bones for fuel. The use of these animals, then, was quite exhaustive and may indicate that the inhabitants were experiencing dietary stress. The occupation of Level IV-A seems to have been a single episode of very short duration, based on the faunal remains and the relative rarity of lithic items. (It should be noted that during excavation, the lithic material from this level was subdivided into two sub-levels—IV-A1 and IV-A2—but all of the faunal material was grouped into a single assemblage.) Chokurcha I might have served as a stop-over for a small group of humans, perhaps during one of their routine movements.

Level IV-B

The faunal assemblage of Level IV-B is fairly small, with only 16.1% identifiable remains in the total assemblage (Table 22-2). The scarcity of animal remains and the degree of fragmentation are significant (NRDt ÷ MNIc = 27; MNE ÷ MNIc = 3.8; and NRDt ÷ MNE = 7.1). As was the case in Level IV-A, these low indices are due to human impact on game animals, which was intensive. On the other hand, ten bones, including three saiga bones, were regurgitated by hyænas. A bone belonging to either a bison or equid has tooth marks from a small carnivore. Carnivore damage is visible on 1.3% of the faunal material. Two hyæna coprolites were also discovered. These carnivores probably came into the cave after it had been abandoned by humans, and therefore affected the faunal material, including by potentially destroying certain bones.

Two species were identified in Level IV-B (Table 22-2). Saiga antelope (*Saiga tatarica*) is represented by cranial bone fragments, a hemi-mandible, long bone fragments (humerus, radius, ulna, metapodium), an innominate, rib fragments, and two semi-lunate carpal bones. These remains were from two individuals: a juvenile and an adult *sensu lato*. The mammoth (*Mammuthus primigenius*) is only represented by 57 fragments of juvenile milk teeth. In addition, a fragment of a long bone metaphysis was attributed to either a juvenile mammoth or juvenile rhinoceros. Twenty-one remains, mostly long bone fragments, belong to one or two large-sized species, Bison or Equidae. Two bones of a small carnivore (fox or mustelid) were identified: a proximal phalanx and a fragment of a distal ulna. The faunal spectrum composition indicates that Level IV-B was deposited in a cold and dry climate in a steppic environment. In addition, only 12 bones (1.4% NRT) have damage from climato-edaphic agencies, which can only be due to weathering.

An additional 702 bones could not be specifically attributed to species. These include 94 cranial bone fragments, 6 teeth of a small artiodactyl, 5 ribs, 2 costal cartilages, 2 flat bones, and more than 593 long bone fragments. These are remains of very large/large, large, medium, and small-sized species, with medium-sized most frequent (Table 22-2). The indeterminate remains most often fall into size class II (2–5 cm in maximum dimension).

A rib shaft and the proximal part of an ulna, both from a juvenile saiga, have butchery marks (0.2% NRT). Grooves on the rib shaft were incurred during defleshing, while those on the ulna were incurred during the disarticulation of the humerus/radius-ulna. Breakage caused by human agency is seen on 7 "flakes" from large and medium-sized species, and by external splintering on a horse or bison long bone metaphysis (1.0% of NRT). More than 159 bones are completely burned (black or grey in color); these are mainly fragments of long bone metaphyses under 5 cm in length (mean length = 2 cm) and they represent 19.0% of the total number of remains of Level IV-B. Four retouchers were identified in this level (0.5% of NRT). Two are diaphyseal fragments of tibia long bones of bison and/or horse. A third is made on a rib fragment of a small to medium-sized animal, possibly saiga. The marks are always perpendicular to the longitudinal axis of the bone. Three of the retouchers show only one zone of use, while the fourth shows two zones. Vermiculation and external splintering are also visible on two of the retouchers. The dimensions of the retouchers vary, from 112 to 45 mm in length, 27 to 17 mm in width, 60 to 24 in elongation. Human modification is therefore present on more than 173 bones (20.6 % NRT).

The Level IV-B occupants brought two saiga antelopes back to Chokurcha I and probably dismembered them in front of the shelter. They also brought back pieces of bison and/or horse and young mammoth (possibly only the head). It is not clear whether they hunted these animals or scavenged pieces of them off of fresh carcasses, especially in the case of horse and/or bison (which are represented by meat rich parts). At the shelter, they ate the meat, the long bone marrow, fashioned some bones into tools, and burned other bones for fuel. The game appears to have been thoroughly exploited, suggesting that the occupants were undergoing a period of dietary stress. Level IV-B seems to have been a single and very short occupation based on the lithic and faunal remains. As with Level IV-A, Level IV-B might have functioned as a resting place for a small group of hominids.

TABLE 22-2
Chokurcha I: fauna of Level IV-B

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus/Bison	21	>2	1	1	adult *sensu lato*
Mammuthus primigenius	57	3	1	1	young
Mammuthus/Coelodonta	1	1	–	–	
Saiga tatarica	54	11	1	2	young/adult *sensu lato*
Total ungulates	133	>17	3	4	
Small carnivore	2	2	1	1	
Total carnivores	2	2	1	1	
Total determinate (NRDt)	135	>19	4	5	adult *sensu lato*
Size very large/large	1	–	–	–	
Size large/medium	19	–	–	–	
Size medium	57	–	–	–	
Size medium/small	336	–	–	–	
Size small	3	–	–	–	
Indeterminate	286	–	–	–	
Total indeterminate (NRI)	702	–	–	–	
Total (NRT)	837	>>19	4	5	
Rodent	1				

Level IV-F

The Level IV-F faunal material is fairly abundant, but only 17.9% of the bones were identifiable (Table 22-3). The shortage of bones and the fragmentation of material is significant (NRDt ÷ MNIc = 17.8; MNE ÷ MNIc = 5.0; and NRDt ÷ MNE = 3.6). These low indices were the result of human impact on their game. It should be noted, however, that marks from a small carnivore are visible on five bones, including four saiga bones (0.4% of NRT). In addition, 18 bones (including 5 saiga, 1 mammoth, 1 mammoth/rhinoceros, 4 *Equus hydruntinus*) were altered by hyænas (1.5% NRT). Most of these (17) are from hyæna vomiting. Carnivores played a small part in the history of the bone assemblage, by damaging or destroying some bones.

Five species were identified in Level IV-F (Table 22-3). Saiga antelope (*Saiga tatarica*) is the most prevalent species. Woolly mammoth (*Mammuthus primigenius*) was mostly identified via tooth and tusk fragments—the only bone attributed to it was a sesamoid. These 89 mammoth bones belonged to at least 2 individuals, a very young juvenile and a 5–10 year-old juvenile. Woolly rhinoceros (*Coelodonta antiquitatis*) is represented by 3 tooth fragments and 3 long bone diaphyses (including one femoral diaphysis), probably all from a young individual. A long bone fragment from either a mammoth or a woolly rhinoceros was also identified. Seven bones of *Equus hydruntinus* were identified: 4 teeth (including one lacteal labial tooth), a juvenile metapodial, a metacarpal, and a vestigial metapodial. These were from at least two individuals, one of which was a juvenile. Twelve fragments from at least two long bones of bison or horse were identified. Wolf (*Canis lupus*) is represented by one mandible (in 3 pieces), probably belonging to an old adult male. A humeral diaphysis of a fœtus or newborn small carnivore is also present. The composition of the faunal spectrum suggests that the climate was cold and dry and the environment steppic during the deposition of Level IV-F. Forty-eight bones (4.0% NRT) show traces of climato-edaphic agencies, including weathering (22 bones) and water percolation (26 bones). During the formation of the overlying Level IV-E, the climate was therefore somewhat more humid.

An additional 976 bones were unidentifiable to species: 17 teeth, 57 cranial bones, 3 hemi-maxillae, 1 hemi-mandible, 5 vertebrae, 21 ribs, 2 short bones, 9 flat bones, and 861 long bone fragments (including 10 fragments of extremities). These belong to large/medium, medium, medium/small, and small-sized species (Table 22-3). Based on the remainder of the faunal assemblage, most can probably be attributed to saiga antelope (Table 22-3). Size class II (2–5 cm) is the best represented.

Acquisition and Processing of Saiga Antelope in Level IV-F

The inhabitants of Chokurcha I Level IV-F consumed four saiga antelopes. All ages are represented (less than 36 months, young adult, adult, and old adult); a mor-

Table 22-3
Chokurcha I: fauna of Level IV-F

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus hydruntinus	7	7	1	2	young/adult *sensu lato*
Equus/Bison	12	>2	1	1	adult *sensu lato*
Coelodonta antiquitatis	6	>2	1	1	young ?
Mammuthus primigenius	89	>5	2	2	very young/5–10 years
Mammuthus/Coelodonta	1	–	–	–	
Saiga tatarica	94	>40	2	4	young/young adult/adult/old
Total ungulates	209	>56	7	10	
Canis lupus	3	3	1	1	old
Small carnivore	1	1	1	1	fœtus or newborn
Total carnivores	4	4	2	2	
Total determinate (NRDt)	213	>60	9	12	
Size large/medium	18	–	–	–	
Size medium	36	–	–	–	
Size medium/small	145	–	–	–	
Size small	2	–	–	–	
Indeterminate	775	–	–	–	
Total indeterminate (NRI)	976	–	–	–	
Total (NRT)	1189	>>60	9	12	
Rodent	7	–	–	–	
Bird	3	–	–	–	

tality profile corresponding to a hunting curve. All skeletal parts are present in the assemblage, although they are numerically limited (Figure 22-11). These animals were transported in their entireties to Chokurcha I and processed just outside the shelter.

Six bones have butchery marks (0.5% NRT): two fragments of a saiga long bone diaphysis, a rib shaft, a fragment of long bone diaphysis and a cranial bone fragment of a medium-sized animal, and a rib shaft of a small/medium-sized animal. These striations are mostly the result of defleshing, and of skinning in the case of the cranial fragment. Breakage caused by humans is seen on 21 bones (1.8% NRT). These bones are from saiga antelope (4 bones, including one flake), a large-sized species (bison/horse, 5 flakes), a medium-sized animal (5 flakes), a large/medium-sized animal (2 flakes), a medium/small-sized animal (2 bones including one flake), and an indeterminate species (3 flakes). There are 172 totally burned bones (black or grey in color); these are mostly long bone metaphyses under 5 cm in length (mean = 2 cm), and they account for 14.5% of the total remains. One retoucher was identified (0.1% NRT). It was made on a long bone metaphyseal fragment from a medium-sized species. The marks, which are localized in a single zone, are perpendicular to the longitudinal axis of the bone. The piece is 65 mm long, with a maximum width of 20 mm, and an elongation index of 31. Anthropically caused modification is therefore visible on 200 bones (16.8% NRT), which belong, for the most part, to saiga antelope.

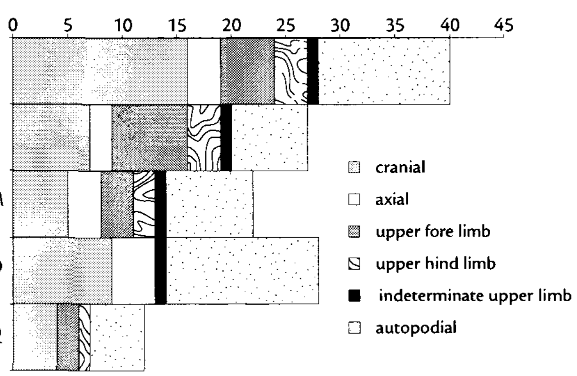


Figure 22-11—Chokurcha I Unit IV: *Saiga tatarica*, preservation of skeletal units (MNE).

The occupants of Chokurcha I Level IV-F brought back to the site pieces of two young mammoths (possibly only heads and feet), a young woolly rhinoceros (pieces that were meat heavy), and two hydruntinian horses (heads and feet). Given these data, it is difficult to ascertain whether the animals had been hunted or scavenged. It is also possible that another predator, such as hyæna, could have brought in chunks of these animals (notably for the small horse). On the other hand, humans unquestionably hunted four saiga antelope. The skins of these antelope were removed, the meat and marrow were eaten, and some of the bones were used for tools and fuel. This level appears to have been a short-lived single occupation. The site might have served as a hunting camp oriented towards saiga antelope.

Level IV-I

The faunal material is fairly abundant in Level IV-I, with 22.7% identifiable remains (Table 22-4). There is significant bone shortage and fragmentation (NRDt ÷ MNIc = 25.7; MNE ÷ MNIc = 4.9; and NRDt ÷ MNE = 5.2). These indices are due to the human occupants and their role in relation to the game animals. There are, however, 11 bones (including 2 saiga and 1 *Equus hydruntinus*) with small carnivore damage (0.9% of NRT). An additional 7 bones (3 of which were saiga) were altered by hyænas; 6 of these correspond to regurgitations (0.6% NRT). These carnivores appear to have scavenged the remains left by humans and might have interfered with the faunal preservation of this level.

Eight species were identified in Level IV-I (Table 22-4). Saiga antelope (*Saiga tatarica*) is the most abundant species. Mammoth (*Mammuthus primigenius*) is also well represented, but only by tooth and tusk fragments. The 100 mammoth remains are from at least 2 skulls, of a very young individual and the other of a 5–10 year-old juvenile. Woolly rhinoceros (*Coelodonta antiquitatis*) is only represented by a few tooth fragments, probably belonging to a sub-adult. Ten *Equus hydruntinus* bones were identified. These include 6 teeth (1 labial and 1 milk tooth were specifically identified), two rib fragments, and two pieces of a long bone diaphysis. These belonged to at least one young individual. Two femur fragments of an adult bison (*Bison cf. priscus*) were identified. Seventeen fragments corresponding to at least one juvenile long bone and an innominate of Bison/Equidae were found. One metatarsal diaphysis of red deer (*Cervus elaphus*) was also identified. An old adult wolf (*Canis lupus*) is represented by a labial tooth. An upper premolar is from a fox (*Vulpes corsac*). A calcaneus epiphysis belongs to a small carnivore.

The composition of the faunal spectrum indicates that Level IV-I was deposited during a cold and dry period in a steppic environment. The presence of red deer remains, however, suggests a slight increase in humidity. Damage by climato-edaphic agencies was identified on 76 bones (6.1% NRT). These bones were modified by weathering (33) and percolating water

TABLE 22-4
Chokurcha I: fauna of Level IV-I

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus hydruntinus	10	7	1	1	young
Bison cf priscus	2	1	1	1	adult *sensu lato*
Equus/Bison	17	2	–	–	
Coelodonta antiquitatis	1	1	1	1	sub-adult
Mammuthus primigenius	100	>6	1	2	very young/5-10 years
Cervus elaphus	1	1	1	1	
Saiga tatarica	149	>33	2	2	young/adult
Total ungulates	280	>51	7	8	
Canis lupus	1	1	1	1	old
Vulpes corsac	1	1	1	1	adult
Small carnivore	1	1	1	1	young
Total carnivores	3	3	3	3	
Total determinate (NRDt)	283	>54	10	11	
Size very large/large	2	–	–	–	
Size large/medium	100	–	–	–	
Size medium	9	–	–	–	
Size medium/small	538	–	–	–	
Size small	10	–	–	–	
Indeterminate	306	–	–	–	
Total indeterminate (NRI)	965	–	–	–	
Total (NRT)	1248	>>54	10	11	
Lagomorpha/Rodentia	2	–	–	–	

(43). During the formation of the overlying Level IV-G, the climate was somewhat more humid.

There are 965 bone fragments that are not identifiable to species in Level IV-I. These include fragments of 10 teeth, 16 cranial bones, 1 hemi-maxilla, 1 hemi-mandible, 4 vertebrae, 61 ribs, 3 costal cartilages, 4 short bones, 3 flat bones, and 862 long bones (of which there are 2 extremity fragments and one of a fœtus or newborn). These fragments belong to species that were very large/large, large/medium, medium, medium/small, and small in size (Table 22-4). Based on the composition of the Level IV-I faunal assemblage, these are probably mostly remains of saiga antelope (Table 22-4). Size class II (2–5 cm) is the most frequent.

Acquisition and Processing of Saiga Antelope in Level IV-I

The inhabitants of Level IV-I consumed two saiga antelopes—a juvenile of 20–24 months and an adult, probably a female. All skeletal elements are present, although in low numbers (Figure 22-11). These animals were complete when brought to the site—the presence of costal cartilage is notable—and processed in the shelter's exterior.

Eleven bones show cut marks (0.9% NRT): an *Equus hydruntinus* rib shaft, a saiga radius-ulna diaphyseal fragment, a saiga second phalanx, and from an indeterminate species, 6 rib fragments and two long bone diaphyseal fragments. The grooves on these bones were essentially the result of defleshing, and of skinning for the second phalanx. Breakage caused by humans was identified on 21 bones (1.7% NRT): belonging to saiga (4 bones, including 2 retouchers), bison (femoral diaphysis), a large-sized species (*Bison/Equus*, one flake), a large/medium-sized animal (6 flakes), a medium-sized species (2 flakes), a small/medium sized species (5 bones including 3 flakes), and an indeterminate species (2 flakes). There are 198 totally burned bones (black or grey in color), or 15.9% of the total number of remains; these are mostly long bone metaphyseal fragments under 5 cm in length (averaging 2 cm). Thirty retouchers were identified (2.4% NRT). These are made on pieces of saiga long bone diaphyses (18), 9 pieces are from a large-sized indeterminate species (7 long bone diaphyses, 1 rib shaft, 1 scapula), 1 is from a large/medium-sized species (long bone diaphysis), and 2 are from a medium-sized indeterminate species (1 long bone metaphysis, 1 rib shaft). The marks, which are found mostly in one zone on the retouchers (25) and more rarely in two separate zones (5), are perpendicular to the longitudinal axis of the bone. The dimensions of the retouchers from Level IV-I are presented in Table 22-5. Human modification, in sum, was identified on 260 bones (20.8% NRT), which can mostly be attributed to saiga antelope.

TABLE 22-5
Chokurcha I: dimensions of "retouchers" in Levels IV-I and IV-M (in mm)

Layer I	*Minimum*	*Mean*	*Maximum*	N	*Layer M*	*Minimum*	*Mean*	*Maximum*	N
Retoucher length	25.00	49.50	92.60	19	Retoucher length	25.00	69.60	118.10	15
Retoucher width	10.00	20.90	37.00	11	Retoucher width	17.00	24.60	38.00	15
Retoucher elongation	19.46	38.47	60.00	11	Retouched elongation	21.25	38.50	80.00	15
Zone length	10.70	16.67	22.50	8	Zone length	7.40	14.70	27.40	13
Zone width	4.30	10.97	20.00	8	Zone width	4.60	9.65	19.00	13
Zone elongation	40.18	64.71	100.00	8	Zone elongation	41.07	66.94	99.00	13

The occupants of Level IV-I brought the skulls of two young mammoths, meat-rich pieces of a hydruntinian horse and a bison, and a red deer foot back to the rockshelter. For these four species, it is difficult to ascertain whether they were hunted or their carcasses scavenged. On the other hand, two saiga antelopes (one of which was female) were hunted. The occupants skinned and ate the meat and marrow of these antelopes, plus used their bones for tools and fuel. Based on the faunal assemblage, the occupation of this level appears to have been a single and short-lived episode. The lithic material is abundant, however. (This level was excavated as two sublevels, I1 and I2, but only the lithic material was subdivided, the faunal remains were grouped as a single unit.) The rockshelter may have served as a seasonal camp. Given the presence of a fœtal/newborn bone, which probably belongs to a saiga antelope based on its dimensions, the occupation of Chokurcha Level IV-I might have taken place at the end of spring.

Level IV-M

The faunal material is abundant in Level IV-M, but only 10.4% of the material could be identified to species (Table 22-6). There is a significant bone shortage and the material is highly fragmented (NRDt ÷ MNIc = 31.2; MNE ÷ MNIc = 6.3; and NRDt ÷ MNE = 4.9). These low indices are due to the way humans treated their game. Modifications caused by hyænas are visible on 19 bones, accounting for 0.7% of the total material (4 bones of saiga, 1 bison, 6 *Equus hydruntinus*, 3 small artiodactyl teeth, and 1 carnivore tooth). Sixteen of these were regurgitated. The hyæna(s) appears to have entered the shelter after the departure of the humans and might be responsible for the destruction of a portion of the faunal assemblage.

Six species were identified in Level IV-M (Table 22-6). Mammoth (*Mammuthus primigenius*) is the most abundant species in terms of total number of remains, but these are only tooth and tusk fragments belonging to at least one juvenile individual. Saiga antelope (*Saiga tatarica*) is represented by 44 remains. Woolly rhinoceros (*Coelodonta antiquitatis*) is represented by two teeth, probably belonging to one sub-adult individual. For *Equus hydruntinus*, 17 remains were identified, which probably belong to one juvenile less than 13–15 months old and to a 4–5-year old male. These are teeth (including one juvenile labial and a canine bud), a patella, 3 autopodial bones, and long bone diaphyseal fragments. Bison (*Bison cf. priscus*) is represented by 4 bones, including a molar bud and metacarpal fragment, which probably belong to a sub-adult individual. Remains from Bison and/or Equidae include 31 long bone fragments, 1 rib, 1 caudal vertebra, and two skull fragments. An old adult female wolf (*Canis lupus*) is represented by 2 dental remains, a fibula in 2 pieces, and a first metacarpal. A small carnivore is represented by 2 skull bone fragments. The composition of the faunal spectrum suggests that the deposition of Level IV-M was during a relatively cold and dry climatic period in a steppic environment. Only 37 remains (1.4% NRT) show climato-edaphic damage. Of these, 26 were modified by weathering and 11 by percolation.

An additional 2,433 bone fragments unidentifiable to species are present in Level IV-M: from 16 teeth, 186 cranial bones, 1 hemi-mandible, 4 vertebrae, 30 ribs, 3 costal cartilages, 2 short bones, 1 flat bone, 2,188 long bones (including 6 extremities), and an innominate and vertebra of a fœtus or newborn. These belong to species that were very large/large, large/medium, medium, medium/small, and small in size. Based on the most frequent size class (II) and the faunal composition of the level, most of these are probably from saiga antelope (Table 22-6).

Acquisition and Processing of Saiga Antelope in Level IV-M

The occupants of Level IV-M consumed an adult saiga that was in the prime of life, and which was possibly a female. All of its skeletal parts are present, although in limited numbers (many of these are probably in the indeterminate fragments, Figure 22-11). This animal was brought whole (especially given the presence of costal cartilages) to the rockshelter and processed just outside.

TABLE 22-6
Chokurcha I: fauna of Level IV-M

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus hydruntinus	17	13	2	2	<13–15 month/4–5 years (male)
Bison cf priscus	4	2	1	1	sub-adult
Equus/Bison	34	2	–	–	
Coelodonta antiquitatis	2	2	1	1	sub-adult
Mammuthus primigenius	171	>4	1	1	young
Saiga tatarica	34	22	1	1	adult
Small Artiodactyla	10	3	–	–	fœtus or newborn
Total ungulates	272	>48	6	6	
Canis lupus	5	4	1	1	old (female)
Small Carnivore	2	2	1	1	adult
Total carnivores	7	6	2	2	
Lepus europaeus	2	2	1	1	Adult *sensu lato*
Total determinate (NRDt)	281	>56	9	9	
Size very large/large	2	–	–	–	
Size large/medium	312	–	–	–	
Size medium	115	–	–	–	
Size medium/small	1598	–	–	–	
Size small	2	–	–	–	
Indeterminate	404	–	–	–	
Total indeterminate (NRI)	2433	–	–	–	
Total (NRT)	2714	>>56	9	9	

Three bones in Level IV-M have cut marks (0.1% NRT): a cranial bone fragment, a rib shaft, and a long bone diaphysis of an indeterminate species. These scratches are mainly from defleshing and from skinning for the cranial fragment. Breakage caused by humans is visible on 8 bones (0.3% NRT); these belong to indeterminate species of large size (Bison/Equus, 3 flakes), very large/large size (1 flake), large/medium-sized (1 flake), and of medium size (3 flakes). There are 320 bones that are completely burned (black or grey in color); these are mostly long bone metaphyseal fragments less than 5 cm in maximum dimension (mean = 2 cm). They represent 11.8% of the total number of remains. Sixteen retouchers were identified (0.6% NRT). These are made on diaphyseal fragments of long bones from *Equus hydruntinus* (5), Bison/Equus (4), *Saiga tatarica* (1), an indeterminate large/medium-sized species (4), an indeterminate medium-sized species (1), and an indeterminate species of unknown size (1). The percussion marks, which are localized in one zone (10) or in two zones (6), are perpendicular to the longitudinal axis of the piece. The dimensions of these retouchers are presented in Table 22-5. In sum, anthropic modification is visible on 347 bones (12.8% NRT).

The inhabitants of Level IV-M brought the skull of a young mammoth and meat-rich parts of two *Equus hydruntinus* and a bison to Chokurcha I. For these three species then, it is impossible to know whether the occupants of the shelter hunted the animals or scavenged fresh carcasses. They did, however, hunt at least one saiga antelope (probably a female). The skins of all of these animals were removed, their meat and long bone marrow consumed, and the bones were used as tools and as fuel. Level IV-M appears to have been occupied only once and for only a brief time. Based on the relatively abundant lithic and faunal assemblages, the occupation might represent a seasonal camp. Given the presence of two bones from a fœtus or newborn, which probably belong to saiga antelope given their size, this occupation may have occurred during the late spring.

Level IV-O

The faunal assemblage of Level IV-O is fairly abundant, but only 7.1% of the bones could be identified (Table 22-7). The bone deficit and degree of fragmentation is very significant (NRDt ÷ MNIc = 10.5; MNE ÷ MNIc = 5.3; and NRDt ÷ MNE = 2.0). The interaction of humans on their game is responsible for these low values. There are, however, 5 bones (including 1 saiga and 1 bison) showing modification by small carnivores (0.3% NRT). In addition, hyænas modified 78 bones (14 from saiga, 1 mammoth, 7 *Equus hydruntinus*, 1 bison), of which 77 were vomited (4.4% NRT). A coprolite was also found. This carnivore, therefore, was responsible for an important amount of damage, and, potentially, completely destroyed some of the faunal assemblage.

Eight mammal species were identified in Level IV-O (Table 22-7). Saiga antelope (*Saiga tatarica*) is represented by 37 bones. Remains of mammoth (*Mammuthus primigenius*) are relatively abundant, but limited to tooth and tusk fragments of at least one juvenile. Woolly rhinoceros (*Coelodonta antiquitatis*) is represented by one tooth and a third phalanx belonging to a juvenile. A rib shaft fragment and a piece of a long bone diaphysis come from either a mammoth or rhinoceros. Fifteen bones of *Equus hydruntinus* were identified. These include teeth (7, of which 4 are lacteals), a hemi-mandible, a humerus, a tibia, and 5 autopodial bones. These represent at least one juvenile and one old adult. Five bones of an adult bison (*Bison cf. priscus*) were identified, including 3 skull bones, a labial tooth, and a long bone diaphyseal fragment. A hemi-mandible and a metacarpal were attributed to a megaloceros (*Megaceros giganteus*). Thirty long bone fragments from Bison, Equidae, and/or Megaloceros were also found. An adult fox (*Vulpes corsac*) is represented by five bones: a hemi-mandible, lower canine, ulna, femur, and a tibia. An incisor probably belongs to a steppic polecat (*Putorius eversmanni*). A canine fragment belongs to a small carnivore. The faunal composition of the level suggests that the material was deposited during a relatively cold and dry period in a steppic environment. In addition, only 16 bones (0.9% NRT) show traces of climato-edaphic agencies, exclusively from weathering. On the other hand, the presence of megaloceros and of the amphibian *Bufo viridis*, hints at more humid conditions.

There are an additional 1,648 bones unidentifiable to species; these are fragments of 11 teeth, 4 cranial bones, 5 vertebrae, 2 ribs, 3 short bones, and 1,623 long bones (including 3 extremities). These belong to very large/large-sized, large/medium, medium, medium/small, and small-sized animals. Based on the most abundant size class (2–5 cm) of these fragments, and the composition of the remainder of the assemblage, they probably mostly belong to saiga antelope (Table 22-7).

Acquisition and Processing of Saiga Antelope in Level IV-O

The occupants of Level IV-O consumed two saiga antelopes: a juvenile and an old adult. All skeletal elements of these are present, although numerically

TABLE 22-7
Chokurcha I: fauna of Level IV-O

Species	*NR*	*MNE*	*MNIf*	*MNIC*	*Age*
Equus hydruntinus	15	15	1	2	young/old
Bison cf priscus	5	3	1	1	adult
Equus/Bison/Megaloceros	30	–	–	–	
Coelodonta antiquitatis	2	2	1	1	young
Mammuthus primigenius	23	3	1	1	young
Mammuthus/Coelodonta	4	3	–	–	
Megaloceros giganteus	2	2	1	1	young adult
Saiga tatarica	37	28	1	2	young/old
Total ungulates	118	56	6	8	
Vulpes corsac	5	5	1	1	adult
Mustelidae indeterminate	1	1	1	1	adult *sensu lato*
Putorius eversmanni	1	1	1	1	adult
Total carnivores	7	7	3	3	
Lepus europaeus	1	1	1	1	adult
Total determinate (NRDt)	126	64	10	12	
Size very large/large	2	–	–	–	
Size large/medium	29	–	–	–	
Size medium	207	–	–	–	
Size medium/small	1234	–	–	–	
Size small	6	–	–	–	
Indeterminate	170	–	–	–	
Total indeterminate (NRI)	1648	–	–	–	
Total (NRT)	1774	>>64	10	12	
Rodent	7	–	–	–	
Bird	13	–	–	–	
Bufo viridis	1	–	–	–	

restricted (many of the bones are among the indeterminate remains, Figure 22-11). These animals appear to have been brought intact to the rockshelter and processed just outside of it. It should be noted that hyænas might have played the role of predator and consumer.

Three bones show traces of butchery (0.2%): a saiga vertebral body, a long bone diaphyseal fragment of an indeterminate medium/small-sized species, and a long bone metaphyseal fragment of an indeterminate large-sized species (*Bison/Equus/Megalaceros*). These striations were from defleshing the carcasses. Breakage caused by humans is visible on 18 bones (1.0% NRT) belonging to mammoth (long bone metaphysis), *Equus hydruntinus* (humerus), bison (long bone metaphysis), large-sized species (8 flakes), large/medium-sized species (5 flakes), medium-sized species (1 flake), and a small-sized species (1 flake). One hundred seventy-four bones in the assemblage were extensively burned (black or grey in color); these are mostly fragments of long bone metaphyses under 5 cm in length (averaging 2 cm). Burned bones represent 9.8% of the total number of faunal remains. Eleven retouchers were identified (0.6% NRT). These were made on a saiga rib shaft (1), and on long bone diaphyseal fragments from *Bison/Equus/Megaloceros* (5), saiga (1), a large/medium-sized species (1), a medium-sized species (2), and a medium/small-sized species (1). The marks are mostly localized within a single zone (9) or, more rarely, in three zones (2), and are perpendicular to the long axis of the bone. Anthropic modification is visible, then, on 206 bones (11.6% NRT).

The Level IV-O humans brought the remains of two saiga antelope, pieces of a young mammoth, the head and one foot of a young rhinoceros, plus pieces of two *Equus hydruntinus*, a bison, and a giant deer to Chokurcha I. Whether all of these animals were hunted or were scavenged is unknown. Since hyænic modification does appear to play a role in the bone assemblage, some of these remains might be the result of that carnivore's activities. Humans consumed the meat and long bone marrow, used some bones as tools, and used some bones as fuel. The human occupation of the shelter appears to have been a short, single episode. The site might have served as a seasonal camp, or as a rest stop given the hyænic modifications. Since lithic material is abundant in this level, the former seems more likely.

Level IV-Q

The Level IV-Q faunal assemblage is fairly small and only 9.3% of remains were identifiable (Table 22-8). The bone shortage and fragmentation are extremely high (NRDt ÷ MNIc = 6.3; MNE ÷ MNIc = 4.3; and NRDt ÷ MNE = 1.5). These indices were caused by human activity. There are indications of small carnivore activity—a humerus of a small carnivore has tooth marks (0.1% NRT). An additional 35 bones show marks of hyænic activity (including 4 saiga, 9 *Equus hydruntinus*, and 1 bison bone), 34 of which show marks of hyænic vomiting (5.2% NRT). This carnivore appears to have played a significant role in the history of the Level IV-Q bone assemblage, including by possibly destroying some of the bones.

Six species were identified in Level IV-Q (Table 22-8). Saiga antelope (*Saiga tatarica*) is represented by 19 bones. Nineteen bones of *Equus hydruntinus* were identified: 9 teeth (including 4 milk teeth), a humerus, a tibia (in two pieces), and 7 bones of the autopodium, belonging to at least one juvenile and three adults. Five fragments of long bone diaphyses (humerus, radius, femur, and tibia) of an adult bison (*Bison cf. priscus*) were identified. A molar from an adult red deer (*Cervus elaphus*) is present. Thirteen bones from Bison or Equidae were found, including 10 long bone fragments, 2 skull bone fragments, and a vertebra. An adult fox (*Vulpes corsac*) is represented by a humerus. A second lower premolar of an adult hyæna (*Crocuta crocuta*) was identified. A fragment of a canine tooth belongs to a small carnivore. The faunal spectrum suggests that Level IV-Q was deposited in a cold—although not severe (given the absence of mammoth and woolly rhinoceros)—climate, which was relatively dry (the presence of red deer suggests slight humidity) in a steppic environment. In addition, a significant number of bones (92 or 13.6% NRT) show modification caused by climato-edaphic agencies—weathering (11 bones) and water percolation (81). It seems, then, that during the formation of the overlying Level IV-P, the climate was more humid.

Unidentifiable remains in Level IV-Q include 613 pieces. These are fragments of 2 teeth, 11 skull bones, 1 hemi-mandible, 2 vertebrae, 3 ribs, 2 flat bones, 1 costal cartilage, and 591 long bones (including fragments of two extremities). These are from very large/large, large/medium, medium, medium/small, and small-sized species. Given the most frequent size class (II) and the faunal spectrum, most of these are probably from saiga antelope (Table 22-8).

Acquisition and Processing of Saiga Antelope in Level IV-Q

The inhabitants of Chokurcha Level IV-Q consumed one saiga antelope, an aged adult. Other than the axial skeleton, all parts of the skeleton are present, although not numerous (some of these are undoubtedly among the indeterminate splinters, Figure 22-11). The animal appears to have been brought whole to the shelter and processed just outside.

Three bones in Level IV-Q show cut marks (0.4% NRT): a radius-ulna diaphysis of a saiga, a metaphyseal fragment of an indeterminate medium-sized

TABLE 22-8
Chokurcha I: fauna of Level IV-Q

Species	*NR*	*MNE*	*MNIf*	*MNIc*	*Age*
Equus hydruntinus	19	18	3	4	1 young/3 adults
Bison cf priscus	5	3	1	1	adult *sensu lato*
Equus/Bison	13	3	–	–	
Bison/Cervus	3	3	–	–	sub-adult
Cervus elaphus	1	1	1	1	adult *sensu lato*
Saiga tatarica	19	12	1	1	old
Total ungulates	60	40	6	7	
Crocuta crocuta	1	1	1	1	adult
Vulpes corsac	1	1	1	1	adult *sensu lato*
Total carnivores	2	2	2	2	
Lepus europaeus	1	1	1	1	adult
Total determinate (NRDt)	63	43	9	10	
Size large/medium	20	–	–	–	
Size medium	12	–	–	–	
Size medium/small	402	–	–	–	
Indeterminate	179	–	–	–	
Total indeterminate (NRI)	613	–	–	–	
Total (NRT)	676	>>43	9	10	
Rodent	1	–	–	–	
Bird	2	–	–	–	

species, and a long bone diaphyseal fragment from *Bison* or *Equus*. These marks are the result of defleshing. Breakage caused by humans is evident on 16 bones (2.4% NRT) belonging to saiga (1 radius), *Equus hydruntinus* (1 humerus), bison (1 tibia), a large-sized species (6, including 2 flakes), a large/medium-sized animal (4 flakes), a medium-sized species (1 flake), and an indeterminate species (2 flakes). Fifty-seven bones, mostly fragments of metaphyses of long bones not exceeding 5 cm in length (averaging 2 cm), are completely burned (black or grey in color). These represent 8.4% of the total number of remains in the assemblage. Two retouchers were identified (0.3% NRT), made on long bone diaphyseal fragments from saiga and a large/medium-sized species. The marks are localized within one zone, which is perpendicular to the longitudinal axis of the bone. Anthropic modification was identified on 78 bones (11.5% NRT) from Level IV-Q.

The occupants of this level brought one saiga antelope (possibly intact), and pieces of four hydruntinian horses, a bison (meat rich parts), and a red deer (foot). It is unknown whether the humans hunted these animals or collected pieces off their freshly killed carcasses. Since hyænas played an important role in the Level IV-Q assemblage, many of these remains might be attributed to that predator. The humans consumed the meat and long bone marrow, plus used certain bones for tools and fuel. The Level IV-Q occupation appears to have been a single episode of very short duration. Based on all of the cultural remains, the rockshelter might have served as a resting place for a small group of hominids.

Other Levels of Unit IV

The presence, on the one hand, of lithic material in all of the levels, sometimes in quite high numbers (Levels IV-L2, IV-G, IV-U, and IV-S, Figure 22-4), and on the other hand, anthropic modification on the bone assemblages (Figures 22-9 and 22-10), indicates that Chokurcha I was frequently visited by humans. Unfortunately, the small size of the faunal assemblages does not permit reliable hypotheses about the subsistence behavior of these humans. Some information and reflections can be offered, however, based on the data and analysis results presented above. In Levels IV-D, IV-G, IV-K, IV-N, IV-P, IV-T, IV-U, and IV-V, carnivores, especially hyænas, appear to have played a major role in the faunal assemblage, while humans played a considerably less significant one (especially in Levels IV-T and IV-V). During Levels IV-L and IV-L2, however, the shelter might have been only a brief resting place. A few humans brought at least a hunted adult saiga antelope back to the site. The presence of a foetal or newborn bone of saiga in Level IV-S suggests that this occupation was at the end of spring.

Discussion

The occupants of Levels IV-A, IV-B, IV-F, IV-I, IV-M, and possibly Levels IV-L, IV-L2, and IV-S, only hunted a few saiga antelopes (sometime pregnant females, as in Levels IV-I, IV-M, and IV-S), which they brought intact to the shelter and processed in the exterior.

They also brought pieces of carcasses of saiga antelope (Levels IV-O and IV-Q), young woolly mammoth (Levels IV-A, IV-B, IV-F, IV-I, IV-M, and IV-O), young woolly rhinoceros (Levels IV-F, IV-O), Bison (Levels IV-A, IV-B?, IV-I, IV-M, IV-O, and IV-Q), Equus (Levels IV-A and IV-B?), red deer (Levels IV-I and IV-Q), Megaloceros (Level IV-O), and hydruntinian horse (Levels IV-F, IV-I, IV-M, IV-O, and IV-Q). It is difficult to ascertain whether the humans hunted these animals or only collected pieces off of fresh carcasses ("scavenging"). In Levels IV-F, IV-O, and IV-Q, hyænas appear to play a significant role, and a portion of the faunal remains might be the result of their activities (such as bringing chunks of meat to the shelter).

Humans consumed meat and long bone marrow in all of the levels. They sometimes skinned the antelopes (seen in Levels IV-I and IV-M). In nearly all of the levels, they also used bones as tools (retouchers) and as fuel.

Whatever the level, the occupation appears to have been a single episode (although the question remains about Level IV-I) and of extremely short duration (Levels IV-A, IV-B, IV-L, IV-L2, and IV-S) or short duration (Levels IV-F, IV-I, IV-M, IV-O, and IV-Q). The rockshelter might have served as a stop-over for a small group of humans during one of their trips (Levels IV-A, IV-B, IV-L, IV-L2, IV-Q, and IV-S) or hunting stop (for saiga antelope?, Level IV-F). During Levels IV-I, IV-M, and possibly IV-O, the shelter appears to have served as a seasonal encampment (in late spring for Levels IV-I and IV-M).

The most significant human occupations of Chokurcha I took place during a relatively cold and dry period. Overall, the exploitation of the animal carcasses appears to have been very exhaustive, which may indicate periods of dietary stress; this is notable in Levels IV-A and IV-B.

(*Translated, from the French, by Katherine Monigal.*)

23

Rodent (Rodentia) Fauna from Chokurcha I Unit IV

Anastasia K. Markova

The rock shelter Chokurcha I is situated in the basin of the Malyi Salgir River, on the second ridge of the Crimean Mountains, within the city of Simferopol (44'58°N; 34'08°E). The site is located 8 m above the present-day water level. Chokurcha I was discovered by N.Ernst in 1927. He recognized four cultural layers: Layer 1, of Holocene age, and Layers 2 through 4, all of Middle Paleolithic age. Recently (1996–2000), Chokurcha I has been re-excavated by Dr. V.P. Chabai, who collected the small mammal bones from the archeological levels correlated with Layer 4 of Ernst's excavations (Unit IV according to the new nomenclature), which contains Crimean Micoquian.

The significant small mammal materials from the earlier excavations (1930 and 1940) of Layer 4 in Chokurcha I were described by I.Gromov (1961). Eight species of rodents were recovered from Chokurcha I in those years: Bobak marmot (*Marmota* conf. *bobak*), ground squirrel (*Spermophilus* conf. *citeloides*), great jerboa (*Allactaga major*), little earth hare (*Pygeretmus (Alactagulus) pumilio*), yellow steppe lemming (*Eolagurus luteus*), steppe lemming (*Lagurus lagurus*), water vole (*Arvicola terrestris*), and root vole (*Microtus oeconomus*). Yellow steppe lemming and ground squirrel remains were predominant in the collection described by Gromov.

Material

The microfaunal material was recovered during the recent excavations by screening and washing sediments. The preservation of the bones is rather good. There are many mandibles with teeth, including molars and incisors. The remains have a homogeneous pale yellow color. All these characteristics indicate that the bones, which were accumulated in the site as owl pellets, were not redeposited. This taphonomical type of small mammal locality provides information about the environments up to several kilometers around the site, representing the hunting area of owls.

Only rodents have been discovered at Chokurcha I. Seven species of Rodentia were identified in all of the levels (Table 23-1). The number of species identified from Unit IV in earlier excavations included eight species (Gromov 1961). The species found in Ernst's excavations and the more recent Chabai excavations include, as well as the same species, some different ones. In the new collection, there are no remains of *Marmota bobak*, *Allactaga major*, *Pygeretmus (Alactagulus) pumilio*, or *Microtus oeconomus*. On the other hand, in newer collection, we have an additional three species: *Cricetulus migratorius*, *Microtus obscurus*, and *Microtus gregalis*. Thus, eleven species altogether of rodents have been found in Unit IV.

The number of bones identified from the new excavations to special taxonomic level is 306. The dominant species in all of the levels is the ground squirrel, or little suslik, *Spermophilus pygmaeus*. The second most frequent is the "obscurus" vole *Microtus obscurus*. The concentration of the bone material is very uneven across the levels. The remains of small mammals were found in Levels IV-B, IV-F, IV-I, IV-K, IV-L, IV-M, IV-O, IV-Q, IV-S, and IV-U.

Rodent Assemblages and Their Ecological Features

The levels of Chokurcha vary in the number of Rodentia remains they contain (Table 23-1). The upper levels in particular have extremely small assemblages. The most abundant fauna was recovered from Levels IV-O, IV-Q, and IV-U (Table 23-1; Figures 23-1, 23-4, 23-8) and it is their description on which this report is concentrated.

Levels IV-B, IV-F, IV-I, IV-K, IV-L, IV-M

The upper levels of Chokurcha I Unit IV—Levels IV-B, IV-F, IV-I, IV-K, IV-L, and IV-M—contained very little microfauna, and was mostly restricted to *Spermophilus pygmaeus* and *Microtus* sp. (Table 23-1). Little suslik (ground squirrel) is a typical species of open habitats (steppe, semi-desert, forest-steppes) (Gromov and Erbaeva 1995; Flint et al. 1970). *Microtus* is represented in these layers by remains that cannot be identified to species. Thus, it is not possible to assign them any particular ecological parameters.

Level IV-O

The fauna material of Level IV-O included the remains of six species (Figure 23-1). Little suslik, yellow steppe lemming, and steppe lemming indicate the presence of dry open landscapes (dry steppes). The yellow steppe lemming *Eolagurus luteus* was very common in Late Pleistocene periglacial steppe communities and also in Pleistocene interglacial steppe faunas (Figure 23-2: *1*) (Markova 1992). The range of *Eolagurus luteus* has since decreased very significantly and this species no longer inhabits Eastern Europe. The steppe lemming (*Lagurus lagurus*) is a typical inhabitant of steppe landscapes and was widely distributed during Pleistocene glacial epochs (Figure 23-2: *2*). It was a member of periglacial non-analog mammal assemblages, together with tundra species. The remains of *Lagurus lagurus* and its ancestral forms were also found in nearly all Pleistocene interglacial faunas of the steppe zone (Markova 1982, 1992; Markova et al. 1995). Thus, both the steppe

Table 23-1
Small mammal remains from Chokurcha I Unit IV

Species	Ecological group	*IV-B*	*IV-F*	*IV-I*	*IV-K*
Spermophilus pygmaeus Pallas (little suslik)	open landscapes	1 mandible with m1; m3; 2 incisors	1 incisor	1 mandible with teeth; 1 maxilla; 2 molars; 2 incisors	1 incisor
Cricetulus migratorius Pallas (grey hamster)	open landscapes	—	—	—	—
Arvicola ex gr. *terrestris* Linnaeus (water vole)	hydromorphic biotopes	—	—	—	—
Eolagurus luteus Eversmann (yellow steppe lemming)	desert, semi-desert, dry steppes	—	—	—	—
Lagurus lagurus Pallas (steppe lemming)	steppes, forest-steppes	—	—	—	—
Microtus obscurus Eversmann (M. arvalis group) (obscurus vole)	steppes, meadows	—	—	—	—
Microtus (Stenocranius) gregalis Pallas (narrow-skulled vole)	steppes: periglacial and common	—	—	—	—
Microtus sp. (vole)	—	1 incisor	—	1 incisor	—
Total number of species		2	1	2	1

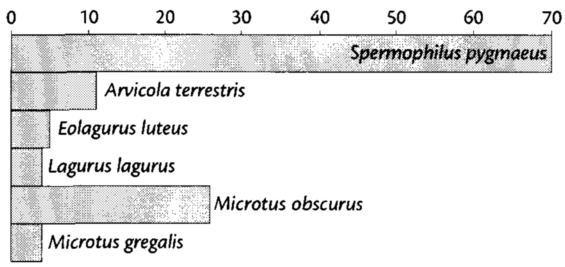


Figure 23-1—Species composition of small mammals in Chokurcha I Level IV-O (number of remains).

lemming and the yellow steppe lemming were rather indifferent to temperature parameters, but indicate, principally, open steppe-like landscapes.

The presence of the narrow-skulled vole (*Microtus gregalis*) in Level IV-O could possibly indicate some cooling. The modern representatives of this species inhabit tundra landscapes, as well as steppes. During the Late Pleistocene, this mammal was very typical among periglacial faunas. For example, it was very abundant in the Paleolithic site of Iudinovo, where it was one of the dominant forms, together with such typical tundra species as pied lemming (*Dicrostonyx gulielmi*) and Siberian lemming (*Lemmus sibiricus*) (Markova 1995). It is important to mention that

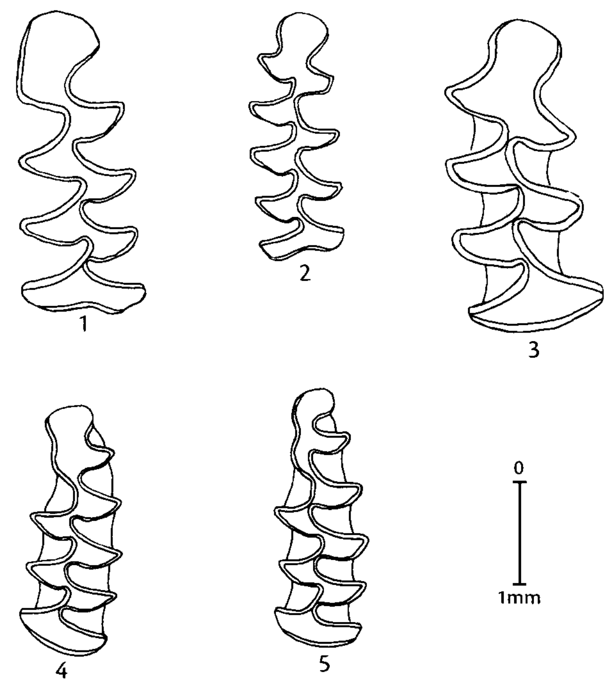


Figure 23-2—Chokurcha I Level IV-O: 1–m1 of *Eolagurus luteus*; 2–m1 of *Lagurus lagurus*; 3–m1 *Arvicola* ex gr. *terrestris*; 4, 5–m1 *Microtus gregalis*.

TABLE 23-1 CONTINUED
Small mammal remains from Chokurcha I Unit IV

IV-L	*IV-M*	*IV-O*	*IV-Q*	*IV-S*	*IV-U*
—	2 incisors	70 remains: mandibles, molars, incisors	—	maxilla with teeth; 2 molars; 10 incisors	1 mandible; 1 molar; 3 incisors
—	—	—	—	—	maxilla with M1–M3; 2 incisors
—	—	1 mandible with m1–m3; 10 incisors	2 m1; 5 incisors	—	2 mandibles; 2 m1; 2 m2; 10 incisors
—	—	2 mandibles with m1–m2; 1 m2;	—	—	—
—	—	2m1	—	—	—
—	—	6 mandibles with teeth; 3 m1; 3 m2; 1 m3; 1 m2; 10 incisors	5 m1	2 m1; 2 m2; 1 M2; 1 M3; 5 mandibles with teeth; 1 maxilla; 20 incisors	5 mandibles with teeth; 15 incisors
—	—	2m1	—	—	—
1 incisor	2 incisors	7 mandibles without teeth; 40 incisors	—	—	—
1	2	6	3	2	4

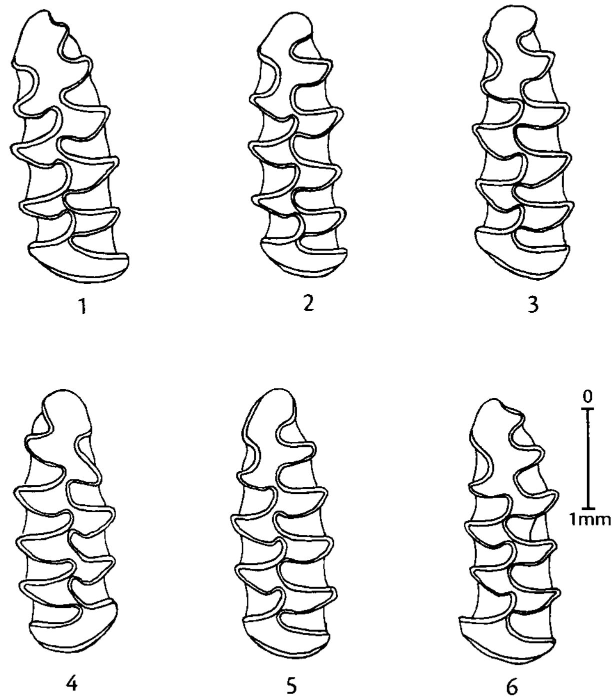


Figure 23-3—Chokurcha I Level IV-O: *1-5*–m1 *Microtus obscurus.*

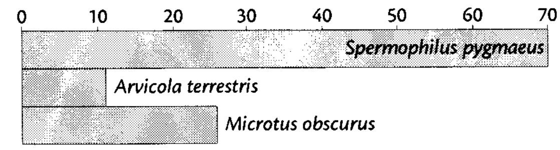


Figure 23-4—Species composition of small mammals in Chokurcha I Level IV-Q (number of remains).

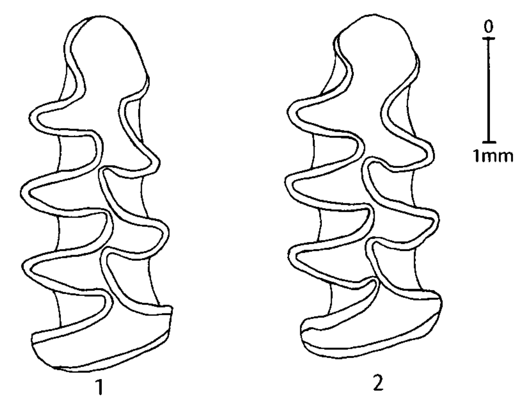


Figure 23-5—Chokurcha I Level IV-Q: *1,2*–m1 *Arvicola* ex gr. *terrestris.*

Microtus gregalis remains have been found among the Kabazi V (Level III/I) fauna (Markova 1999), in Level C of Buran-Kaya III (dated circa 32–36,000 BP), and also in Levels 6-2 and 6-1 of Buran-Kaya III with an Epi-Gravettian industry (Markova, Chapter 3). The remains of this mammal were also identified in archeological Level VI/6 at Kabazi II. All the Crimean *Microtus gregalis* remains from Middle Paleolithic sites have a rather simple tooth structure and small size, similar to the modern narrow-skulled voles that inhabit the steppes (Figure 23-2: *4, 5*). Thus, the remains of *Microtus gregalis* from Crimean sites most probably indicate open steppe environments.

There are neither forest nor cold-tolerant species in Level IV-O. The presence of water vole (*Arvicola* ex gr. *terrestris*) remains indicates a nearby stream (Figure 23-2: 3). All other rodents from Level IV-O indicate the presence of steppe landscape near the site.

Levels IV-Q, IV-S, IV-U

Levels IV-Q, IV-S, and IV-U are similar in their microfaunal composition to Level IV-O, but yellow steppe lemming (*Eolagurus luteus*), steppe lemming (*Lagurus lagurus*), and narrow-skulled vole (*Microtus gregalis*) are absent. Their absence suggests warmer and more humid conditions during the formation of these levels, perhaps in one of the early Valdai interstadials. On the other hand, the small sample sizes may be the cause of their absence; Levels IV-Q, IV-S, and IV-U have less abundant faunal remains than Level IV-O.

Two first lower molars of the water vole *Arvicola* ex gr. *terrestris* were found in Level IV-Q. These teeth are small (length = 3.03 and 3.05 mm; width = 1.82 and 1.80 mm) and have universal enamel. These features show some archaic morphology (Figure 23-5: *1, 2*).

A sizeable number of *Microtus obscurus* remains were also found in Levels IV-Q and IV-S. The first lower molars of this species are characterized by a complicated structure of the anteroconid complex and by their large sizes (length = 2.73, 2.80, 2.85 mm; width = 1.10, 1.20, 1.30 mm) (Figures 23-6: *1–5*; 23-7: *1–2*). The upper second molar of this species does not have the additional loop on the posterior loop, so these remains do not belong to *M. socialis* (Figure 23-7: 3).

The very disparate ratio of little suslik (ground squirrel) *Spermophilus pygmaeus* remains in the microfaunal composition of Level IV-O on the one hand, and Levels IV-Q, IV-S, and IV-U on the other, indicates that climatic conditions during the deposition of these lower levels were more moderate (Table 23-1; Figures 23-9, 23-10).

These are the preliminary reconstructions, which relate more to environments than to the age of the levels.

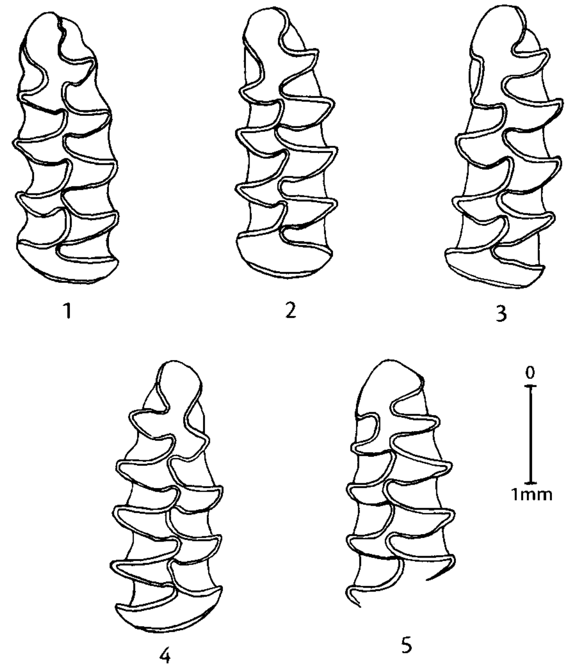


Figure 23-6—Chokurcha I Level IV-Q: 1-5–m1 *Microtus obscurus*.

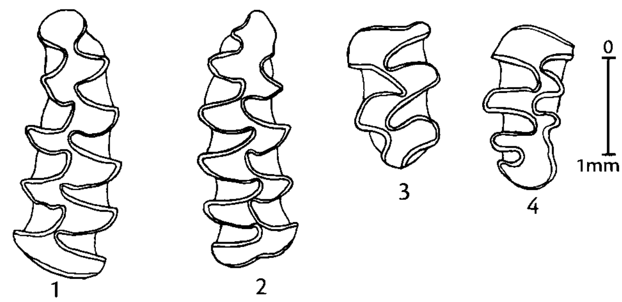


Figure 23-7—Chokurcha I Level IV-S: 1, 2–m1 *Microtus obscurus*; 2–M2 *Microtus* sp.; 3–M3 *Microtus* sp.

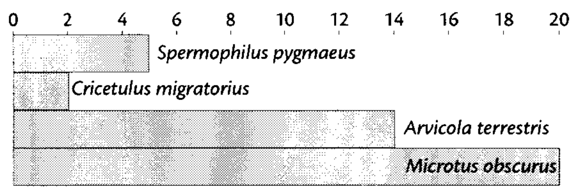


Figure 23-8—Species composition of small mammals in Chokurcha I Level IV-U (number of remains).

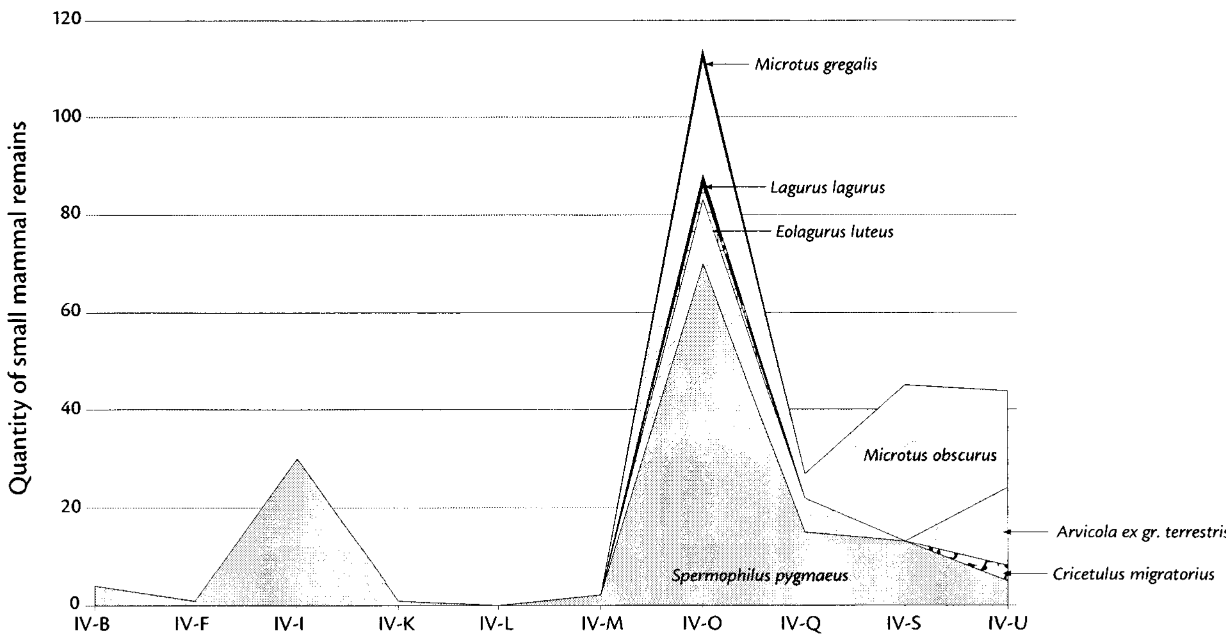


Figure 23-9—Species composition of small mammals from selected levels of Chokurcha I Unit IV.

Conclusions

Rodent fauna from the various levels of Unit IV of Chokurcha I share some general features: (1) none of the levels contains forest-dwelling microfauna; (2) none of the levels contains typical cold-tolerant species; and (3) the species compositions for all levels suggest that there was a steppe-like environment around the site (six species) and a nearby stream (one species).

The disproportionate sample sizes from the Unit IV levels make it difficult to reconstruct the environmental changes that took place during the accumulation of this unit. Rodent remains were restricted to little suslik (ground squirrel) and the vole *Microtus* sp. in Levels IV-B, IV-F, IV-I, IV-K, IV-L, and IV-M. These indicate the presence of steppe environs around the site during the deposition of these levels.

More diverse faunal compositions were found in the older Levels IV-O, IV-Q, IV-S, and IV-U. Most of the species identified from these levels indicate open steppe-like landscapes. There are neither forest species nor cold-tolerant species in any of the Chokurcha I levels. There are only steppe and semi-desert species, which prevail in all of the horizons, as well as a few hydrogenous and meadow steppe species (Figure 23-10). However, the much higher proportion of *Spermophilus pygmaeus* (ground squirrel) remains in Level IV-O as compared to Levels IV-Q, IV-S, and IV-U shows that the climatic conditions of the lowest levels were more moderate (Figures 23-9, 23-10).

A very similar picture of the environments near Chokurcha I is evident from the rodent list published by Prof. Igor Gromov (1961) from the samples obtained during Ernst's excavations. The species composition of the fauna studied previously from Ernst's Layer 4 also includes only steppe and periaquatic species. Thus, all the data indicate steppe landscapes around the site and the proximity of a stream. The absence of cold-tolerant small mammal species could relate to a rather weak ice-sheet influence on the Crimean landscapes during oxygen isotope stage 3 (Markova et al. 1995). It seems that global cooling only resulted in an increase in dry conditions and a decrease of forested areas at these latitudes. Studies of small mammal remains have been carried out within the framework of the multidisciplinary investigations of the Middle Paleolithic of the Crimean Peninsula (e.g., Marks and Chabai, eds. 1998; Chabai and Monigal, eds. 1999). The results of microfaunal analyses from several Crimean Paleolithic-age sites can therefore now be compared. These studies suggest a rather weak manifestation of cooling at these latitudes (Markova 1999, Chapter 3). The rather stable environments in the Crimean Mountains during oxygen isotope stage 3 provided favorable conditions for Paleolithic inhabitants of this region.

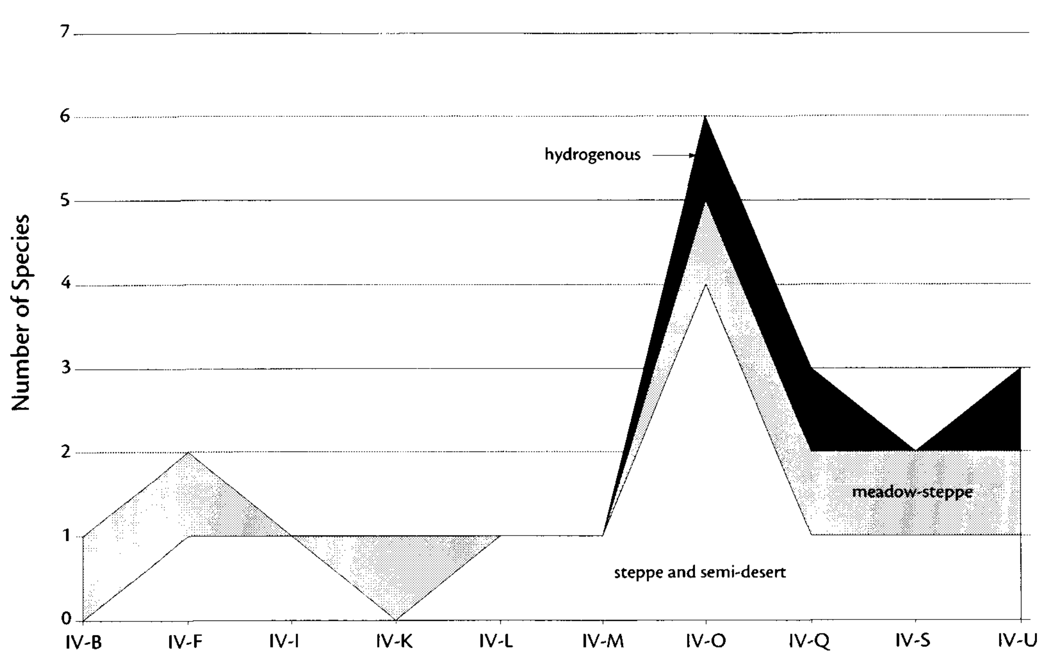


Figure 23-10—Ecological groups of small mammals from selected levels of Chokurcha I Unit IV.

24

Chokurcha I Unit IV: Artifacts

Victor P. Chabai

This chapter describes the artifacts recovered from twenty levels of Unit IV during the 1996 and 2000 field seasons. These descriptions follow the variant of Gladilin's (1976) classification adopted for our other Crimean Middle Paleolithic studies (Chabai and Demidenko 1998). All twenty artifact assemblages exhibit pronounced typological and technological features of the Crimean Micoquian. Yet, there are some differences among their typological structures that might have resulted from either statistical variations within the Crimean Micoquian or dissimilar processes of flint reduction.

Structure of the Artifact Assemblage

A total of 9,089 artifacts were found in Unit IV. The artifacts have been subdivided into three main groups: artifacts made on flint, pebble artifacts, and bone artifacts (Table 24-1). The most numerous and variable are the flint artifacts. They include 9,008 items which are subdivided into seven categories, the dominant category being chips (< 3 cm), followed by tools, flakes, chunks, blades, cores, and preforms (Table 24-1). In the essential count, excluding chunks and chips, tools are most numerous, accounting for more than half of all artifacts (Table 24-1). This predominance of tools is characteristic of all levels. Flakes are not quite as frequent, while blades, cores, and preforms are even less common.

A total of 38 pebble artifacts were recovered from Unit IV. They are subdivided into four categories: pebble retouchers (most numerous), hammerstones, choppers, and chopping tools (Table 24-1).

The bone artifacts consist only of retouchers on bones (Table 24-1). Combined, bone and pebble instruments for flintknapping account for 9.5% of the essential artifact count.

The main features of the Unit IV artifact structure are a dominance of tools among the flint artifacts, a proportionately large number of instruments for flaking, and a paucity of cores and preforms. While the high percentage of tools and the low percentage of cores is not a rare event in the Crimean Middle Paleolithic, the number of flaking instruments is striking. In fact, the ratio of retouchers to flint tools (l : 5) is unexpectedly high in comparison to other sites' assemblages.

Chunks

Chunks were found in nine of twenty levels (Table 24-1). These are small pieces of flint, with maximum dimensions no more than 3.5 cm, without pronounced traces of flaking. Thus, there are no chunks in Unit IV that might be interpreted as a raw material supply. It is most likely that all chunks present in the assemblages were produced during the process of raw material reduction.

Preforms

The only preform in Unit IV was found in Level IV-O. Most likely, it is the preform of a backed bifacial scraper (Figure 24-1). The back was shaped before the edges were retouched. Alternatively, it could be a backed bifacial scraper in a stage of edge reshaping. Whichever the case, this piece does not exhibit continuous edge retouch and therefore could not be classified as a tool.

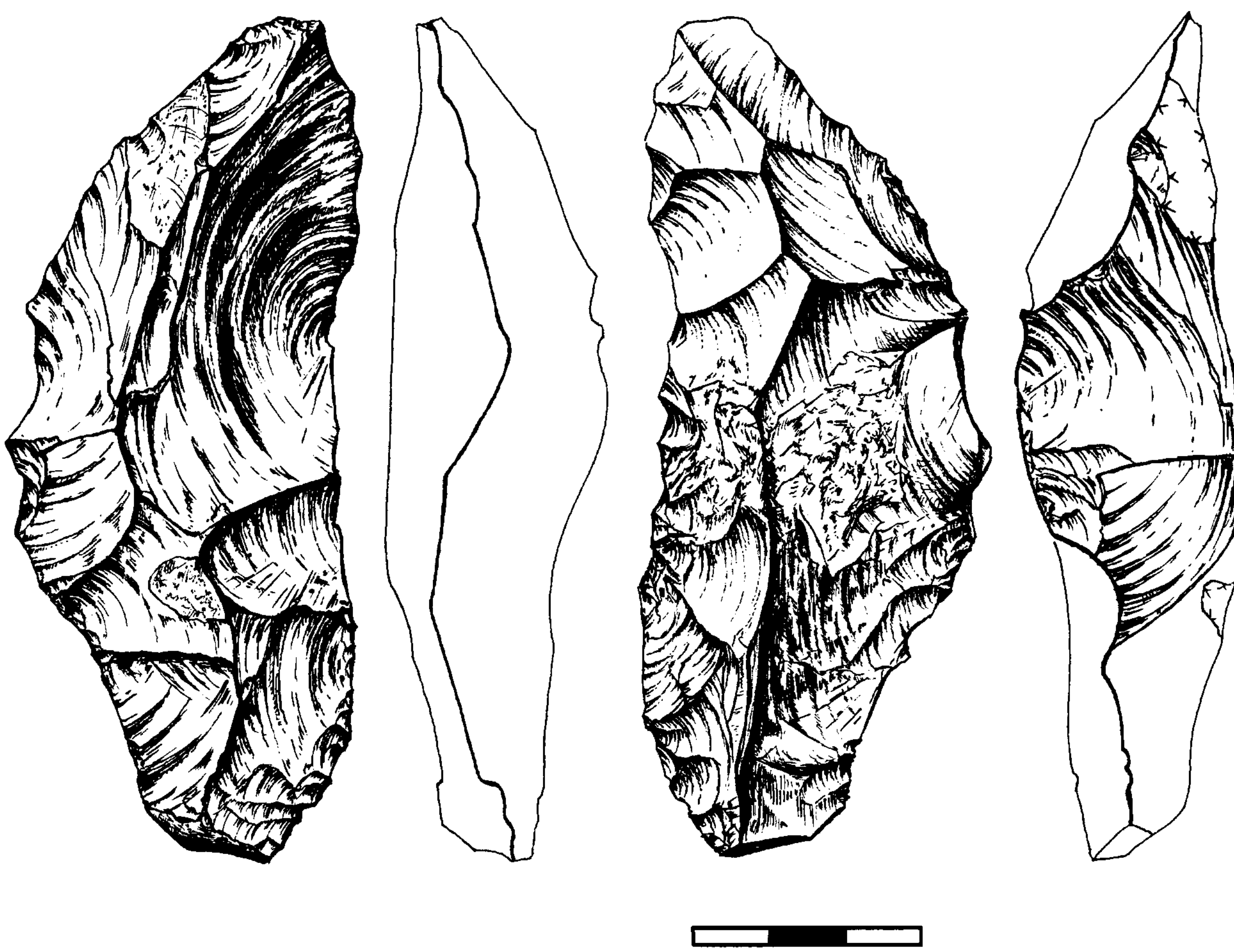


Figure 24-1—Chokurcha I Level IV-O: preform of bifacial tool.

Cores

Cores were found in only three of the twenty levels (Table 24-1). Five of the 7 cores come from Level IV-O. Typologically, these 5 cores are radial (Levels IV-F and IV-O), 1 is unidirectional transverse (Level IV-I2), and 1 is unidentifiable (IV-O). Typological definitions are futile, however, as all of the cores found in Unit IV are exhausted. The biggest radial core (Figure 24-2: *3*) is only 4.7 cm in length, 4.3 cm in width, and 2.2 cm in thickness. No other core is more than 3.5 cm in greatest dimension. In fact, the early reduction stages of these cores are not clear. Pieces classified as cores in the Unit IV assemblages might, in fact, be reduced fragments of both bifacial and unifacial tools.

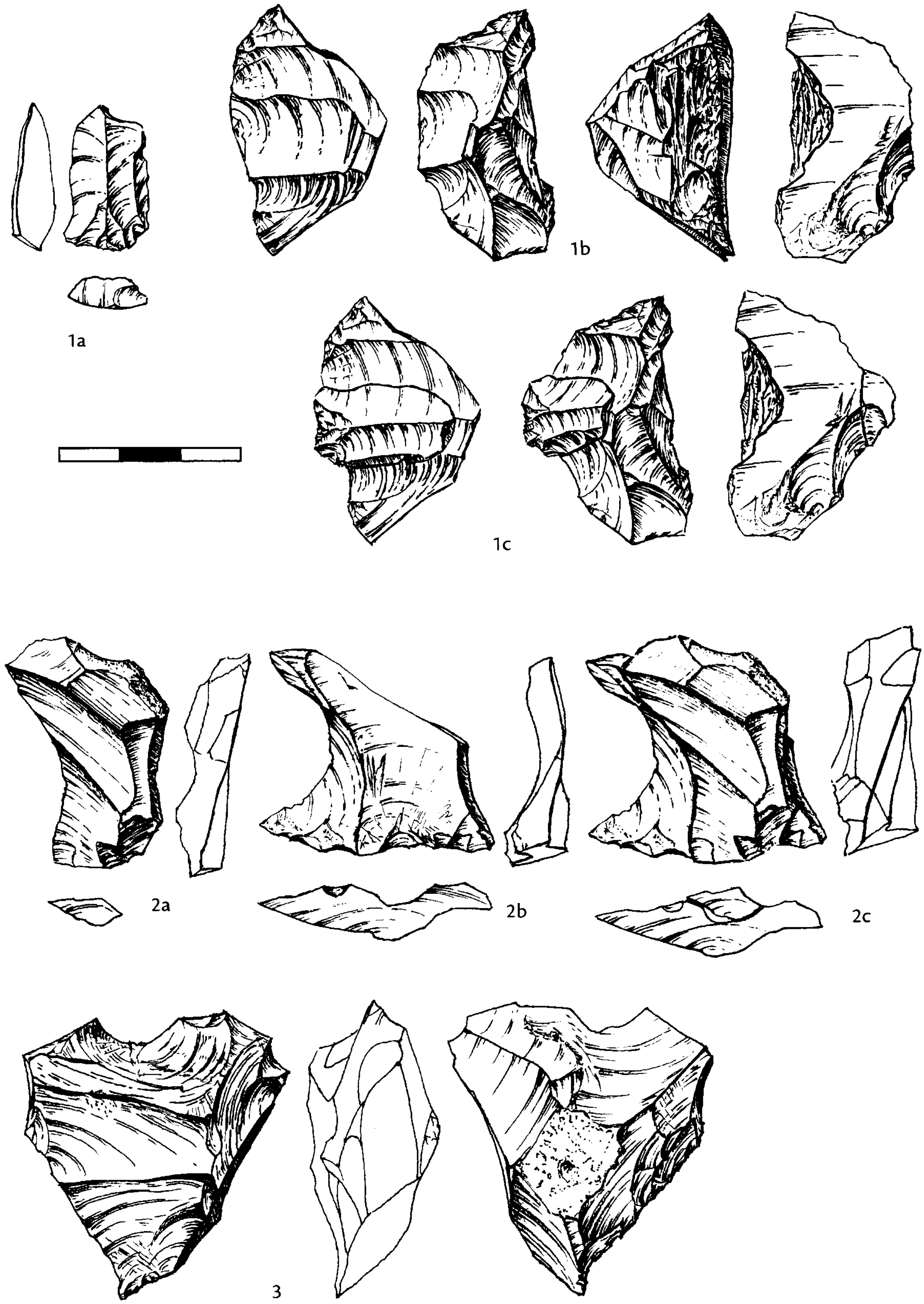


Figure 24-2—Chokurcha I Level IV-O: *1a, 1b, 1c*–conjoined chip and core-like scraper; *2a, 2b, 2c*–conjoined flakes from core-like scraper; 3–radial core.

TABLE 24-1
Chokurcha I Unit IV: artifact totals

Flint Artifacts	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2
Chunks	·	2	1	·	6	·	7	3	·	1	·
Preforms	·	·	·	·	·	·	·	·	·	·	·
Cores	·	·	·	·	1	·	·	1	·	·	·
Chips	62	69	393	42	822	243	1,964	226	80	80	154
Flakes	8	8	22	5	20	15	65	10	·	2	3
Blades	·	·	2	·	1	·	7	2	·	·	2
Tools	6	2	20	5	42	6	79	17	7	4	6
Total	76	81	438	52	892	264	2,122	259	87	87	165
Pebble & Bone Artifacts	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2
Retouchers on pebbles	1	1	1	·	5	·	9	2	·	·	·
Hammerstones	·	·	·	·	·	·	·	·	·	1	1
Hammerstones, retouchers	·	·	·	·	·	·	·	·	1	·	·
Choppers	·	·	·	·	·	·	1	·	·	·	·
Choppings	·	·	·	·	·	·	·	·	·	·	·
Retouchers on bones	2	·	3	·	11	·	12	3	1	·	·
Total	3	1	4	·	16	·	22	5	2	1	1

There may also be some primary flaking evident on the Chokurcha core-like scrapers (Figure 24-2: 1a-1c) found in Levels IV-M (1) and IV-O (3). These scrapers are made on thick flakes with dorsal retouch. The ventral surface of these core-like scrapers served as the striking platform, not only for obverse retouch, but also for short flakes. Some of the flakes removed from these core-like scrapers possess the thick, plain platforms that were previously part of the ventral surface of the core-like scrapers (Figure 24-2: 2a–2c). To some extent, the core-like scrapers could be interpreted as pyramidal cores made on flakes.

Blank Variability

The majority of blanks are chips, follows by bifacial thinning chips (Figure 24-3: *1, 4, 7, 9, 12*), flakes, bifacial thinning flakes (Figure 24-3: *5, 11*), blades, and bifacial thinning blades (Figure 24-*3: 6*) (Table 24-2). Among the blanks with identifiable butts, bifacial thinning blanks account for more than 20%. One-third of these blanks are flakes, while the other two-thirds are blade-proportioned (Figure 24-4).

Chips

Chips have been subdivided into four major groups: "regular," bifacial thinning chips, rejuvenation chips, and chips with broken butts (Table 24-3). Broken, "regular," and bifacial thinning chips were found in each of the twenty levels of Unit IV. The bifacial thinning chips exhibit obtuse, faceted or plain platforms, lipped butts, and, in most cases, numerous proximal dorsal scars. Rejuvenation chips (Figure 24-3: *3, 10*) were recovered from six levels. Rejuvenation chips are subdivided into two types: reshaping chips of bifacial tool tips (21) and Prondnik para-burin spalls (3). The Prondnik para-burin spalls were found in Levels IV-M (2) and IV-O (1). Overall, rejuvenation chips comprise 3.1% of the total number of bifacial thinning and rejuvenation chips.

Flakes and Blades

The blade index is 7.79. This low number, however, does not accurately reflect the status of blades in the Unit IV assemblages. The majority of complete blades were the result of bifacial tool reduction (Figures 24-3: *6*; 24-4). Thus, taking into account the absence of blade cores, there is no reason to suggest the presence of any purposeful blade technology in the Unit IV assemblages.

Bifacial thinning and rejuvenation flakes are prominent elements within the flake assemblage (Figures 24-3: *2, 5, 8, 11*; 24-4). These pieces were found in fourteen of the twenty Unit IV levels. About one-third of the bifacial thinning and rejuvenation flakes came from Level IV-I (Table 24-2). Rejuvenation flakes are relatively rare—comprising only 5 (7.2%) of the total

Table 24-1 continued
Chokurcha I Unit IV: artifact totals

IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	Total	%	*ess %*
12	2	17	·	·	·	·	·	·	51	0.6	
·	·	1	·	·	·	·	·	·	1	0.0	0.1
·	·	5	·	·	·	·	·	·	7	0.1	1.0
1,818	83	1,845	13	109	93	5	121	35	8,257	91.7	
35	3	69	1	4	2	1	5	6	284	3.2	40.6
5	·	2	·	3	·	·	·	·	24	0.3	3.4
72	7	91	1	7	8	2	2	·	384	4.3	54.9
1,942	95	2,030	15	123	103	8	128	41	9,008	100.0	100.0

IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	Total
6	·	6	·	·	·	·	·	·	32
·	·	2	·	·	·	·	·	·	4
·	·	·	·	·	·	·	·	·	
·	·	·	·	·	·	·	·	·	1
1	·	·	·	·	·	·	·	·	1
10	·	·	·	·	1	·	·	·	43
17	·	8	·	·	1	·	·	·	81

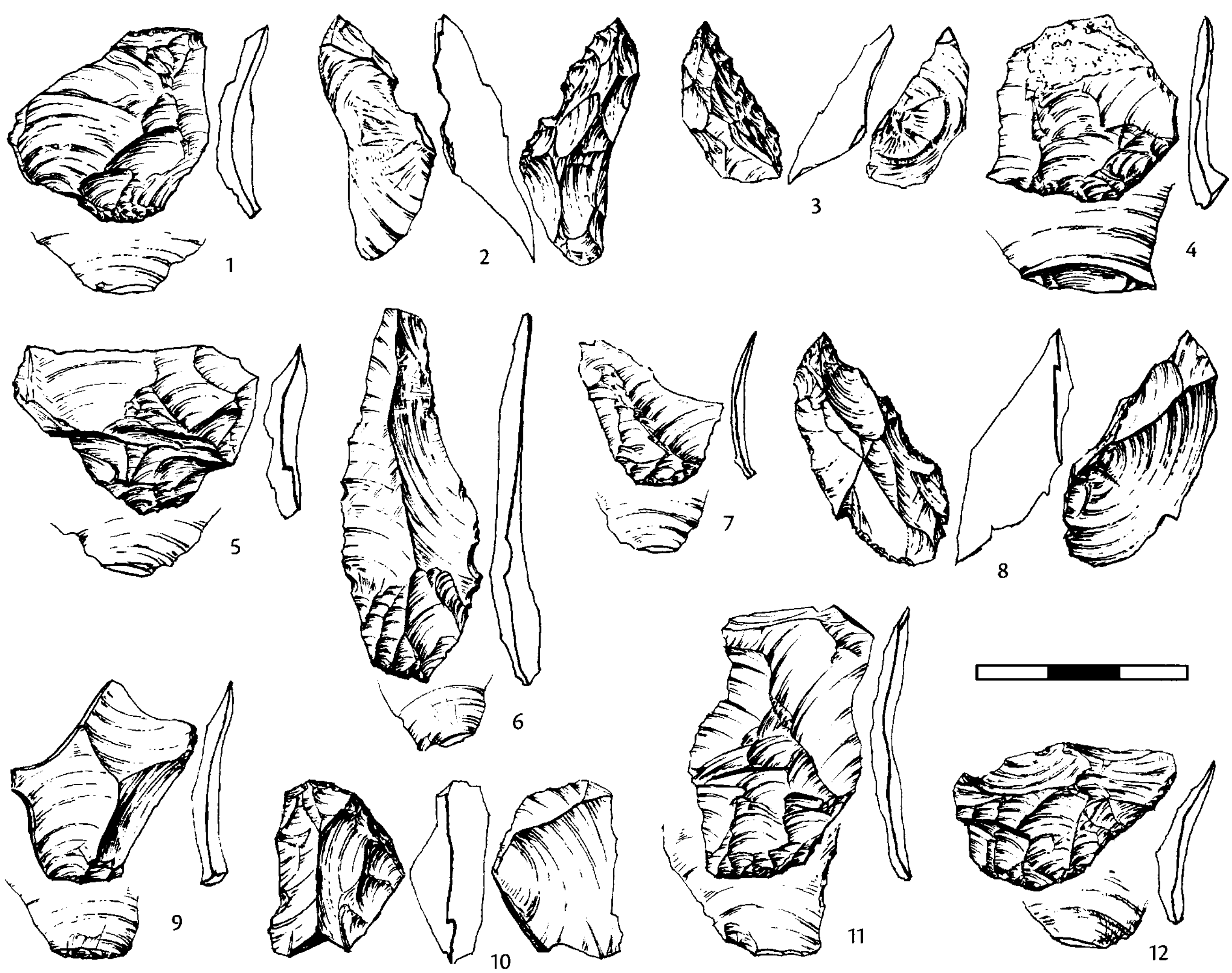


Figure 24-3—Chokurcha I Levels IV-A2 (7, 9), IV-B (11), IV-I (1, 4, 5, 6, 10, 12), IV-M (2, 3, 8) bifacial thinning and rejuvenation blanks: *1, 4, 7, 9, 12*–bifacial thinning chips; *5, 11*–bifacial thinning flakes; *6*–bifacial thinning blade; *3, 10*–rejuvenation chips; *2, 8*–rejuvenation flakes.

Table 24-2
Chokurcha I Unit IV: blank variability as numbers and percentages of each type†

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2
Chip‡	59	57	359	41	782	224	1,781	195	58	75	151
Bifacial thinning & rejuvenation chip	3	12	34	1	47	20	190	34	23	5	5
Flake‡	10	10	27	6	37	16	79	11	1	4	5
Bifacial thinning & rejuvenation flake	·	·	6	·	6	3	24	5	2	2	
Blade‡	·	·	5	·	4	·	6	3	1	·	3
Bifacial thinning blade	·	·	·	·	1	·	4	1	·	·	
Total	72	79	431	48	877	263	2,084	249	85	86	164

LEVEL	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	%
Chip‡	1,647	70	1,722	7	91	72	2	102	30	7,525	85.2
Bifacial thinning & rejuvenation chip	183	13	135	6	18	22	3	19	5	778	8.8
Flake‡	61	9	111	2	10	4	3	5	5	416	4.7
Bifacial thinning & rejuvenation flake	5	1	8	·	1	4	·	1	1	69	0.8
Blade‡	6	·	3	·	3	·	·	·	·	34	0.4
Bifacial thinning blade	1	·	·	·	·	·	·	·	·	7	0.1
Total	1,903	93	1,979	15	123	102	8	127	41	8,829	100.0

†including tools; ‡including pieces with broken butts.

Table 24-3
Chokurcha I Unit IV: grouped maximum dimensions for different kinds of chips

	LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2
"Regular"	0.1–1.9 cm	25	20	135	8	183	77	424	49	18	20	32
	2.0–2.9 cm	8	6	31	6	58	16	96	12	3	4	7
"Bifacial"	0.1–1.9 cm	3	10	24	·	26	17	144	23	14	1	2
	2.0–2.9 cm	·	2	9	1	18	3	38	10	9	3	3
"Rejuvenation"	0.1–1.9 cm	·	·	·	·	1	·	4	·	·	1	·
	2.0–2.9 cm	·	·	1	·	1	·	4	·	·	·	·
Broken		26	31	193	27	535	130	1,254	132	36	51	110
Total		62	69	393	42	822	243	1,964	226	80	80	154

	LEVEL	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess%*
"Regular"	0.1–1.9 cm	561	25	735	1	27	28	1	31	7	2,407	64.7
	2.0–2.9 cm	133	9	127	·	3	10	1	3	4	537	14.4
"Bifacial"	0.1–1.9 cm	147	12	104	4	16	18	1	15	3	584	15.7
	2.0–2.9 cm	29	1	25	2	2	4	2	4	2	167	4.5
"Rejuvenation"	0.1–1.9 cm	3	·	4	·	·	·	·	·	·	13	0.4
	2.0–2.9 cm	4	·	1	·	·	·	·	·	·	11	0.3
Broken		941	36	849	6	61	33	·	68	19	4,538	·
Total		1,818	83	1,845	13	109	93	5	121	35	8,257	100.0

Table 24-4
Chokurcha I Unit IV: average size of debitage (mm)

	$\bar{X}$ *Length*	$\bar{X}$ *Width*	$\bar{X}$ *Thickness*
Flake	3.0	2.9	0.7
Bifacial thinning flake	2.8	3.2	0.5
Blade	3.8	1.7	0.5
Bifacial thinning blade	4.2	1.6	0.4
All blanks	3.0	2.8	0.6

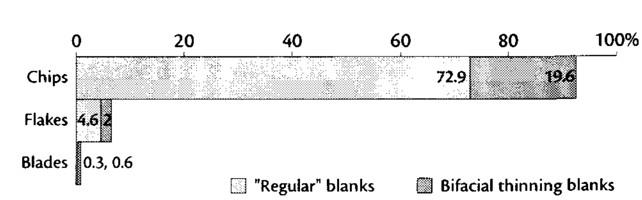


Figure 24-4—Chokurcha I Unit IV: blank variability.

number of bifacial thinning and rejuvenation flakes. All of them are reshaping flakes of bifacial tool tips.

Dimensions

The different categories of blanks have about the same length/width pattern (Figure 24-5). Most blanks are neither longer nor wider than 3.9 cm; only 3% of blanks are longer than 4.9 cm. There are only 5 blanks that are either longer or wider than 5.9 cm (Figure 24-5). The means of blank dimensions show that regular flakes are a little longer and a little thicker than bifacial thinning flakes, while bifacial thinning flakes are a little wider than regular flakes (Table 24-4). "Regular" blades are wider and thicker than bifacial thinning blades, while the latter are a little longer than "regular" blades. In sum, the average dimensions of all blanks are quite small (Table 24-4).

Surface Cortex

Flakes have more dorsal cortex than other blank types (Table 24-5). Flakes without dorsal cortex comprise less than one-half of all flakes, while for both bifacial thinning flakes and blades those without traces of dorsal cortex dominate. Heavily corticated (more

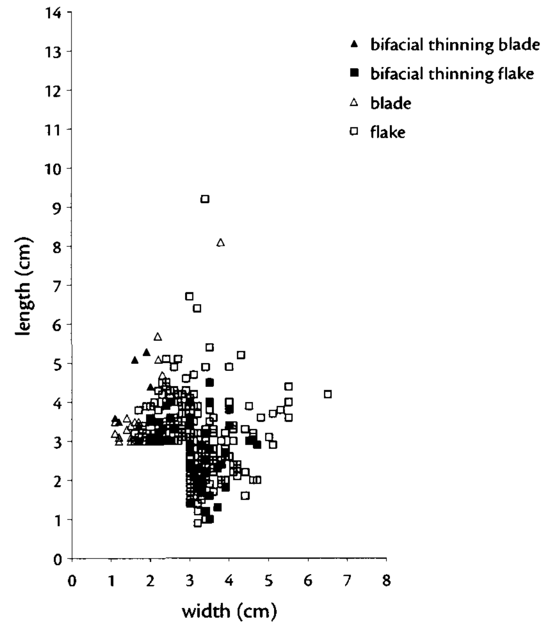


Figure 24-5—Chokurcha I Unit IV: length/width scatterplot for different kinds of flakes and blades, including tools on different kinds of flakes and blades.

TABLE 24-5
Chokurcha I Unit IV: flake and blade percentage of dorsal cortical coverage

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	%
Flakes & tools on flake																						
0%	6	6	14	5	24	5	25	5	1	2	2	23	4	44	1	4	2	1	1	·	175	42.1
<25 %	2	3	7	1	6	4	23	3	·	2	1	20	3	41	1	2	1	1	1	1	123	29.6
25–50 %	·	·	2	·	2	3	11	1	·	·	1	11	1	16	·	1	·	·	1	1	51	12.3
50–75 %	·	·	1	·	3	·	5	·	·	·	·	1	1	3	·	1	·	1	2	2	20	4.8
>75 %	1	1	·	·	·	·	1	1	·	·	·	3	·	1	·	2	·	·	·	·	10	2.4
100%	1	·	3	·	2	4	14	1	·	·	1	3	·	6	·	·	1	·	·	1	37	8.9
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
0%	·	·	5	·	6	3	17	4	1	2	·	2	1	6	·	1	2	·	1	1	52	75.4
<25 %	·	·	1	·	·	·	6	1	1	·	·	2	·	1	·	·	1	·	·	·	13	18.8
25–50 %	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	1	·	·	·	2	2.9
50–75 %	·	·	·	·	·	·	·	·	·	·	·	1	·	1	·	·	·	·	·	·	2	2.9
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
0%	·	·	4	·	2	·	3	2	1	·	2	5	·	2	·	2	·	·	·	·	23	
<25 %	·	·	·	·	1	·	2	1	·	·	1	·	·	1	·	·	·	·	·	·	6	
25–50 %	·	·	1	·	·	·	1	·	·	·	·	1	·	·	·	·	·	·	·	·	3	
50–75 %	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	1	
100%	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
0%	·	·	·	·	·	·	4	·	·	·	·	·	·	·	·	·	·	·	·	·	4	
<25 %	·	·	·	·	1	·	·	1	·	·	·	1	·	·	·	·	·	·	·	·	3	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

than 50% of surface cortex) bifacial thinning pieces and blades are very rare or absent in most assemblages, while about 15% of regular flakes have extensively corticated dorsal surfaces. Primary flakes comprise 8.9% of regular flakes. Primary elements are represented by a single blade (Table 24-5). There is no direct relationship between the blank size and surface cortex amount. The "small" blanks are covered by cortex to the same extent as the "large" blanks. This is characteristic for flint plaquette reduction, because the amount of cortex in relation to flint volume is always greater on plaquettes than on nodules. There were no differences in surface cortex patterning between the levels.

Dorsal Scar Patterns

Blanks with unidirectional and unidirectional-crossed scar patterns occurred on more than half of all flake and blade assemblages (Table 24-6). These two types of dorsal scar patterns were found in all levels of Unit IV. Bifacial treatment blanks display less variety in their dorsal scar patterns than do regular blanks. Dorsal scar patterns of cortex, lateral, bilateral, radial, and crested do not appear on bifacial thinning and rejuvenation blanks. On the other hand, unidirectional and unidirectional-crossed types are equally characteristic for both "regular" and bifacial thinning blanks.

TABLE 24-6
Chokurcha I Unit IV: flake and blade dorsal scar patterns

LEVEL	IV-A	IV-A$_2$	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I$_2$	IV-K	IV-L	IV-L$_2$	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Cortex	2	·	2	·	3	4	15	2	·	·	1	3	·	7	·	·	1	·	·	1	41	11.5
Lateral	·	·	1	1	4	1	2	·	·	2	·	6	1	7	·	·	·	1	·	2	28	7.9
Bilateral	·	·	·	·	·	·	3	·	·	·	·	·	·	2	·	·	1	·	·	·	6	1.7
Radial	·	·	3	·	·	·	4	1	·	·	·	·	·	3	·	·	·	·	·	·	11	3.1
Converging	·	·	1	·	1	·	3	·	·	·	·	4	·	1	·	·	·	·	·	1	11	3.1
Unidirectional	3	2	7	2	10	4	25	3	1	1	1	18	2	28	2	3	1	2	3	·	118	33.1
Unidirect.-crossed	1	1	4	·	7	5	6	2	·	·	3	10	2	31	·	3	·	·	1	1	77	21.6
Bidirectional	·	1	1	·	·	1	6	·	·	·	·	5	·	7	·	·	1	·	1	·	23	6.4
Bidirect.-crossed	3	5	4	·	3	·	8	·	·	1	·	5	1	6	·	·	·	·	·	·	36	10.1
Crested	·	·	·	·	·	·	3	1	·	·	·	1	·	1	·	·	·	·	·	·	6	1.7
Unidentifiable	1	1	4	3	9	1	4	2	·	·	·	9	3	18	·	4	·	·	·	·	59	·
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Converging	·	·	1	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	2	3.3
Unidirectional	·	·	1	·	1	3	15	1	1	2	·	2	·	2	·	1	2	·	1	·	32	52.5
Unidirect.-crossed	·	·	2	·	1	·	3	1	·	·	·	1	1	3	·	·	·	·	·	·	12	19.7
Bidirectional	·	·	1	·	·	·	5	·	1	·	·	·	·	2	·	·	1	·	·	·	10	16.4
Bidirect.-crossed	·	·	1	·	1	·	·	1	·	·	·	·	·	·	·	·	1	·	·	1	5	8.2
Unidentifiable	·	·	·	·	3	·	·	2	·	·	·	2	·	1	·	·	·	·	·	·	8	·
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Cortex	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Lateral	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	1	
Bilateral	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Radial	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	1	
Unidirectional	·	·	1	·	·	·	1	·	·	·	1	2	·	1	·	3	·	·	·	·	9	
Unidirect.-crossed	·	·	1	·	·	·	1	2	·	·	·	4	·	1	·	·	·	·	·	·	9	
Bidirectional	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Bidirect.-crossed	·	·	1	·	2	·	·	1	·	·	·	·	·	1	·	·	·	·	·	·	5	
Crested	·	·	1	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	2	
Unidentifiable	·	·	·	·	1	·	3	·	·	·	·	·	·	·	·	·	·	·	·	·	4	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Unidirect.-crossed	·	·	·	·	·	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	6	
Unidentifiable	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	1	4	·	1	·	·	·	1	·	·	·	·	·	·	·	·	·	7	

Table 24-7
Chokurcha I Unit IV: flake and blade axes

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
On-axis	7	6	11	1	22	5	33	7	1	2	2	22	3	41	1	5	1	·	3	2	175	52.9
Off-axis	1	4	10	·	6	9	31	3	·	2	3	28	3	48	·	2	3	2	1	·	156	47.1
Unident.	2	·	6	5	9	2	15	1	·	·	·	11	3	22	1	3	·	1	1	3	85	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flakes																						
On-axis	·	·	3	·	1	·	9	1	2	2	·	1	1	6	·	1	·	·	1	·	28	43.8
Off-axis	·	·	3	·	4	3	15	3	·	·	·	2	·	1	·	·	4	·	·	1	36	56.3
Unident.	·	·	·	·	1	·	·	1	·	·	·	2	·	1	·	·	·	·	·	·	5	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
On-axis	·	·	4	·	3	·	4	2	1	·	·	1	·	2	·	2	·	·	·	·	19	
Off-axis	·	·	1	·	1	·	2	1	·	·	3	5	·	1	·	1	·	·	·	·	15	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
On-axis	·	·	·	·	·	·	1	1	·	·	·	·	·	·	·	·	·	·	·	·	2	
Off-axis	·	·	·	·	1	·	3	·	·	·	·	1	·	·	·	·	·	·	·	·	5	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

Axis

The proportion of on- and off-axis blanks for "regular" and bifacial thinning blanks is different, but not dramatically. On-axis pieces predominate among the "regular" flakes and blades, while the majority of bifacial thinning flakes and blades are off-axis (Table 24-7).

Shapes

Trapezoidal pieces account for ca. 33% to 40% of both "regular" and bifacial thinning flakes (Table 24-8). The second most common shape is irregular, comprising about a quarter of both "regular" and bifacial thinning pieces. Rectangular and expanding shapes follow, while all other shapes are infrequent. Among the blades, rectangular and triangular shapes comprise about half of the assemblage. In other words, there is no difference in shape between "regular" and bifacial thinning blanks, while the flake and blade assemblages are quite different. This disparity, to a large extent, is caused by blade and flake definitions. Blades, the longer pieces, tend to be rectangular or triangular, rather than trapezoidal.

Lateral Profiles

Flat lateral profiles account for about a quarter of "regular" flakes and only about 10% of bifacial thinning flakes (Table 24-9). On the other hand, incurvate medial, incurvate distal, and twisted profiles are common among both bifacial thinning blanks and "regular" blades; hence, the lateral profiles of "regular" blades are closest to the lateral profiles of bifacial thinning pieces. In sum, incurvate and twisted lateral profiles are dominant for both "regular" and bifacial thinning blanks, though this is reflected in different proportions. Incurvate and twisted lateral profiles comprise 56.1% of "regular" blanks, while these profiles account for 86.1% of bifacial thinning blanks.

Distal Profiles

Feathering distal profiles are most common among bifacial thinning blanks (Table 24-10), while hinged and blunt terminations are more common among "regular" blanks.

TABLE 24-8
Chokurcha I Unit IV: flake and blade shapes

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Rectangular	·	·	1	·	3	2	8	2	·	1	·	4	·	7	1	1	·	·	·	1	31	11.7
Triangular	·	·	·	·	·	·	2	2	·	·	·	7	·	9	·	1	·	·	·	·	21	7.9
Trapezoidal	1	1	7	·	4	3	19	2	1	·	2	19	4	23	·	3	·	1	·	·	90	33.8
Trap. elongated	1	1	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	3	1.1
Ovoid	·	·	1	·	1	·	3	·	·	·	·	1	·	4	·	·	·	·	·	·	10	3.8
Leaf shaped	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	0.4
Crescent	·	·	2	·	1	·	2	·	·	·	·	1	·	6	·	·	1	·	1	·	14	5.3
Expanding	3	4	2	·	·	·	3	3	·	1	·	1	·	6	·	·	1	·	1	·	25	9.4
Irregular	1	4	1	·	8	5	10	2	·	2	1	8	·	23	·	1	2	·	2	1	71	26.7
Unidentifiable	4	·	12	6	20	6	31	·	·	·	2	20	5	33	1	4	·	2	1	3	150	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Rectangular	·	·	3	·	1	1	3	·	1	1	·	·	·	2	·	·	·	·	·	·	12	20.0
Triangular	·	·	·	·	·	·	1	1	·	·	·	·	·	·	·	·	·	·	·	·	2	3.3
Trapezoidal	·	·	1	·	·	2	13	·	1	·	·	2	·	3	·	1	·	·	·	1	24	40.0
Crescent	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	1	1.7
Expanding	·	·	1	·	3	·	·	·	·	·	·	·	·	·	·	·	1	·	1	·	6	10.0
Irregular	·	·	1	·	1	·	6	3	·	·	·	·	·	2	·	·	2	·	·	·	15	25.0
Unidentifiable	·	·	·	·	1	·	1	1	·	1	·	3	1	1	·	·	·	·	·	·	9	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Rectangular	·	·	·	·	1	·	1	1	·	·	1	4	·	1	·	2	·	·	·	·	11	
Triangular	·	·	2	·	2	·	1	1	·	·	·	1	·	·	·	·	·	·	·	·	7	
Trap. elongated	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	1	
Ovoid	·	·	1	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	2	
Expanding	·	·	1	·	·	·	1	1	·	·	·	·	·	·	·	1	·	·	·	·	4	
Irregular	·	·	·	·	1	·	1	·	·	·	·	1	·	1	·	·	·	·	·	·	4	
Unidentifiable	·	·	1	·	·	·	1	·	1	·	2	·	·	·	·	·	·	·	·	·	5	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Rectangular	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Triangular	·	·	·	·	·	·	1	·	·	·	·	1	·	·	·	·	·	·	·	·	2	
Crescent	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Expanding	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	
Irregular	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Unidentifiable	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

TABLE 24-9
Chokurcha I Unit IV: flake and blade lateral profiles

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Flat	3	1	10	2	12	5	19	2	1	1	2	13	2	20	1	2	·	·	·	1	97	26.4
Incurvate medial	2	2	4	·	5	2	18	1	·	·	·	9	·	15	·	3	·	2	·	2	65	17.7
Incurvate distal	·	·	2	·	1	2	11	3	·	1	1	11	1	15	·	1	3	·	2	·	54	14.7
Twisted	3	7	5	1	9	5	15	2	·	·	·	5	·	22	·	·	1	·	1	1	77	20.9
Convex	1	·	1	·	3	1	8	2	·	2	2	14	5	31	·	1	·	1	2	1	75	20.4
Unidentifiable	1	·	5	3	7	1	8	1	·	·	·	9	1	8	1	3	·	·	·	·	48	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Flat	·	·	1	·	·	1	2	·	·	1	·	·	·	1	·	·	·	·	1		7	10.8
Incurvate medial	·	·	4	·	3	1	6	·	·	1	·	·	1	2	·	1	·	·	·	1	20	30.8
Incurvate distal	·	·	·	·	·	·	8	2	1	·	·	1	·	1	·	·	·	·	·	·	13	20.0
Twisted	·	·	1	·	3	1	7	1	1	·	·	1	·	3	·	·	4	·	·	·	22	33.9
Convex	·	·	·	·	·	·	1	·	·	·	·	1	·	1	·	·	·	·	·	·	3	4.6
Unidentifiable	·	·	·	·	·	·	·	2	·	·	·	2	·	·	·	·	·	·	·	·	4	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Flat	·	·	1	·	·	·	1	·	·	·	1	·	·	·	·	·	·	·	·	·	3	
Incurvate medial	·	·	1	·	·	·	1	1	1	·	·	1	·	1	·	·	·	·	·	·	6	
Incurvate distal	·	·	·	·	·	·	·	1	·	·	·	2	·	1	·	·	·	·	·	·	4	
Twisted	·	·	3	·	4	·	2	1	·	·	2	3	·	1	·	3	·	·	·	·	19	
Convex	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Unidentifiable	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Flat	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Twisted	·	·	·	·	1	·	3	1	·	·	·	1	·	·	·	·	·	·	·	·	6	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

TABLE 24-10
Chokurcha I Unit IV: flake and blade distal profiles

LEVEL	IV-A	IV-A$_2$	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I$_2$	IV-K	IV-L	IV-L$_2$	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess%*
Flakes & tools on flake																						
Feathering	3	7	11	1	9	6	20	4	·	1	·	11	·	25	·	2	1	2	·	2	105	39.3
Hinged	3	1	3	·	8	2	11	2	1	1	2	19	4	40	·	2	2	·	4	1	106	39.7
Overpassed	·	·	·	·	·	·	·	·	·	·	·	·	·	5	·	·	·	·	·	·	5	1.9
Blunt	1	1	3	·	2	3	15	2	·	·	1	2	2	16	1	1	·	·	1	·	51	19.1
Missing	3	1	10	5	18	5	33	3	·	2	2	29	3	25	1	5	1	1	·	2	149	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Feathering	·	·	6	·	5	2	11	·	·	1	·	1	·	4	·	·	1	·	·	1	32	68.1
Hinged	·	·	·	·	·	1	2	1	1	·	·	·	1	2	·	1	2	·	·	·	11	23.4
Blunt	·	·	·	·	·	·	2	1	·	·	·	·	·	·	·	·	1	·	·	·	4	8.5
Missing	·	·	·	·	1	·	9	3	1	1	·	4	·	2	·	·	·	·	1	·	22	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Feathering	·	·	1	·	1	·	1	1	·	·	·	3	·	1	·	1	·	·	·	·	9	
Hinged	·	·	1	·	1	·	3	·	·	·	·	3	·	1	·	1	·	·	·	·	10	
Blunt	·	·	·	·	·	·	1	·	·	·	1	·	·	·	·	1	·	·	·	·	3	
Missing	·	·	3	·	2	·	1	2	1	·	2	·	·	1	·	·	·	·	·	·	12	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Feathering	·	·	·	·	·	·	3	1	·	·	·	·	·	·	·	·	·	·	·	·	4	
Hinged	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	1	
Overpassed	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Missing	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

Table 24-11
Chokurcha I Unit IV: flake and blade cross-sections

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Flat	1	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	3	0.9
Triangular	3	3	6	·	6	2	19	·	·	·	4	13	1	23	1	1	·	·	·	2	84	24.8
Lateral steep	·	·	2	·	4	2	12	2	1	2	·	2	1	14	·	·	·	·	2	·	44	13.0
Trapezoidal	1	5	8	1	7	5	14	2	·	·	1	16	2	26	·	5	·	·	2	1	96	28.3
Polyhedral	·	·	·	·	3	4	15	4	·	2	·	8	2	18	·	1	2	·	·	·	59	17.4
Convex	·	·	·	·	3	1	4	1	·	·	·	5		7	·	1	·	1	1	2	26	7.7
Irregular	1	2	4	·	1	·	3	·	·	·	·	7	1	7	·	·	1	·	·	·	27	8.0
Unidentifiable	4	·	7	5	12	2	12	2	·	·	·	10	2	16	1	2	·	2	·	·	77	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Flat	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	1	1.5
Triangular	·	·	2	·	2	1	5	·	·	·	·	·	·	1	·	1	·	·	·	1	13	19.7
Lateral steep	·	·	·	·	·	1	3	1	·	·	·	·	·	·	·	·	·	·	·	·	5	7.6
Trapezoidal	·	·	4	·	2	·	4	·	·	2	·	·	·	2	·	·	·	·	1	·	15	22.7
Polyhedral	·	·	·	·	·	1	10	3	1	·	·	2	1	4	·	·	1	·	·	·	23	34.8
Convex	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	1	1.5
Irregular	·	·	·	·	1	·	2	1	1	·	·	·	·	1	·	·	2	·	·	·	8	12.1
Unidentifiable	·	·	·	·	1	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	3	
Total	·	·	6	·	6	3	24	5	2	2		5	1	8		1	4		1	1	69	100.0
Blades & tools on blade																						
Triangular	·	·	1	·	·	·	3	3	·	·	1	3	·	·	·	2	·	·	·	·	13	
Lateral steep	·	·	1	·	1	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	3	
Trapezoidal	·	·	3	·	1	·	1	·	1	·	2	3	·	1	·	1	·	·	·	·	13	
Polyhedral	·	·	·	·	2	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	3	
Convex	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Unidentifiable	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Triangular	·	·	·	·	·	·	2	·	·	·	·	·	·	·	·	·	·	·	·	·	2	
Trapezoidal	·	·	·	·	·	·	2	1	·	·	·	1	·	·	·	·	·	·	·	·	4	
Polyhedral	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

Cross-Sections at Midpoint

The major difference between the cross-sections of "regular" pieces and bifacial thinning pieces is most apparent in the polyhedral cross-sections (Table 24-11), where they are proportionately twice more common among bifacial thinning blanks than among "regular" flakes. The other cross-section types do not demonstrate any significant differences between "regular" and bifacial thinning blanks.

Platform Preparation

Plain platforms are most common on "regular" blanks, while polyhedral and faceted platforms are most common on bifacial thinning blanks (Table 24-12). Cortical platforms comprise ca. 10% of all identifiable "regular" blank butts, while there is none among bifacial thinning blanks. Thus, for "regular" blanks, the IFl = 31.8 and the IFs = 10.1; for bifacial thinning blanks the IFl = 49.3 and the IFs = 15.1; for total blanks the IFl = 36.6 and IFs = 11.5. Taking into account the absence of evidence for primary flaking, these indices do not mean much. At the same time, it is clear that the platforms of bifacial thinning blanks were more often "faceted" than were the platforms of "regular" blanks. Thus, the amount of platform preparation in Micoquian industries is reflected by "regular" blanks only.

Platform Lipping

Platform lipping frequencies for "regular" and bifacial thinning blanks are quite different (Table 24-13), because "platform lipping" is a basic attribute for recognizing bifacial thinning blanks. Lipped and semi-lipped platforms comprise more than 90% of bifacial thinning blank platforms. Among "regular" pieces, lipped and semi-lipped butts comprise slightly more than 33%. On bifacial thinning blanks, unlipped platforms are found only on bifacial tool tip rejuvenation flakes.

TABLE 24-12
Chokurcha I Unit IV: flake and blade platform types

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Cortex	·	·	·	·	·	·	4	·	·	·	1	2	1	8	·	1	1	1	·	·	19	10.7
Plain	2	1	3	1	10	2	19	3	·	1	2	16	2	40	2	3	·	·	·	·	107	60.1
Dihedral	1	·	1	·	·	1	1	1	·	·	1	8	·	7	·	1	·	·	·	·	22	12.4
Multihedral	·	·	·	·	·	1	1	1	·	·	·	4	1	5	·	·	·	·	·	·	13	7.3
Faceted	1	3	5	·	·	4	2	1	·	·	·	·	·	1	·	·	·	·	·	·	17	9.6
Crushed	2	3	6	·	5	·	16	·	·	3	·	8	·	10	·	2	3	1	2	·	61	
Miss. by retouch	·	·	·	·	1	·	1	1	·	·	·	3	1	8	·	2	·	·	·	·	17	
Missing	4	3	12	5	21	8	35	4	1	·	1	20	4	32	·	1	·	1	3	5	160	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Plain	·	·	2	·	2	1	14	2	2	1	·	·	·	2	·	1	4	·	1	1	33	48.5
Dihedral	·	·	2	·	1	·	2	·	·	·	·	·	·	1	·	·	·	·	·	·	6	8.8
Multihedral	·	·	·	·	1	·	4	3	·	1	·	5	1	4	·	·	·	·	·	·	19	27.9
Faceted	·	·	2	·	1	2	4	·	·	·	·	·	·	1	·	·	·	·	·	·	10	14.7
Crushed	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Plain	·	·	·	·	1	·	·	1	·	·	2	2	·	1	·	1	·	·	·	·	8	
Dihedral	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Faceted	·	·	1	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	2	
Crushed	·	·	2	·	·	·	1	·	·	·	·	2	·	1	·	1	·	·	·	·	7	
Missing	·	·	2	·	2	·	5	2	·	·	1	2	·	1	·	1	·	·	·	·	16	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Plain	·	·	·	·	·	·	3	·	·	·	·	1	·	·	·	·	·	·	·	·	4	
Faceted	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Crushed	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Missing	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

TABLE 24-13
Chokurcha I Unit IV: flake and blade platform lipping

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Unlipped	6	5	7	1	11	5	17	4	·	·	1	16	2	45	2	2	1	·	·	·	125	61.3
Semi-lipped	·	1	8	·	1	2	15	3	·	·	2	12	2	18	·	2	2	1	·	·	69	33.8
Lipped	·	·	·	·	1	1	1	·	·	1	1	1	·	4	·	·	·	·	·	·	10	4.9
Unknown	4	4	12	5	24	8	46	4	1	3	1	32	5	44	·	6	1	2	5	5	212	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Unlipped	·	·	·	·	2	·	1	1	1	·	·	1	·	·	·	·	·	·	·	·	6	8.8
Semi-lipped	·	·	3	·	·	·	1	1	·	·	·	1	·	2	·	·	2	·	·	·	10	14.7
Lipped	·	·	3	·	4	3	22	2	1	2	·	3	1	6	·	1	2	·	1	1	52	76.5
Unknown	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Unlipped	·	·	2	·	1	·	·	·	·	·	·	1	·	2	·	·	·	·	·	·	6	
Semi-lipped	·	·	1	·	·	·	·	·	1	·	2	1	·	·	·	·	·	·	·	·	5	
Lipped	·	·	·	·	1	·	·	1	·	·	·	1	·	·	·	1	·	·	·	·	4	
Unknown	·	·	2	·	2	·	6	2	·	·	1	3	·	1	·	2	·	·	·	·	19	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Semi-lipped	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	
Lipped	·	·	·	·	·	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	6	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

TABLE 24-14
Chokurcha I Unit IV: flake platform angles

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	IV-V	*N*	*ess %*
Flakes & tools on flake																						
Right, 90°	4	4	10	·	6	2	14	5	·	·	2	14	2	26	2	4	1	1	·	·	97	51.0
Semi-obtuse, 90–110°	·	·	·	·	·	1	·	·	·	·	·	·	·	3	·	·	·	·	·	·	4	2.1
Obtuse, >110°	1	2	5	1	5	4	15	1	·	1	2	17	2	33	·	·	·	·	·	·	89	46.8
Unknown	5	4	12	5	26	9	50	5	1	3	1	30	5	49	·	6	3	2	5	5	226	
Total	10	10	27	6	37	16	79	11	1	4	5	61	9	111	2	10	4	3	5	5	416	100.0
Bifacial thinning and rejuvenation flakes & tools on bifacial thinning and rejuvenation flake																						
Right, 90°	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	1	1.5
Obtuse, >110°	·	·	6	·	5	3	24	4	2	2	·	4	1	8	·	1	4	·	1	1	66	98.5
Unknown	·	·	·	·	1	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	2	
Total	·	·	6	·	6	3	24	5	2	2	·	5	1	8	·	1	4	·	1	1	69	100.0
Blades & tools on blade																						
Right, 90°	·	·	2	·	·	·	·	·	1	·	2	1	·	·	·	·	·	·	·	·	6	
Obtuse, >110°	·	·	1	·	2	·	·	1	·	·	·	1	·	1	·	1	·	·	·	·	7	
Unknown	·	·	2	·	2	·	6	2	·	·	1	4	·	2	·	2	·	·	·	·	21	
Total	·	·	5	·	4	·	6	3	1	·	3	6	·	3	·	3	·	·	·	·	34	
Bifacial thinning blades & tools on bifacial thinning blade																						
Obtuse, >110°	·	·	·	·	1	·	4	·	·	·	·	1	·	·	·	·	·	·	·	·	6	
Unknown	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	
Total	·	·	·	·	1	·	4	1	·	·	·	1	·	·	·	·	·	·	·	·	7	

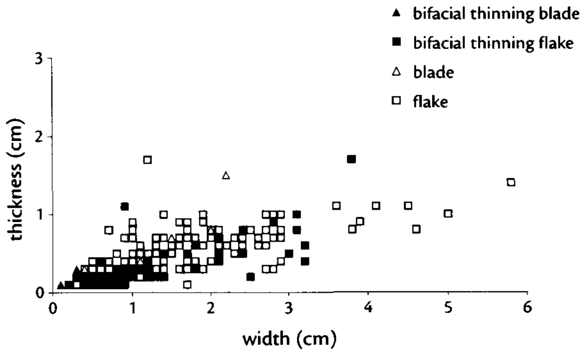


Figure 24-6—Chokurcha I Unit IV: blank platform sizes.

Table 24-15
Chokurcha I Unit IV: average blank platform sizes (mm)

	$\bar{X}$ *Width*	$\bar{X}$ *Thickness*
Flake	1.4	0.5
Bifacial thinning flake	1.2	0.3
Blade	1.1	0.5
Bifacial thinning blade	0.5	0.2
All blanks	1.3	0.4

Platform Angles

As with lipping, a markedly obtuse platform angle is characteristic of bifacial thinning flakes (Table 24-14). All but one of the bifacial thinning blanks has an obtuse platform angle. At the same time, about half of the "regular" blank platforms have right angles.

Platform Dimensions

The dimensions of platforms (Figure 24-6) exhibit some differences among flakes, bifacial thinning flakes, blades, and bifacial thinning blades (Table 24-15). The widest and thickest are the flake platforms, while the narrowest and thinnest are the bifacial thinning blade platforms. In general, the "regular" blank platforms are wider and thicker than the bifacial thinning blanks. At the same time, the majority of both bifacial thinning and "regular" blanks have similar maximum dimensions: width = 3.0 cm, thickness = 1.0 cm. Outside this cluster, there were only 5 bifacial thinning blanks and 10 "regular" blanks.

Tools

Tools were found in nineteen of the twenty levels of Unit IV. Not one tool was discovered in Level IV-V. The majority of tools were made on flakes (Table 24-16), while more than 30% were produced on chips (blanks < 3 cm in greatest dimension) and bifacial thinning blanks. The patterns of size distribution for

Table 24-16
Chokurcha I Unit IV: blank types used for tool production

LEVEL	IV-A	IV-A2	IV-B	IV-D	IV-F	IV-G	IV-I	IV-I2	IV-K	IV-L	IV-L2
Tool on chip	·	·	·	·	6	1	7	2	1	·	2
Tool on flake	2	2	11	1	18	3	25	4	1	2	2
Tool on blade	·	·	3	·	3	·	3	2	1	·	1
Tool on bifacial thinning chip	·	·	·	·	·	·	·	1	·	·	·
Tool on bifacial thinning flake	·	·	·	·	3	1	13	2	1	2	·
Tool on bifacial thinning blade	·	·	·	·	1	·	·	·	·	·	·
Tool on rejuvenation chip	·	·	·	·	1	·	·	·	·	·	·
Tool on rejuvenation flake	·	·	·	·	2	·	·	·	1	·	·
Total	2	2	14	1	34	5	48	11	5	4	5

LEVEL	IV-M	IV-N	IV-O	IV-P	IV-Q	IV-S	IV-T	IV-U	*N*	%
Tool on chip	12	·	11	·	·	1	·	·	43	16.3
Tool on flake	30	7	47	1	7	3	2	1	169	64.0
Tool on blade	1	·	1	·	·	·	·	·	15	5.7
Tool on bifacial thinning chip	·	·	1	·	·	·	·	·	2	0.8
Tool on bifacial thinning flake	1	·	3	·	·	3	·	·	29	11.0
Tool on bifacial thinning blade	1	·	·	·	·	·	·	·	2	0.8
Tool on rejuvenation chip	·	·	·	·	·	·	·	·	1	0.4
Tool on rejuvenation flake	·	·	·	·	·	·	·	·	3	1.1
Total	45	7	63	1	7	7	2	1	264	100.0

unretouched blanks and tool blanks are about the same, although some bifacial tools show a broad range of metric distributions (Figure 24-7). That is, about 25% of bifacial tools are longer than the majority of other artifacts. Most unifacial tools and unretouched blanks are no longer than 4 cm. The majority of bifacial tools are larger than 5 cm. The average size of tools on blanks (length = 3.3 cm, width = 2.9 cm, thickness = 0.7 cm) is similar to that of unretouched blanks (length = 2.9 cm, width = 3.0 cm, thickness = 0.5 cm), while the average size of bifacial tools is much larger (length = 5.5 cm, width = 3.2 cm, thickness = 1.4 cm).

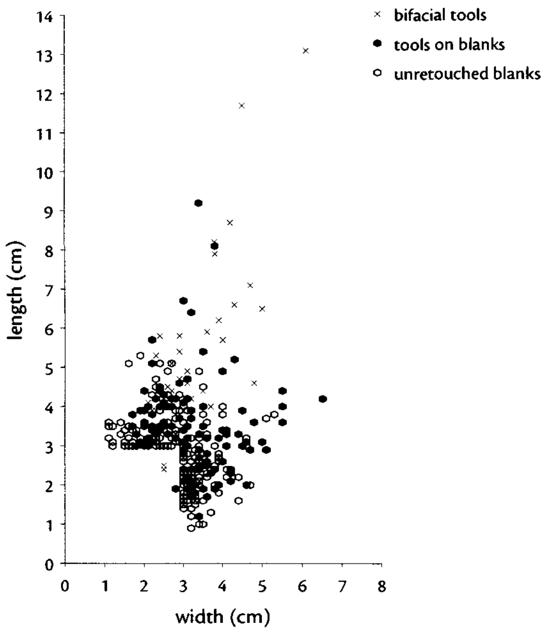


Figure 24-7—Chokurcha I Unit IV: length/width scatterplot for unretouched blanks, tool blanks, and bifacial tools.

There are twelve typological groups present among the tools: points, scrapers, endscrapers, denticulates, composite tools, bifacial points, bifacial scrapers, bifacial heavily exhausted tools, reutilized bifacial tools fragments, retouched pieces, thinned pieces, and unidentifiable retouched fragments. Unifacial scrapers are most numerous, accounting for about two-thirds of the essential tool count (Table 24-17). These are followed by bifacial scrapers and bifacial points, the latter comprising ca. 7% of the essential tool count (Table 24-17). Other tool groups do not exceed 4% for each category. Bifacial tools represent 25.7% of all tools. This basic tool assemblage structure is characteristic for the Ak-Kaya facies of the Crimean Micoquian.

Points

Points were found in five of nineteen levels containing tools (Table 24-17). More than half of the points in Unit IV came from Level IV-M. Points were made on flakes (6), blades (2), and chips (5). Six of these 13 are sub-triangular (Figure 24-8: *1, 3, 6, 10*) and triangular (Figure 24-8: *4*). Another 4 points are semi-trapezoidal (Figure 24-8: *5, 7, 8, 9*). The majority of sub-triangular and triangular points (Figure 24-8: *1, 3, 4, 10*) were made on off-axis blanks, making them morphologically close to semi-trapezoidal pieces. The only sub-leaf point (Figure 24-8: *2*), from Level IV-I, was made on a relatively large primary blade. Blanks longer or wider than 5 cm were used for points in Levels IV-B, IV-I, and IV-S (Figure 24-8: *1, 2, 9, 10*). On the other hand, points from Level IV-M were produced on triangular and/or trapezoidal chips and small flakes (Figure 24-8: *3, 4, 5, 6, 8*), making their morphology very close to Kiik-Koba facies points. Points were produced by combinations of non-invasive, marginal, scalar, flat, and/or semi-steep retouch.

Scrapers

The scrapers came from ten of the nineteen tool-bearing levels (Table 24-17). They have been subdivided into forty types, comprising five main typological groups: transverse and diagonal (31), simple (41), double (14), convergent (34), and core-like (4). Altogether, scrapers with one retouched edge account for 58.1%, bilateral for 11.3%, and converging scrapers for 30.65%. Four types account for half of the scraper assemblage: straight, transverse convex, semi-trapezoidal, and diagonal.

The main typological problem for scraper classification at Chokurcha I Unit IV is their small size. A large majority, ca. 80%, was made either on chips or flakes with maximum dimensions less than 4 cm. At the same time, all of these have scalar flat/semi-steep/steep continuous retouch. Thus, if the chosen blanks (chips or small flakes) do not fit "normal" expectations for scraper blank size, the kinds of retouch are quite typical for scrapers.

Transverse and Diagonal Scrapers

Transverse and diagonal scrapers were found in nine of the ten levels where scrapers were recovered (Table 24-17). Almost all of these scrapers belong to three types: transverse-straight (Figure 24-9: *2, 3*), transverse-convex (Figure 24-9: *4, 6, 8*), and diagonal (Figure 24-9: *1, 9*). One of each type was found, including: transverse-straight, alternating (Figure 24-9: *7*), transverse-wavy, and transverse-wavy with thinned back. The transverse and diagonal scrapers were made on chips (4), flakes (23), bifacial thinning chips (1), and bifacial thinning flakes (3). All but 1 scraper (Figure 24-9: *4*) in this group are smaller than 4 cm in both length and width.

TABLE 24-17
Chokurcha I Unit IV: tool classification

LEVEL IV-	A	A_2	B	D	F	G	I	I_2	K	L	L_2	M	N	O	P	Q	S	T	U	*N*	%	*ess %*
Points																				*13*		*6.8*
Sub-leaf, dorsal							1													1	0.3	0.5
Sub-triangular, dorsal			1									3				1				5	1.3	2.6
Triangular, dorsal												1								1	0.3	0.5
Semi-trapezoidal, dorsal		1	1									2								4	1.0	2.1
Unidentifiable, dorsal												2								2	0.5	1.1
Scrapers																				*124*		*64.9*
Transverse-straight, dorsal					1		2	1				1				1	1			7	1.8	3.7
Transverse-straight, alternating														1						1	0.3	0.5
Transverse-convex, dorsal			1		3		2	1		1		2		1		1	1			13	3.4	6.8
Transverse-wavy, dorsal																	1			1	0.3	0.5
Transverse-wavy, dorsal, thinned back														1						1	0.3	0.5
Diagonal, dorsal					1							2		5						8	2.1	4.2
Straight, dorsal					1		9	2	1					5			1			19	5.0	10.0
Straight, dorsal, thinned base																2				2	0.5	1.1
Straight, dorsal, truncated-faceted base							1													1	0.3	0.5
Straight, alternating														1						1	0.3	0.5
Convex, dorsal			1		1		2					1								5	1.3	2.6
Convex, alternating							1		1											2	0.5	1.1
Convex, dorsal, naturally backed			1				1							2						4	1.0	2.1
Convex, dorsal, thinned back														1						1	0.3	0.5
Concave, dorsal					1		1					1		2						5	1.3	2.6
Wavy, dorsal, naturally backed							1													1	0.3	0.5
Double straight, dorsal			1											3						4	1.0	2.1
Double straight, alternate, dist. trunc.							1													1	0.3	0.5
Double straight-convex, dorsal							1		1					1						3	0.8	1.6
Double convex, dorsal					1		1													2	0.5	1.1
Double convex, dorsal, distally thinned												1								1	0.3	0.5
Double convex-wavy, dorsal					1							1								2	0.5	1.1
Double wavy, dorsal												1								1	0.3	0.5
Semi-leaf, dorsal								1												1	0.3	0.5
Sub-leaf, dorsal							1													1	0.3	0.5
Sub-triangular, dorsal														1						1	0.3	0.5
Triangular, dorsal								1				1								2	0.5	1.1
Triangular, dorsal, distally thinned														1						1	0.3	0.5
Semi-trapezoidal, dorsal			1		1		4					2		3						11	2.9	5.8
Semi-trapezoidal, bi-terminally thinned														1						1	0.3	0.5
Sub-trapezoidal, dorsal					2		1													3	0.8	1.6
Sub-trapezoidal, dorsal, thinned back							1					1								2	0.5	1.1
Semi-rectangular, dorsal			1										1							2	0.5	1.1
Sub-rectangular, dorsal														1						1	0.3	0.5
Semi-crescent, dorsal			1											2						3	0.8	1.6
Semi-crescent, dorsal, thinned back														1						1	0.3	0.5
Crescent, dorsal, thinned back												1								1	0.3	0.5
Unidentifiable-convergent, dorsal			2											1						3	0.8	1.6
Core-like, dorsal												1		3						4	1.0	2.1
Endscrapers																				*1*		*0.5*
Wavy, dorsal												1								1	0.3	0.5
Denticulates																				*1*		*1.6*
Straight, dorsal						1								2						3	0.8	1.6
Composite tools																				*1*		*0.5*
Denticulate-notch, dorsal												1								1	0.3	0.5

Table 24-17 continued
Chokurcha I Unit IV: tool classification

LEVEL IV-	A	A_2	B	D	F	G	I	I_2	K	L	L_2	M	N	O	P	Q	S	T	U	*N*	%	*ess %*
Bifacial points																				*6*		*3.1*
Sub-leaf	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Sub-leaf, thinned base	1	·	·	·	·	·	1	·	1	·	·	·	·	·	·	·	·	·	·	3	0.8	1.6
Sub-triangular	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Unidentifiable	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	1	0.3	0.5
Bifacial scrapers																				*34*		*17.8*
Convex	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	1	0.3	0.5
Convex, thinned back	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Convex, naturally backed	·	·	·	·	1	·	2	1	·	·	·	2	·	2	·	·	·	·	·	8	2.1	4.2
Sub-leaf	·	·	·	·	·	·	1	·	·	·	·	1	·	·	·	·	·	·	·	2	0.5	1.1
Sub-leaf, thinned base	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Leaf, thinned base	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Sub-triangular	·	·	·	·	1	·	·	·	·	·	·	·	·	1	·	·	·	·	·	2	0.5	1.1
Sub-triangular, backed	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	1	0.3	0.5
Triangular, "Chokurcha" type	·	·	·	·	·	·	1	1	·	·	·	·	·	·	·	·	·	·	·	2	0.5	1.1
Sub-cordiform	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Semi-trapezoidal, naturally backed	·	·	·	·	·	·	·	·	·	·	1	1	·	·	·	·	·	·	·	2	0.5	1.1
Semi-crescent	·	·	·	·	·	·	2	·	·	·	·	2	·	·	·	·	·	·	·	4	1.0	2.1
Semi-crescent, naturally backed	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	1	0.3	0.5
Sub-crescent, thinned base	·	·	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	0.5
Crescent	·	·	·	·	·	1	·	·	·	·	·	2	·	·	·	·	·	·	·	3	0.8	2.6
Convergent unidentifiable	·	·	·	·	·	·	2	·	·	·	·	·	·	1	·	·	·	·	·	3	0.8	1.6
Bifacial heavily exhausted tools																				*4*		*2.1*
	1	·	2	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	4	1.0	2.1
Bifacial tool reutilized fragments																				*5*		*2.6*
	·	·	·	·	1	·	3	·	·	·	·	·	·	1	·	·	·	·	·	5	1.3	2.6
Retouched pieces																				*112*		
On chip, lateral, dorsal	·	·	·	·	2	1	4	1	·	·	2	5	·	5	·	·	·	·	·	20	5.2	
On chip, bilateral, dorsal	·	·	·	·	·	·	·	·	·	·	·	1	·	2	·	·	·	·	·	3	0.8	
On chip, distal, dorsal	·	·	·	·	·	·	·	·	2	·	·	1	·	1	·	·	·	·	·	4	1.0	
On flake, lateral, dorsal	1	1	2	·	8	1	7	3	·	·	1	7	·	10	1	·	3	1	1	47	12.2	
On flake, lateral, ventral	·	·	·	·	·	·	·	·	·	1	1	1	·	·	·	·	·	·	·	3	0.8	
On flake, bilateral, dorsal	·	·	·	·	1	·	1	·	·	·	·	·	·	1	·	·	·	·	·	3	0.8	
On flake, bilateral, alternate	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	1	0.3	
On flake, distal, dorsal	·	·	·	·	·	1	3	·	·	1	·	4	3	3	·	·	·	·	·	15	3.9	
On flake, proximal, dorsal	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	1	0.3	
On blade, lateral, dorsal	·	·	·	·	3	·	1	1	·	·	1	1	·	·	·	·	·	·	·	7	1.8	
On chunk	·	·	·	·	2	·	2	·	·	·	·	3	·	1	·	·	·	·	·	8	2.1	
Thinned pieces																				*2*		
On flake, distal, ventral	·	·	·	·	1	·	·	·	·	·	·	·	·	·	·	·	·	·	·	1	0.3	
On flake, proximal, ventral	·	·	·	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	1	0.3	
Unidentifiable																				*79*		
Unifacial tools fragments	1	·	1	1	5	1	6	3	·	1	·	5	1	18	·	2	·	1	1	47	12.2	
Bifacial tool fragments	1	·	2	4	3	·	7	1	1	·	·	8	·	3	·	·	·	·	·	30	7.8	
Heavily burnt	·	·	1	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	2	0.5	
Total	6	2	20	5	42	6	79	17	7	4	6	72	7	91	1	7	8	2	2	384	100.0	100.0

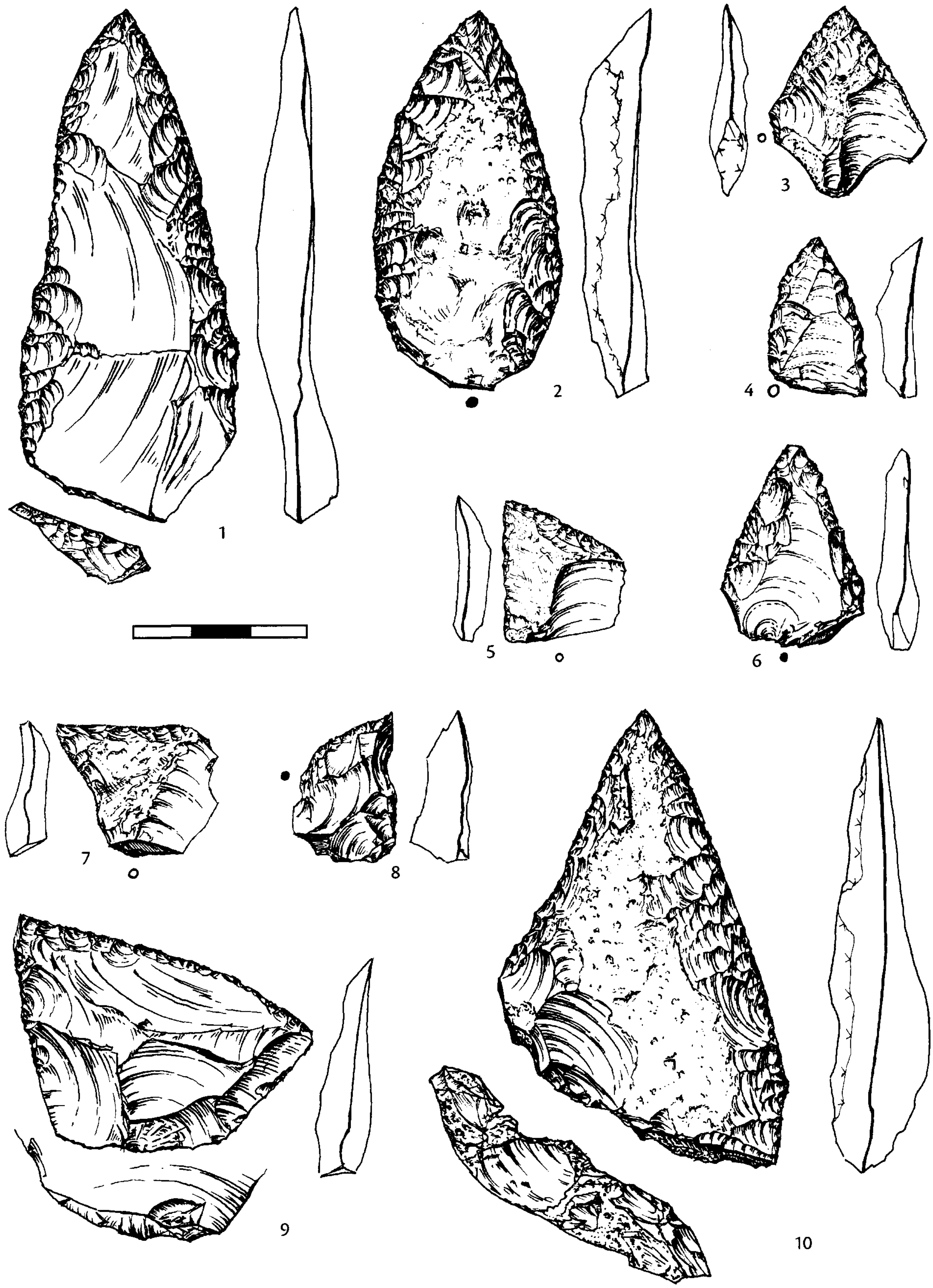


Figure 24-8—Chokurcha I Levels IV-A2 (7), IV-B (1, 9), IV-I (2), IV-M (3, 4, 5, 6, 8), IV-Q (10) points: 4–triangular; 1, 3, 6, 10–sub-triangular; 2–sub-leaf; 5, 7, 8, 9–semi-trapezoidal. Tools made on: 1, 2–blade; 3, 6, 9, 10–flake; 4, 5, 7, 8–chip.

Simple Scrapers

The simple scrapers were found in all ten levels containing scrapers (Table 24-17). According to the shape of the single retouched edge, the simple scrapers are subdivided into straight (23), convex (12), concave (5), and wavy (1).

Most straight scrapers (19) have obverse retouch (Figure 24-10: *1, 2, 12, 14*) and exhibit no ventral thinning. Two straight scrapers have thinned bases (Figure 24-10: *5*), 1 has a truncated-faceted base, and one has alternating retouch. Five of 12 convex scrapers have obverse retouch and no additional typological elements (Figure 24-10: *10*). Four convex scrapers are naturally backed (Figure 24-10: *9*), 1 piece has basal thinning, and 2 have alternating retouch. Additionally, the concave scrapers have simple shapes, though they lack all other typological elements. The single wavy scraper is naturally backed (Figure 24-10: *13*).

The simple scrapers were made on blades (5), flakes (25), chips (7), bifacial thinning flakes (3), and a bifacial thinning blade (1). Except for a few artifacts, the maximum dimensions of scrapers do not exceed 4 cm.

Double Scrapers

Double scrapers were discovered in six levels. Half of the total of 14 double scrapers belongs to two types: double straight and straight-convex (Figure 24-10: *6, 8, 11*). There are also 2 double convex (Figure 24-10: *3*), 2 convex-wavy (Figure 24-10: *4*) scrapers, and single

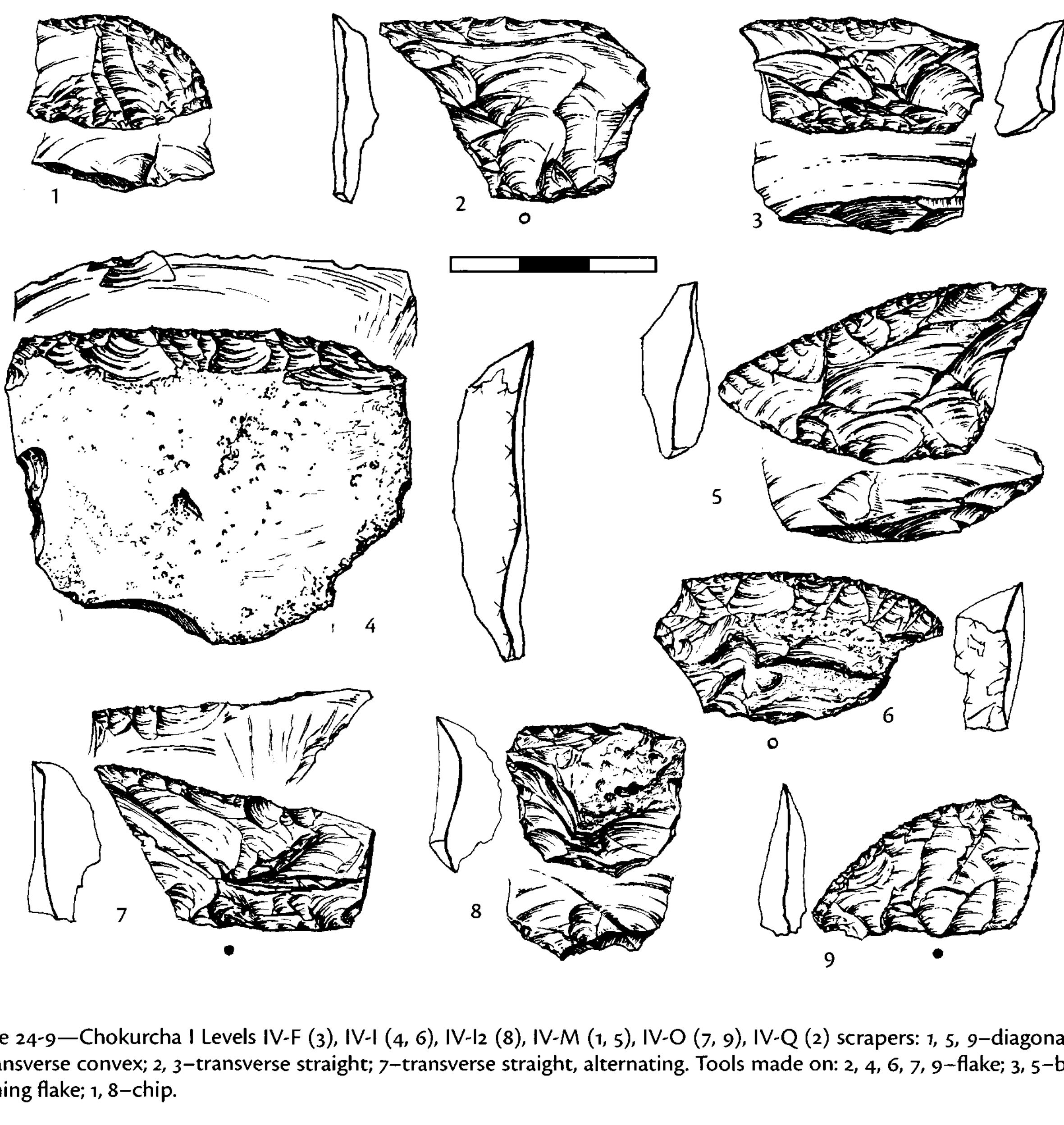


Figure 24-9—Chokurcha I Levels IV-F (3), IV-I (4, 6), IV-I2 (8), IV-M (1, 5), IV-O (7, 9), IV-Q (2) scrapers: 1, 5, 9–diagonal; 4, 6, 8–transverse convex; 2, 3–transverse straight; 7–transverse straight, alternating. Tools made on: 2, 4, 6, 7, 9–flake; 3, 5–bifacial thinning flake; 1, 8–chip.

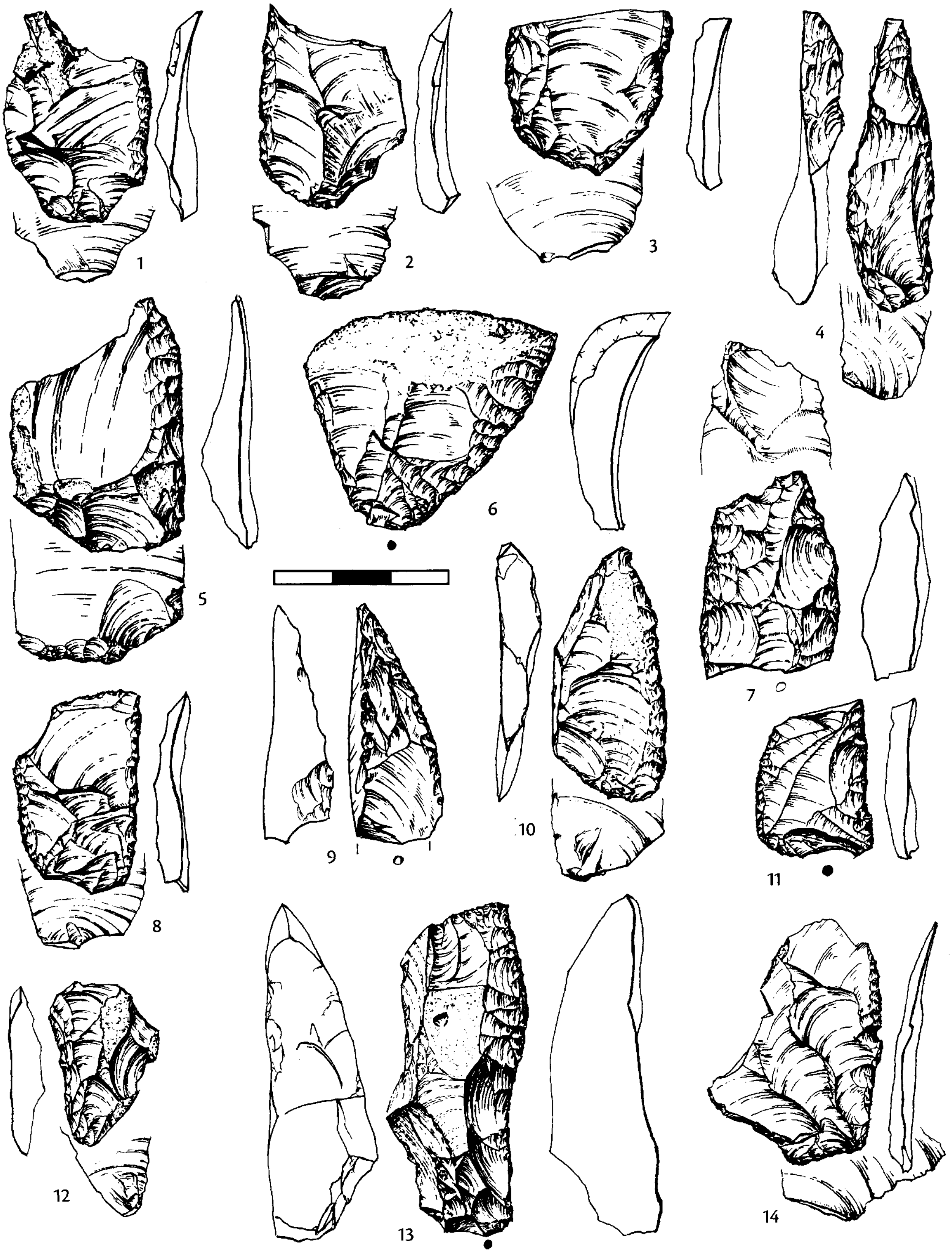


Figure 24-10—Chokurcha I Levels IV-B (9), IV-F (3, 4), IV-I (1, 2, 6, 13), IV-I2 (12), IV-K (8), IV-M (7, 10), IV-O (11), IV-Q (5), IV-S (14) scrapers: *1, 2, 12, 14*–straight; *5*–straight with thinned base; *10*–convex; *9*–convex with natural back; *13*–wavy with natural back; *6, 8, 11*–straight-convex; *3*–double convex; *7*–double-convex with distal thinning; *4*–convex-wavy. Tools made on: 5, 6, 7, 8–flake; 1, 2, 3, 14–bifacial thinning flake; 9, 10–blade; 4–bifacial thinning blade; 11, 12–chip; 13–"ancient" blank: patinated negatives on the dorsal surface shown by stippled wave lines.

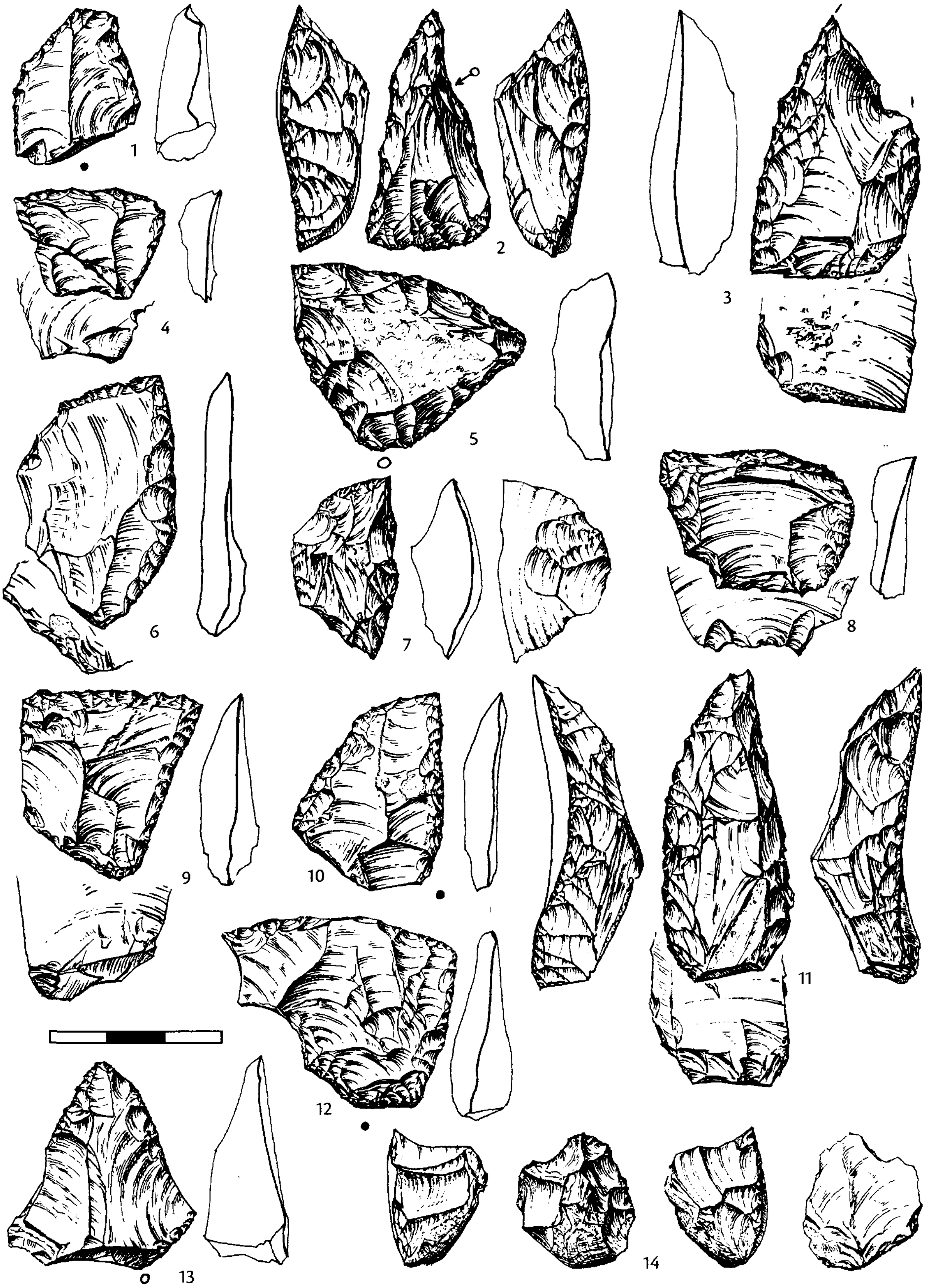


Figure 24-11—Chokurcha I Levels IV-B (6), IV-F (4), IV-I (3, 8, 9, 10), IV-I2 (2), IV-M (5, 7, 14), IV-O (1, 11, 12, 13) scrapers: *2, 5*–triangular; *13*–sub-triangular; *4, 9, 12*–semi-trapezoidal; *8, 10*–sub-trapezoidal; *6*–semi-rectangular; *7*–crescent with thinned back; *1*–semi-crescent; *11*–semi-crescent with thinned base; *3*–sub-leaf; *14*–core-like scraper. Tools made on: 1, 4–chips; 2, 3, 5–10, 12, 13, 14–flakes; 11–blades. Tool 3 also shows traces of use as a retoucher on its bulb of percussion.

examples of the other three types (Table 24-17). All 12 double scrapers have obversely retouched edges and no other secondary modifications. One double straight scraper was both alternately retouched and distally truncated, and another double convex scraper was distally thinned (Figure 24-10: *7*).

The double scrapers were made on flakes (9), bifacial thinning flakes (2), a bifacial thinning blade (1), a blade (1), and a chip (1). Except for a few pieces, their maximum dimensions do not exceed 4 cm.

Convergent Scrapers

Convergent scrapers were found in seven levels. Based on the morphology of the retouched edges, they are subdivided into five main shapes: leaf (2), triangular (4), trapezoidal (17), rectangular (3), and crescent (5). Three others are tip fragments that are morphologically unidentifiable.

The most numerous type, comprising one-third of the convergent scrapers, is semi-trapezoidal with obverse retouch (Figure 24-11: *4, 9, 12*). The remaining trapezoidal shapes are subdivided into three categories: semi-trapezoidal, bi-terminally thinned, sub-trapezoidal (Figure 24-11: *8, 10*), and sub-trapezoidal with thinned back. The semi-rectangular (Figure 24-11: *6*) and sub-rectangular scrapers are morphologically very close to the trapezoidal shapes. In fact, they are only a little more elongated than the semi- and sub-trapezoidal scrapers. In Unit IV, the semi-rectangular and sub-rectangular scrapers are all obversely retouched.

The crescent-shaped scrapers are represented by three types: semi-crescent (Figure 24-11: *1*), semi-crescent with thinned base (Figure 24-11: *11*), and crescent with thinned back (Figure 24-11: *7*). Additionally, there are a few leaf and triangular shapes. Among the foliate-shaped crescent scrapers there are two types (one each): semi-leaf and sub-leaf (Figure 24-11: *3*). Both are obversely retouched. The sub-leaf scraper's bulb of percussion was used as a retoucher (Figure 24-11: *3*). The triangular shapes fall into three types: sub-triangular (Figure 24-11: *13*), triangular (Figure 24-11: *2, 5*), and triangular distally thinned.

The convergent scrapers were made on flakes (24), bifacial thinning flakes (4), and chips (6). Except for a few pieces, the maximum dimensions do not exceed 4 cm.

Core-Like Scrapers

There are only 4 core-like scrapers in the Unit IV tool assemblages (Table 24-17). Three were found in Level IV-O (Figure 24-2: *1a–1c*) and 1 in Level IV-M (Figure 24-11: *14*). All were made on relatively thick flakes. Their ventral surfaces served as the striking platform for a number of removals from around the perimeter of the initial flake. After these removals, the edge of the tool was retouched by scalar steep and stepped retouch. Thus, these artifacts are an intermediate form between cores on flake and scrapers. Their lengths vary from 2.3 to 4.0 cm, their widths from 2.1 to 3.7 cm, and their thicknesses from 0.9 to 2.2 cm. Thus, they are really small for either Middle Paleolithic cores or scrapers.

Endscrapers

A single endscraper was found in Level IV-M (Table 24-17). It is atypical, made on a transverse flake with obverse, scalar, abrupt retouch. The distal retouch is wavy.

Denticulates

Denticulated tools were found in Levels IV-G and IV-O (Table 24-17). All are on flakes; 1 has a straight edge with obverse retouch.

Composite Tools

A single piece from Level IV-M has two modified edges: one denticulated by obverse scalar abrupt retouch, another edge with a notch made by the same kind of retouch.

Bifacial Points

Bifacial points were found in five levels (Table 24-17). Four of the 6 are leaf-shaped (Figure 24-12: *1–4*) and 3 of these have thinned bases. In addition, a single sub-triangular bifacial point (Figure 24-12: *6*), and an unidentifiable broken bifacial point were recovered.

All of the bifacial points are plano-convex; a combination of scalar and parallel retouch was employed in their production. Retouch angles vary from flat to semi-steep. The sub-leaf basally-thinned bifacial point from Level IV-K shows a clear impact fracture on its tip (Figure 24-12: *2*).

The length and width ranges for the bifacial points are not very standardized (5.8–7.9 cm and 2.6–4.7 cm, respectively), while the range of thickness is more limited (1.0 to 1.8 cm). The maximum lengths of the thinning scars on the bifacial tool surfaces vary from 2.6 to 4.8 cm, with most ranging from 3.0 to 4.0 cm.

Bifacial Scrapers

Bifacial scrapers were found in eight levels (Table 24-17). One-third of the Unit IV bifacial scrapers came from Level IV-I, and a moderate number were also found in Levels IV-M and IV-O. Bifacial scrapers are subdivided into five main morphological groups: simple (10), leaf-shaped (4), triangular (6), trapezoidal (2), and crescent (9). Three others are distal fragments that are unidentifiable to shape.

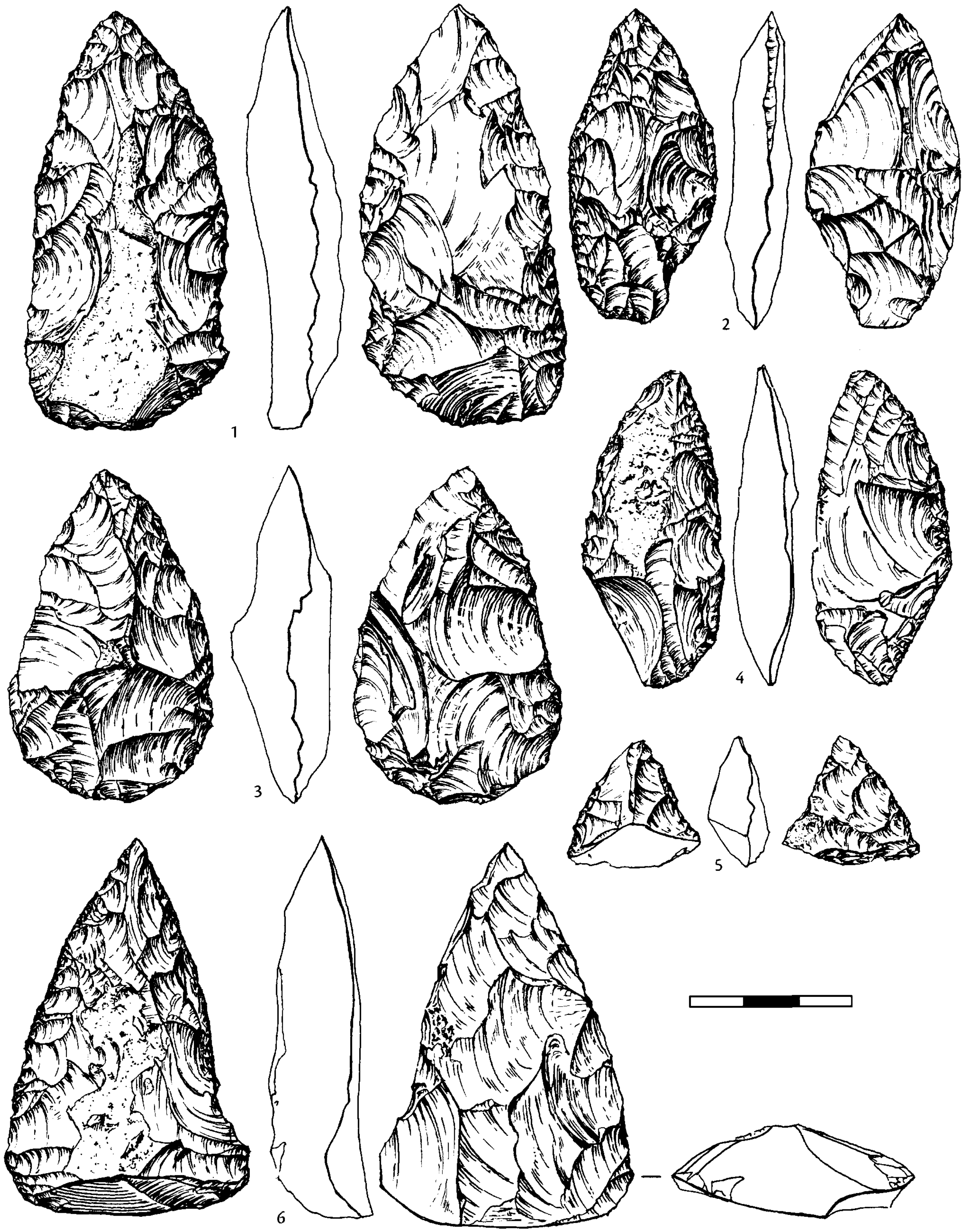


Figure 24-12—Chokurcha I Levels IV-A (4), IV-B (6), IV-I (1, 3, 5), IV-K (2) bifacial points: 1–sub-leaf; 2, 3, 4–sub-leaf, with thinned base; 6–sub-triangular; 5–bifacial tool reutilized fragment.

Simple-Shaped Bifacial Scrapers

The simple-shaped bifacial scrapers exhibit a single convex retouched edge and are subdivided into three types: convex (Figure 24-13: *4*), convex with thinned back (Figure 24-13: *5*), and convex with natural back (Figure 24-13: *1, 2, 3*). In 8 of the 10 cases, the single retouched edge was parallel to a natural back, while another simple bifacial scraper has a thinned back. All of the bifacial simple scrapers are plano-convex, with a combination of scalar flat and semi-steep retouch. Six were made on flint plaquettes, 1 was made on a flake, 2 on artifacts that had already been patinated, and 1 on a flint pebble. The backed bifacial scraper from Level IV-I2 was made on a bifacial tool fragment, where the break served as a natural back. Only 2 of the 9 complete simple scrapers are longer than 5 cm, and 3 are wider than 3 cm. The thicknesses of these tools vary from 1.0 to 1.8 cm. Some of the naturally backed bifacial scrapers in Unit IV were probably the result of multiple stages of reduction, which was the case for all bifacial tool manufacture.

Crescent-Shaped Bifacial Scrapers

The crescent-shaped bifacial scrapers are subdivided into four types: semi-crescent, semi-crescent with natural back (Figure 24-14: *2*), sub-crescent with thinned base, and crescent (Figures 24-14: *1*; 24-15: *5, 9*). Six of 9 are plano-convex. Two pieces have alternately retouched plano-convex edges (Figure 24-14: *1*), and 1 piece has a straight edge with alternating retouch. In 1 case, the edge has demi-Quina retouch, while the rest of the crescent bifacial scrapers were made via a combination of scalar flat and semi-steep retouch. Three of 10 were made on flint plaquettes, while the initial blanks for 9 bifacial scrapers are unidentifiable. In general, the crescent bifacial scrapers are larger than the simple bifacial scrapers. Only 2 of the 7 complete pieces are smaller than 5 cm. The thicknesses of bifacial crescent scrapers range from 0.8 to 1.8 cm.

Triangular-Shaped Bifacial Scrapers

The triangular-shaped bifacial scrapers are subdivided into three types: sub-triangular (Figure 24-15: *1*), sub-triangular with natural back (Figure 24-15: *8*), triangular (Figure 24-15: *2, 6*), and sub-cordiform (Table 24-17). Three of these four scrapers were made on flakes. It is difficult to identify the initial blank type used for sub-cordiform scraper production. The edges of the sub-triangular bifacial scraper from Level IV-F exhibit demi-Quina retouch (Figure 24-15: *1*), while the rest of the triangular-shaped bifacial scrapers were made by a combination of scalar flat and semi-steep retouch. The sub-triangular bifacial scraper from Level IV-F is the only relatively large tool among the triangular-shaped bifacial scrapers (Figure 24-15: *1*). The maximum dimensions of the others do not exceed 5 cm. The thicknesses vary from 0.9 to 2.0 cm.

The shapes of the triangular (Figure 24-15: *2, 6*) and crescent (Figure 24-15: *5, 9*) bifacial scrapers are comparable and likely comprise one morphological group. The only difference is the presence of a right angle between the two short edges. If this angle is sharp, it is triangular-shaped (Figure 24-15: *2, 6*); if the angle is rounded, it is crescent-shaped (Figure 24-15: *5, 9*).

Leaf-Shaped Bifacial Scrapers

The leaf-shaped bifacial scrapers are subdivided into three types: sub-leaf (Figure 24-16: *1*), sub-leaf with thinned base (Figure 24-17), and leaf with thinned base (Figure 24-16: *2*). All of them are plano-convex. The sub-leaf bifacial scraper from Level IV-M was made on a tip fragment of a bifacial tool. The sub-leaf with thinned base bifacial scraper from Level IV-I is heavily exhausted, while all other leaf-shaped bifacial scrapers are massive, with lengths ranging from 6.6 cm to 13.2 cm. The thicknesses of bifacial leaf-shaped scrapers range from 1.0 to 1.7 cm. The maximum length and width dimensions of the largest thinning scars on leaf-shaped bifacial scrapers exceed 5 cm.

It is necessary to note that leaf-shaped points and leaf-shaped scrapers are morphologically very close. The only difference is tip sharpness. In fact, leaf-shaped bifacial points and scrapers fall into the same morphological group.

Trapezoidal-Shaped Bifacial Scrapers

There are 2 trapezoidal-shaped bifacial scrapers and they belong to one type: semi-trapezoidal with natural back. Both are plano-convex, formed by a combination of scalar flat and semi-steep retouch. Both pieces are smaller than 5 cm, while thicknesses vary from 1.3 to 1.5 cm.

Bifacial Heavily Exhausted Tools and Bifacial Reutilized Tool Fragments

There are 4 bifacial heavily exhausted pieces (Table 24-17). The common features of the exhausted bifacial tools are the absence of retouch on the tool edges, as well as their narrow and thick proportions. These proportions distinguish bifacial heavily exhausted tools from preforms of bifacial tools. The heavily exhausted bifacial tool from Level IV-A was an attempt to rejuvenate by thinning an already patinated bifacial tool (Figure 24-15: *4*), resulting in a number of hinge fractures. The edges were not retouched. Also, the artifacts from Level IV-B and IV-F (fragment) are unretouched bifacial pieces at the thinning stage (Figure 24-15: *3*).

These tools were found in three levels (Table 24-17). The broken edges were modified by retouch (Figures 24-12: *5*; 24-15: *7*).

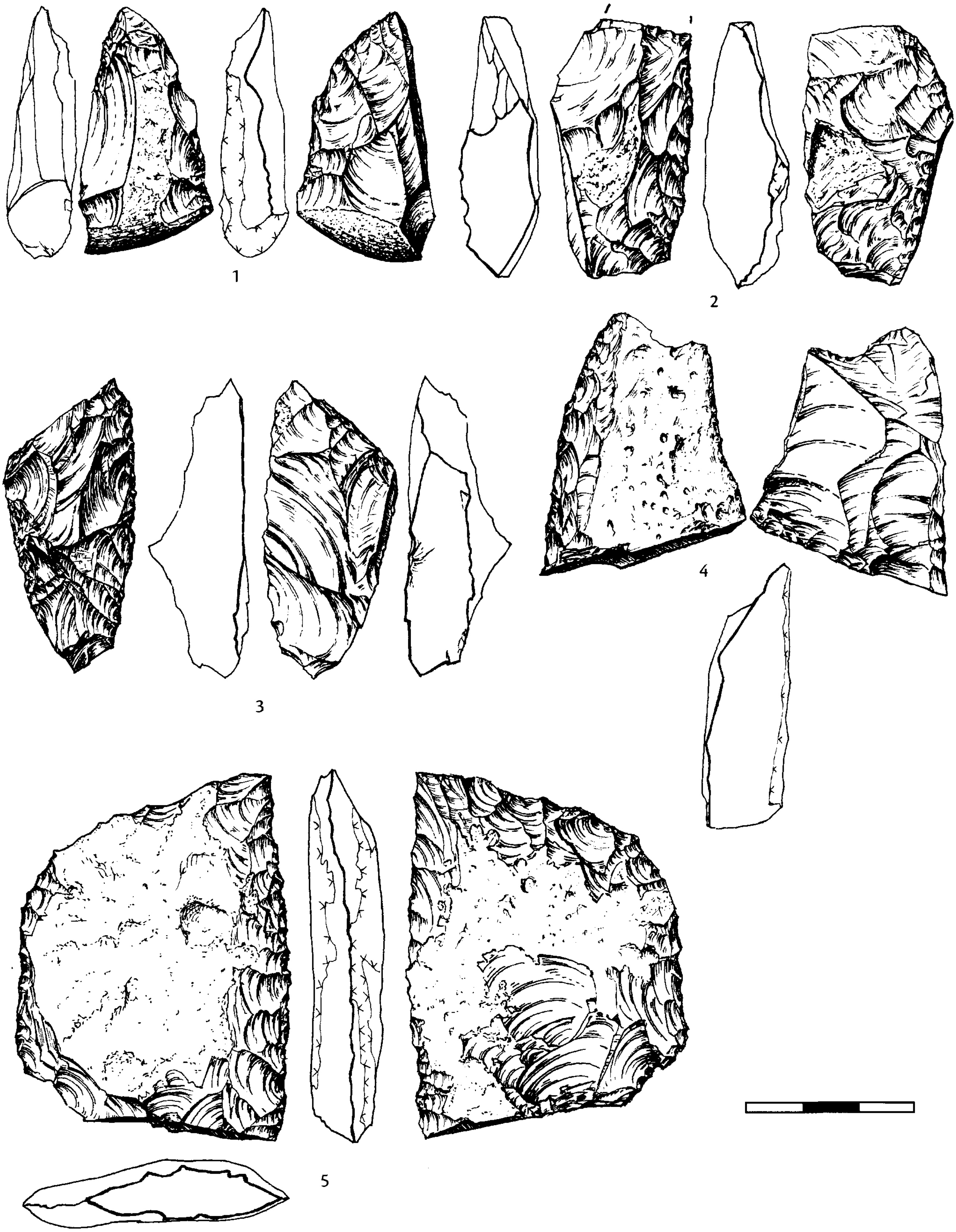


Figure 24-13—Chokurcha I Levels IV-I (2, 5), IV-I2 (3), IV-M (1), IV-O (4) bifacial scrapers: 1, 2, 3–convex, with natural back; 4–convex; 5–convex, with thinned back.

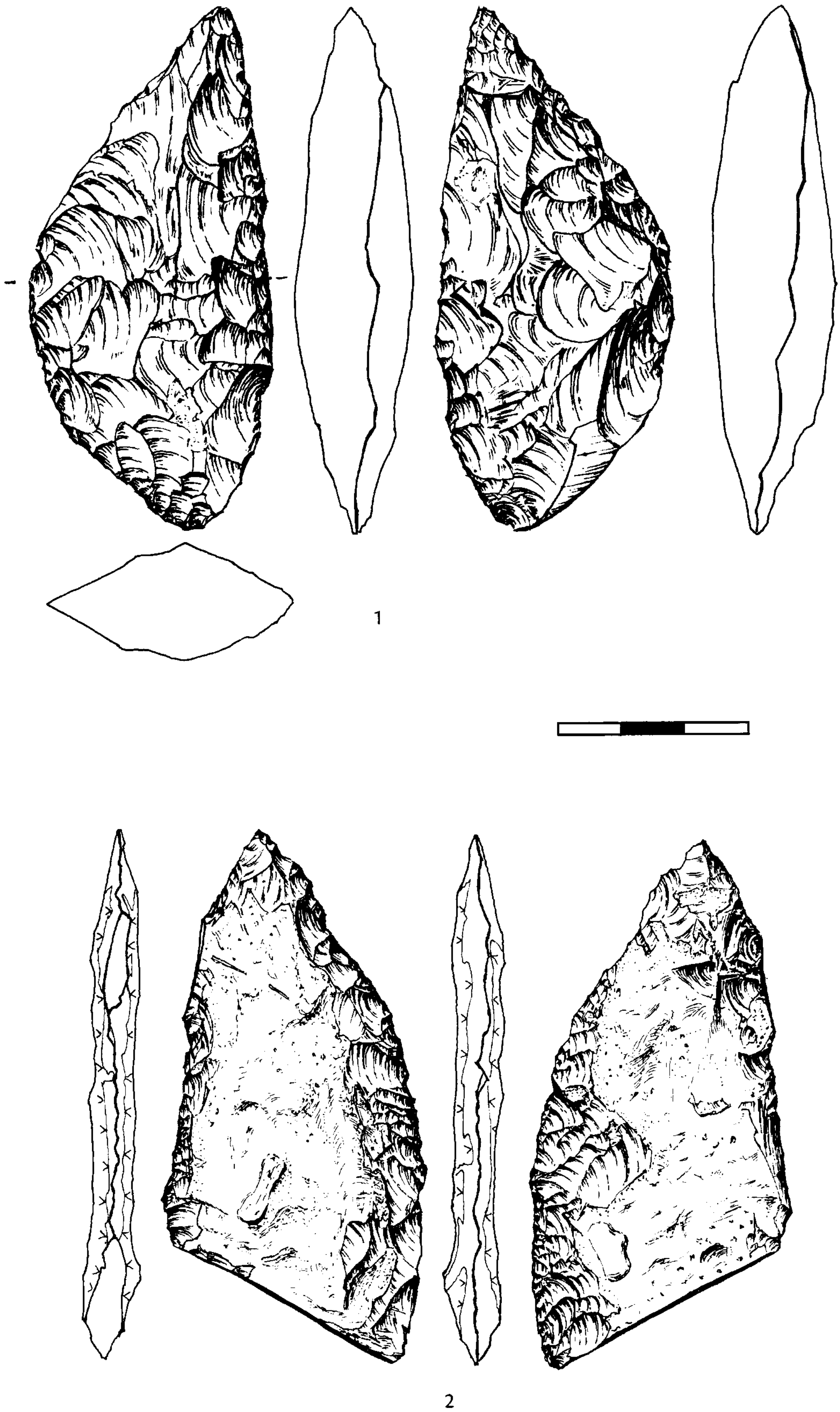


Figure 24-14—Chokurcha I Levels IV-G (1), IV-S (2) bifacial scrapers: 1–crescent; 2–semi-crescent, with natural back.

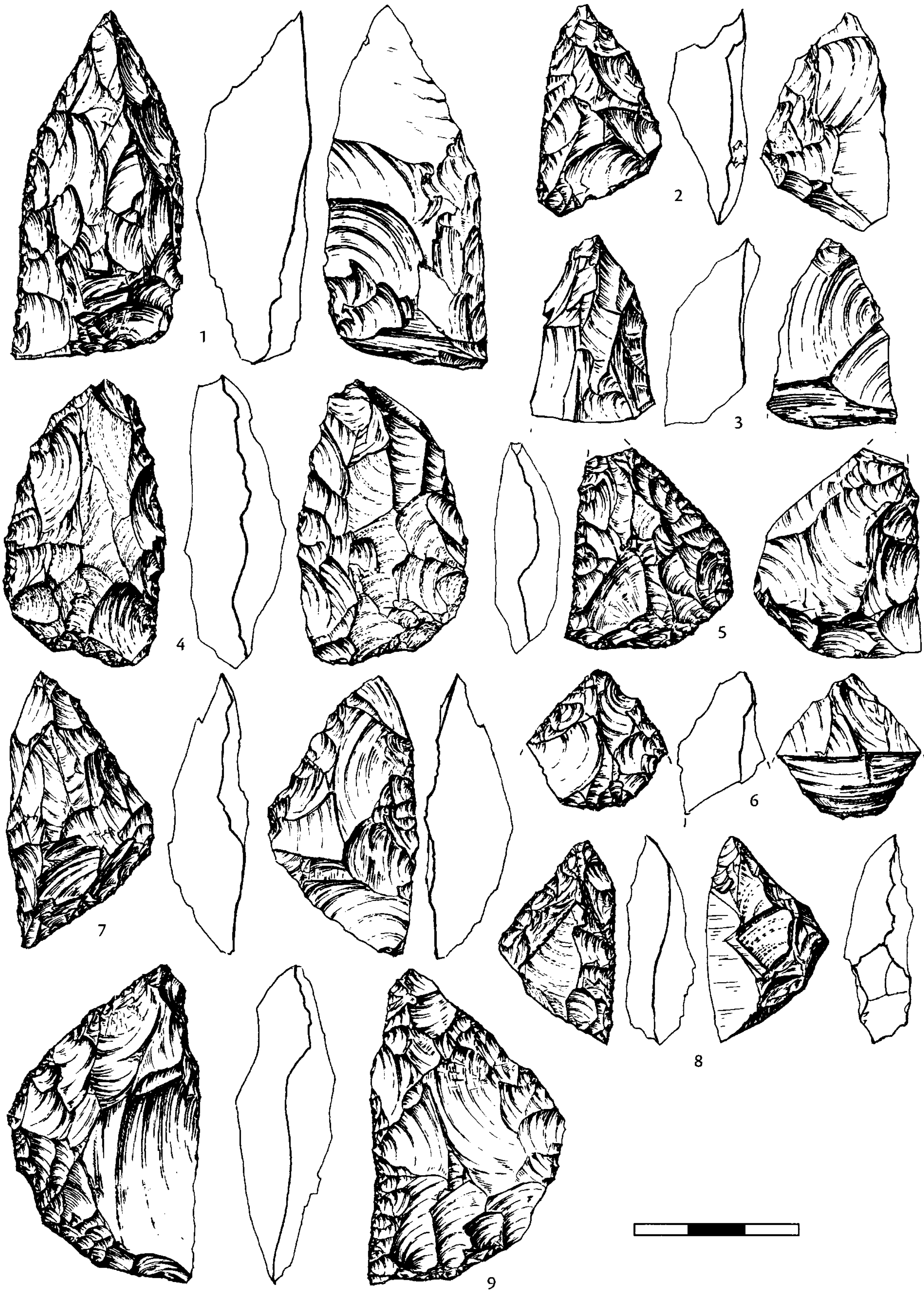


Figure 24-15—Chokurcha I Levels IV-A (4), IV-F (1, 3), IV-I (6), IV-I2 (2), IV-M (5, 8, 9), IV-O (7) bifacial scrapers: 1–sub-triangular; 2, 6–triangular; 8–sub-triangular, with natural back; 5, 9–crescent. 3, 4–Bifacial heavily exhausted tools. 7–Bifacial tool reutilized fragment. The patinated negatives showing by the dotted lines (4).

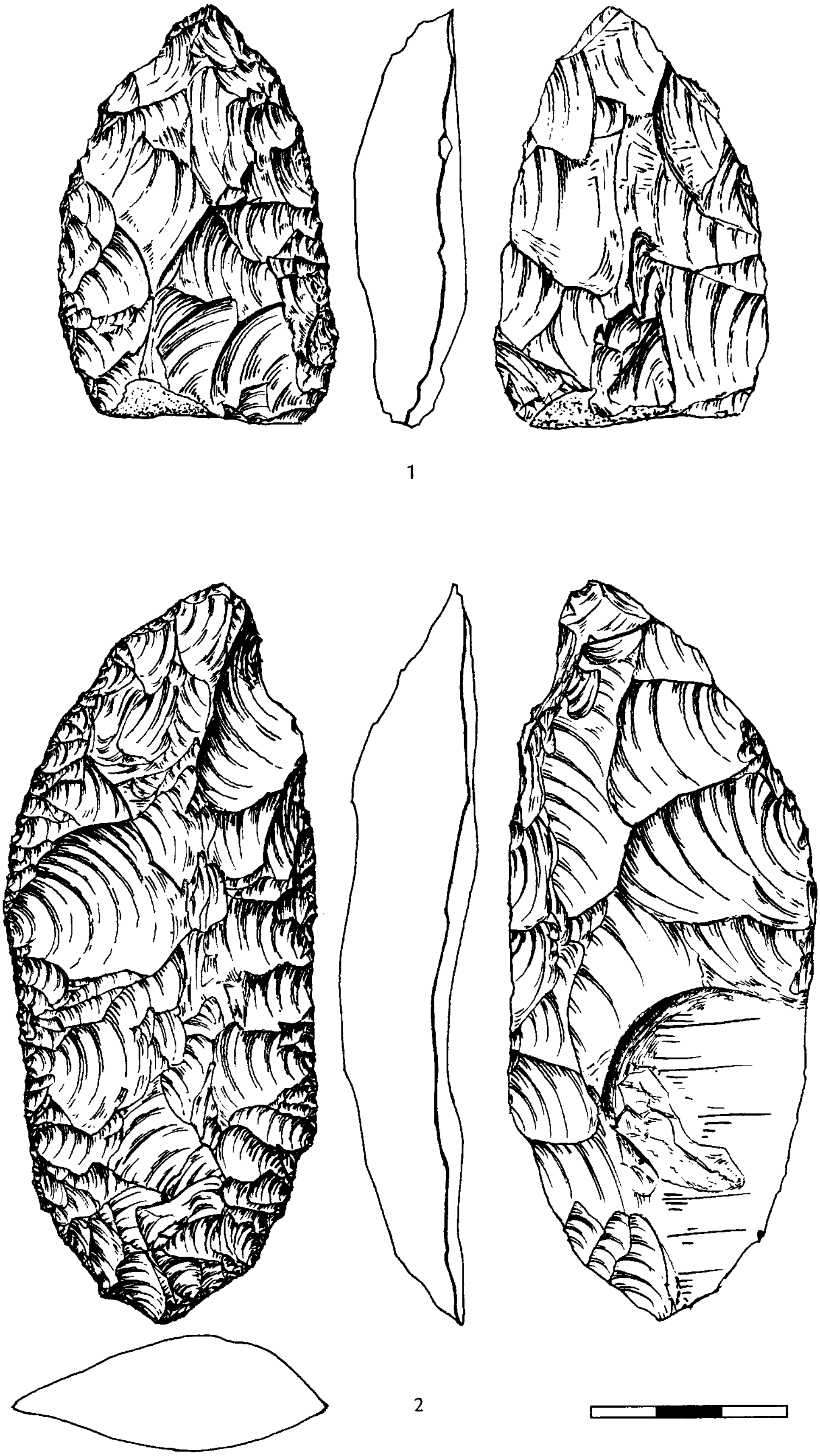


Figure 24-16—Chokurcha I Level IV-I (1, 2) bifacial scrapers: 1–semi-leaf; 2–leaf with thinned base.

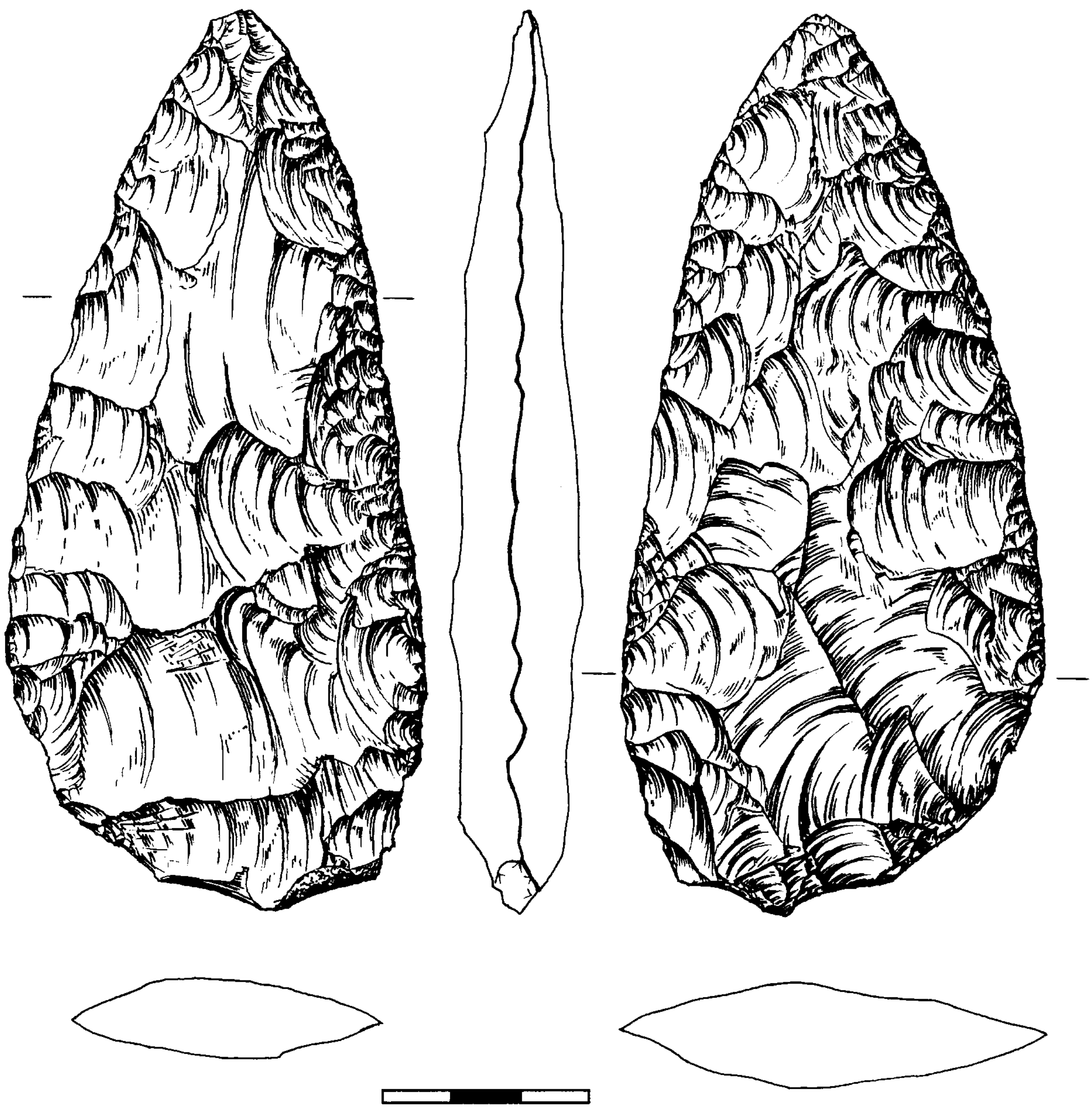


Figure 24-17—Chokurcha I Level IV-A, bifacial scraper: sub-leaf with thinned base.

Retouched Pieces and Thinned Pieces

Retouched pieces were found in seventeen of the nineteen levels containing tools. It is one of the most common tool classes, representing 29.2% of the total number of Unit IV tools. The most numerous form is a flake or chip with one obversely retouched lateral edge. Altogether, these account for ca. 60% of all retouched pieces. The remaining 40% fall into the other nine types of retouched pieces.

There are only two thinned pieces in Unit IV; both are flakes with ventral distal and ventral proximal thinning.

Unidentifiable Tools

The unidentifiable tools are tiny fragments of unifacial tools (59.5%), bifacial tools (38.0%), and heavily burned fragments (2.5%) of either unifacial or bifacial tools.

Pebble Macro-Tools

There are 2 pebble macro-tools in Unit IV: a chopper from Level IV-I and chopping tool from Level IV-M. The dimensions of the chopper are a length of 18.0 cm, a width of 10.5 cm, and a thickness of 6.5 cm. The chopping tool is somewhat smaller, with a length of 10.2 cm, a width of 9.8 cm, and a thickness of 5.7 cm.

Pebble Retouchers

The 31 pebble retouchers from Unit IV are subdivided into six types (Table 24-18). The most numerous are simple retouchers with one working surface, defined as a zone of cuts and scratches on one end of a pebble (Figure 24-18: *1*). The double retouchers have two working surfaces on opposite ends, but on the same pebble face (Figure 24-18: *2*). The alternate retouchers show two working surfaces situated on opposite ends and on opposite faces. The alternating retouchers have two working surfaces that are situated on the same end but on opposite faces (Figure 24-18: *3*). The semi-bifacial retouchers have three working surfaces, two of them are situated at the opposite ends of one face, and the third is situated on the opposite face. The bifacial retouchers are characterized by four working surfaces that are situated on both ends of both faces (Figure 24-18: *4*).

Pebble retoucher dimensions vary from 3.2 to 7.4 cm in length, from 2.3 to 5.3 cm in width, and from 0.7 to 3.7 cm in thickness. There was no relationship, however, between retoucher type and pebble size. For example, the size of the most complicated bifacial retoucher from Level IV-M is smaller (length = 3.7 cm, width = 2.3 cm, thickness = 1.8 cm) than the simple retoucher from Level IV-A (length = 7.4 cm, width = 5.3 cm, thickness = 3.7 cm). Five retouchers were made on sandstone pebbles, one on jasper, and the rest on tufa-like pebbles.

Table 24-18
Chokurcha I Unit IV: pebble retouchers

	IV-A	IV-A2	IV-B	IV-F	IV-I	IV-I2	IV-M	IV-O	*N*
Simple	1	1	·	2	4	1	2	5	16
Double	·	·	·	·	3	·	1	1	5
Alternate	·	·	1	1	·	·	·	·	2
Alternating	·	·	·	1	·	·	1	·	2
Semi-bifacial	·	·	·	1	·	·	1	·	2
Bifacial	·	·	·	·	2	1	1	·	4
Total	1	1	1	5	9	2	6	6	31

Hammerstones

Four hammerstones on tufa-like (2) and sandstone (2) pebbles came from Levels IV-L (1), IV-L2 (1), and IV-O (2). All exhibit a single working surface on a short and narrow end of the pebble. Pebble hammerstone dimensions vary in length from 6.1 to 7.9 cm, in width from 4.1 to 5.7 cm, and in thickness from 2.5 to 3.4 cm.

Hammerstone-Retoucher

A single piece found in Level IV-K had a combination of retoucher and hammerstone traces. It is on a tufa-like pebble with one area of cuts and scratches on a flat side and an area of deep cuts on a narrow side adjacent to the zone of cuts and scratches. The dimensions of this piece are a length of 6.5 cm, a width of 4.5 cm, and a thickness of 2.1 cm.

Bone Retouchers

Bone retouchers were found in eight levels (Table 24-19) and are subdivided into three types: simple, double, and triple. The simple retouchers have a single working surface on the distal extremity of the convex exterior side of the bone (Figure 24-19: *1, 2*). The simple retouchers were made on tubular bones fragments (18) and ribs (2 pieces). It is difficult to identify the species because of the diminutive size of the bones. It appears the majority of bone fragments (Figure 24-19: *1*), as well as the ribs (Figure 24-19: *2*), came from horses. One bone fragment might have been from a mammoth and 2 others from saiga.

Table 24-19
Chokurcha I Unit IV: bone retouchers

	IV-A	IV-B	IV-F	IV-I	IV-I2	IV-K	IV-M	IV-S	*N*
Simple	1	·	5	7	·	1	5	1	20
Double	1	2	6	4	3	·	5	·	21
Triple	·	1	·	1	·	·	·	·	2
Total	2	3	11	12	3	1	10	1	43

The double retouchers have two working surfaces on the proximal and distal extremities of the convex exterior side of the bone (Figures 24-19: *3*; 24-20: *1*). Double retouchers were made on tubular bone fragments, a rib, and bone flakes. Probably 2 of the 19 tubular fragments came from mammoth (Figure 24-20: *1*). The only double retoucher on a rib might be from a horse.

Two triple retouchers were found. The triple retoucher from Level IV-B has two working surfaces on the proximal and distal extremities of one side, and another working surface on the distal region of the other side of the bone. The retoucher from Level IV-I has two working surfaces on one side of the bone, while the third is on a narrow part of the bone (Figure 24-20: *2*).

There is no relationship between bone retoucher types and sizes. In many cases, it is not clear which bone retouchers are complete and which are broken, though the double and triple bone retouchers are

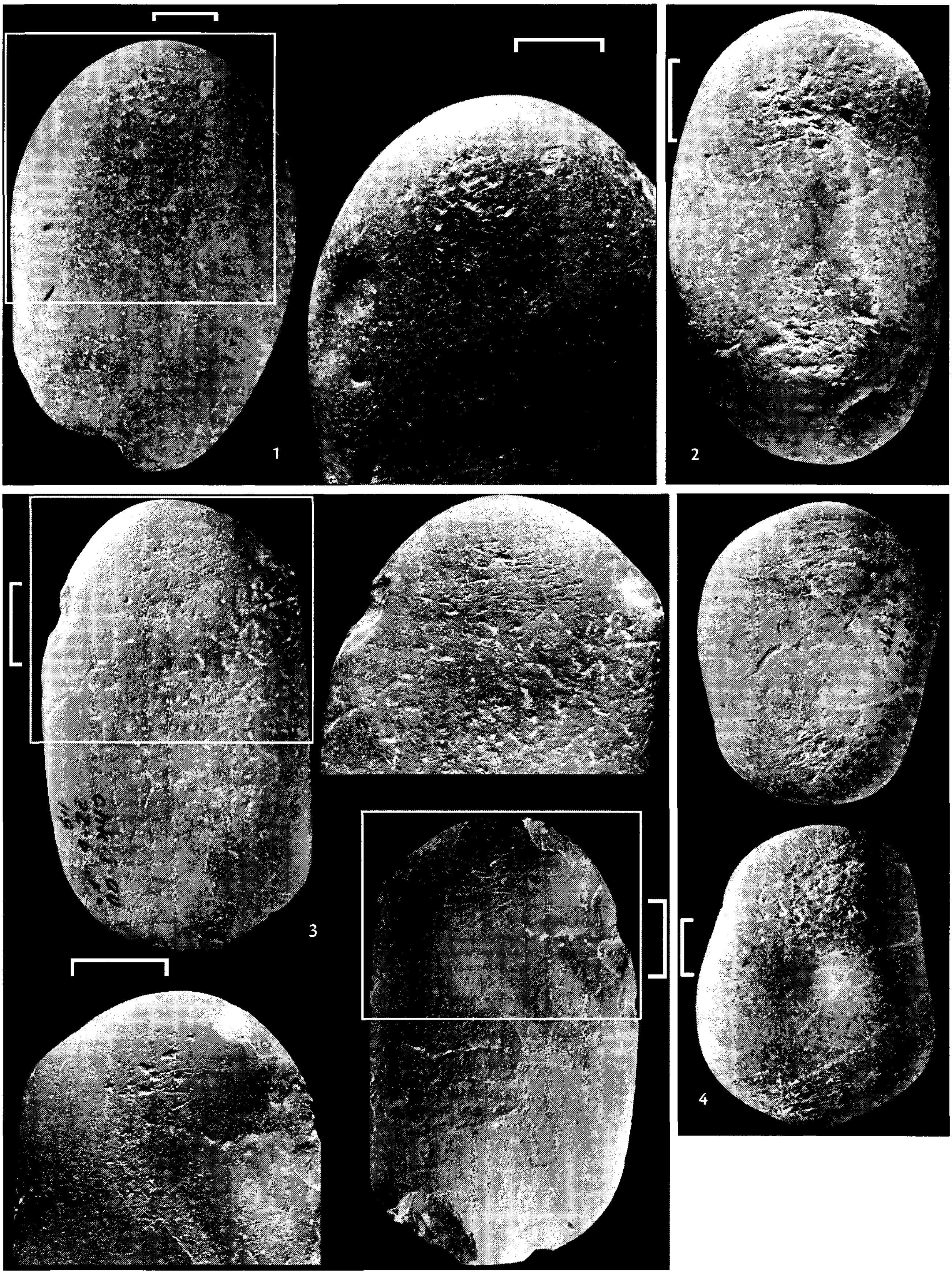


Figure 24-18—Chokurcha I Levels IV-K (1), IV-I2 (2), IV-F (3), IV-I (4) pebble retouchers: 1–simple; 2–double; 3–alternating; 4–bifacial. Photographed by Yu. Dekonchiev.

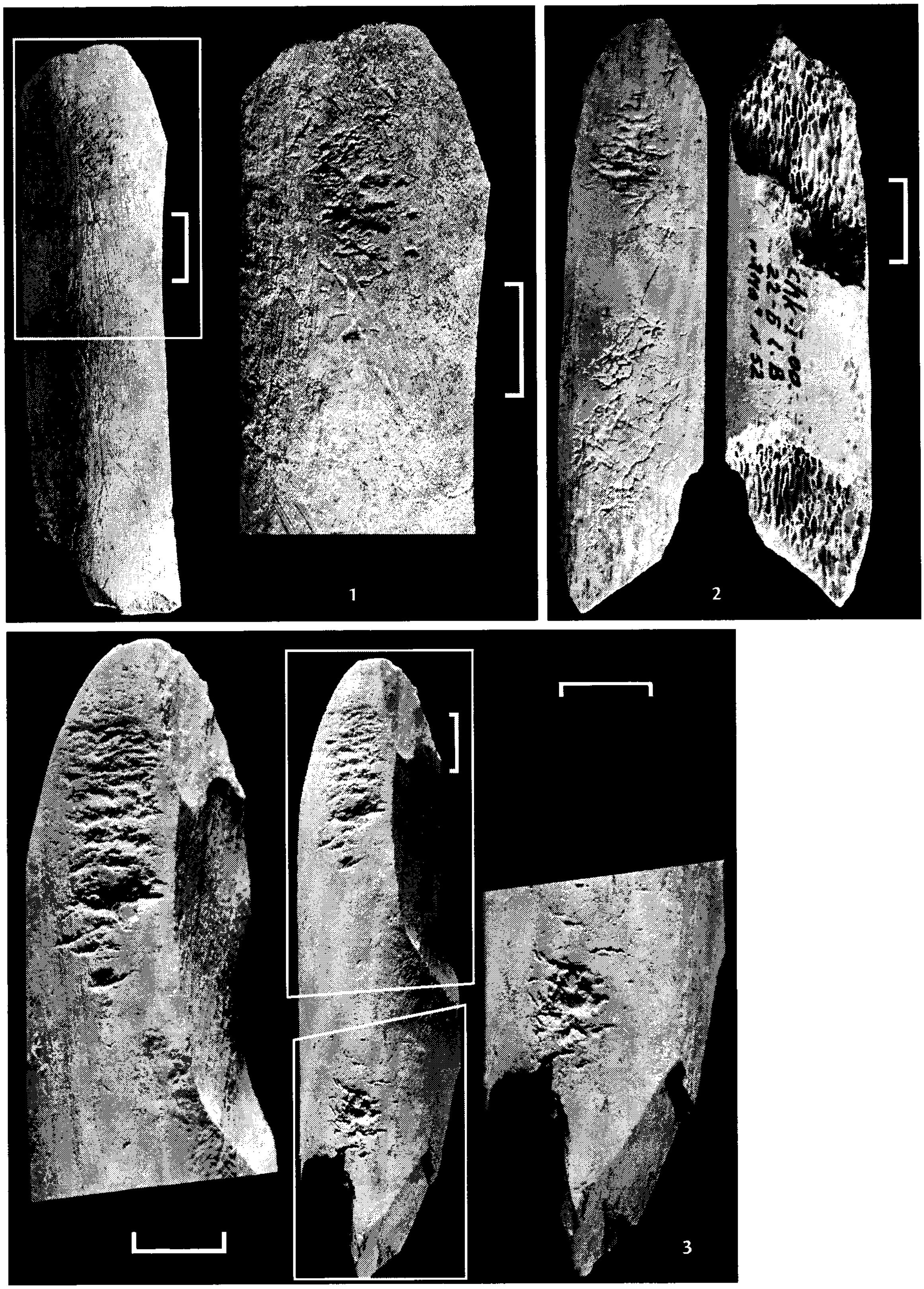


Figure 24-19—Chokurcha I Levels IV-M (1), IV-B (2), IV-I (3) bone retouchers: *1*–simple; *2*–simple, on rib fragment; *3*–double. The lower end of simple retoucher (2) shows the natural destruction of rib surface. Photographed by Yu. Dekonchiev.

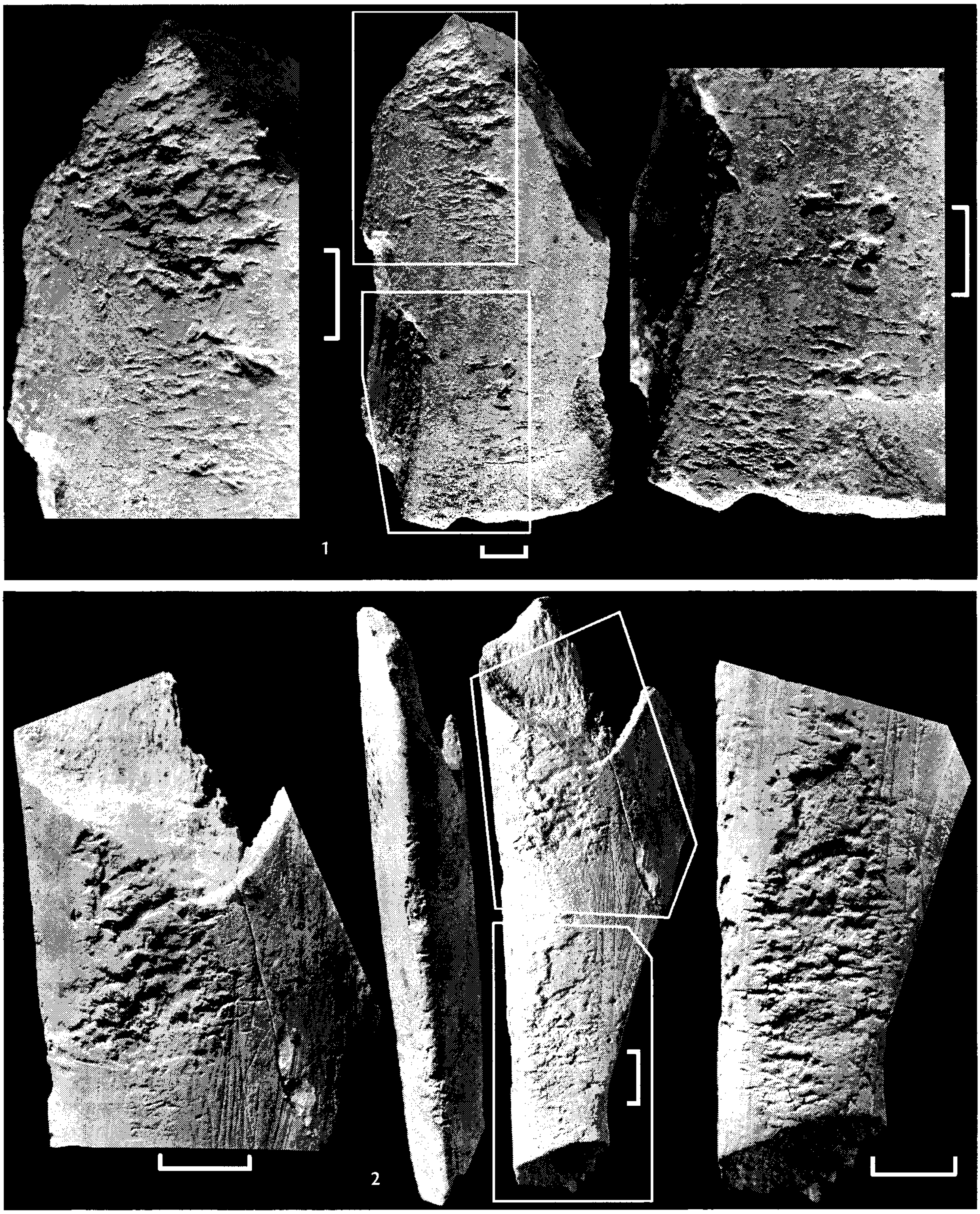


Figure 24-20—Chokurcha I Level IV-F bone retouchers: *1*–simple, on mammoth bone fragment; *2*–triple. Photographed by Yu. Dekonchiev.

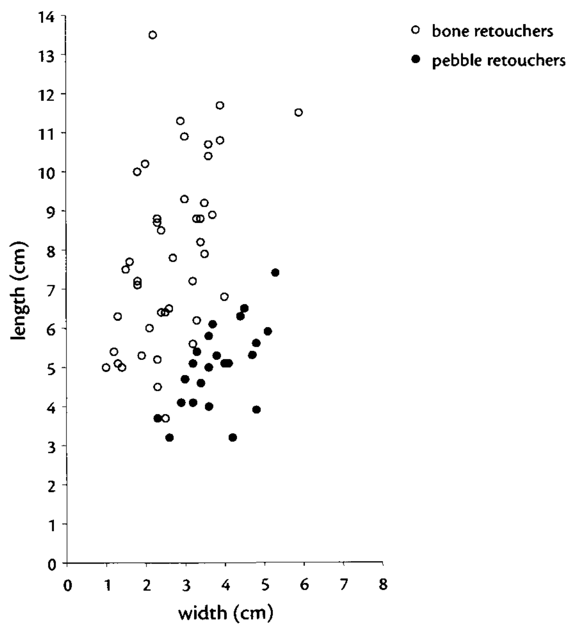


Figure 24-21—Chokurcha I Unit IV: length/width scatterplot for bone and pebble retouchers.

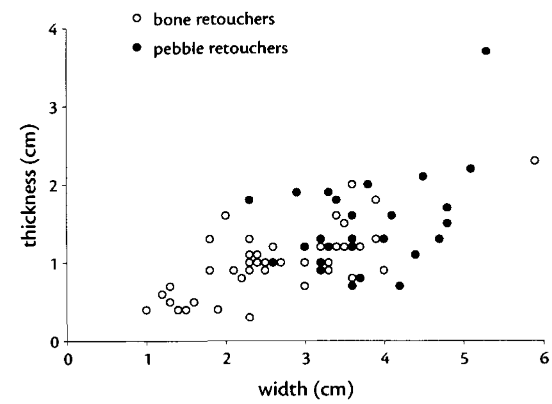


Figure 24-22—Chokurcha I Unit IV: width/thickness scatterplot for bone and pebble retouchers.

assumed to be complete. If so, these two types show the "real" size of bone retouchers. The double and triple retouchers range in length from 5.2 cm to 11.7 cm, width from 1.2 cm to 5.9 cm, and thickness from 0.6 cm to 2.3 cm. The maximum dimensions of simple retouchers are similar (length = 13.5 cm, width = 3.7 cm, thickness = 1.6 cm), while the minimum dimensions (length = 3.7 cm, width = 1.0 cm, thickness = 0.3 cm) differ little from that of double retouchers.

The dimensions of bone and pebble retouchers differ mainly by length (Figure 24-21), rather than by width or thickness (Figure 24-22).

Comparative Typological Analyses

On the whole, all the levels of Unit IV exhibit a similar pattern of artifact attribute composition. The differences that are present are caused by the statistically insufficient samples from many levels. There are three levels that produced a moderate number of artifacts: IV-I, IV-M, and IV-O. The comparison of debitage attributes for these levels found no significant differences.

There are, however, a number of typological differences between these levels, although they all fall within the traditionally recognized variability of the Crimean Middle Paleolithic. The percentages of bifacial tools vary from a maximum of 35.4% in Level IV-I to a minimum of 13.3% in Level IV-O. Usually, such a low bifacial tool percentage, as seen in Level IV-O, is characteristic of either the Staroselian or the Kiik-Koba facies of the Crimean Micoquian. On the other hand, more than 50% of the essential tool count of Level IV-O consists of simple, one-edge scrapers, while convergent scrapers account for only 24.4%. Such a high percentage of simple scrapers and a low percentage of convergent scrapers are considered to be characteristic of the Ak-Kaya facies of the Crimean Micoquian. The small tool size, which rarely exceeds 4 cm in length and width, is more common for the Kiik-Koba facies than the others. The series of small-sized semi-crescent, semi-trapezoidal, and sub-triangular scrapers (Figure 24-11: *1, 12, 13*) also fits well into a Kiik-Koba facies definition. Yet, the absence of points makes the Level IV-O assemblage closer to the Ak-Kaya facies, than to the Starosele or Kiik-Koba facies.

The percentages of bifacial tools in Levels IV-I (35.4%) and IV-M (27.8%), while similar to one another, differ from that of Level IV-O. Such high percentages of bifacial tools are characteristic of the Ak-Kaya facies of the Crimean Micoquian in its clearest manifestations, such as at Zaskalnaya VI Layer II and Kabazi II Units V and VI (Kolosov 1986; Chabai in press). Furthermore, the percentages of simple scrapers and converging scrapers in the Chokurcha I assemblages are close to what is found in the classic Ak-Kaya assemblages. At the same time, the assemblage of Level IV-M contains a series of small triangular and trapezoidal-shaped points (Figure 24-8: *3–6, 8*) identical in shape and size to the points found in the Kiik-Koba facies.

Certainly, all of these characteristics might be the result of the limited size of the excavated areas and the statistically insufficient number of artifacts. Given the size of the excavated area, it is difficult to prove that these typological differences were caused by either intensity of occupation or different models of raw material exploitation.

Technology

It appears that very little primary flaking took place in the excavated areas of Chokurcha I, thus, there is little to say regarding technology. It is clear that all bifacial tools were produced in the typical Micoquian plano-convex manner. The only pieces related to primary flaking are the core-like scrapers, where some refitting was possible (Figure 24-2: *1a–2c*). Even here, however, it is not clear whether to interpret the flakes struck from the core-like scrapers as "desired" products of primary flaking, or the waste from core-like scraper production. It is possible that the few recovered cores initially might have been bifacial tools that were broken during their exploitation and then reutilized as cores. The only visible technology employed in the Unit IV assemblages was the secondary treatment of both bifacial and unifacial tools. Flat to semi-steep scalar retouch was used on over 95% of both bifacial and unifacial tools in the essential count. The rest of the tools were retouched by a combination of flat or semi-steep scalar and sub-parallel retouch.

The bifacial tools underwent tip rejuvenation and edge resharpening. Bifacial tool tip rejuvenation was achieved by a lateral blow, removing the tool's distal extremity (Figure 24-3: 2, 3, 8, 10). In theory, the next step should have been the modification of this distal part into a plano-convex tip. The initial step of edge resharpening might have resulted in those preforms and/or heavily exhausted bifacial tools that are present in the assemblages (Figures 24-1; 24-15: 3, 4). The patinated bifacial tool shows that the resharpening started with relatively large removals (Figure 24-15: 4), while the subsequent stage retouched the "resharpened" edges. In any case, the edge resharpening resulted in a significant decrease of both width and length, while the thickness remained the same for relatively "fresh" bifacial pieces (Figures 24-7; 24-23).

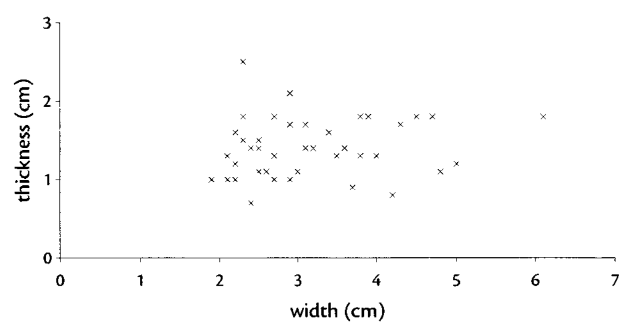


Figure 24-23—Chokurcha I Unit IV: width/thickness scatterplot for bifacial tools.

The Model of Raw Material Exploitation

The high tool percentages in each level (Table 24-1) suggest mainly off-site tool production. This conclusion is strengthened by the rarity of both cores and preforms (Table 24-1). Bifacial tools comprise 13.3% to 35.4% of each tool assemblage. The amount of bifacial thinning and blank rejuvenation (Table 24-2, Figure 24-4), the average blank size (Table 24-4), the size of thinning scars on bifacial tools, as well as the similarities between blank and bifacial tool sizes (Table 24-7) all suggest that the blanks from Chokurcha I Unit IV originated mainly from bifacial tool resharpening, reshaping, and rejuvenation. The process of bifacial tool reshaping/rejuvenation played a significant role in all Unit IV occupations. This is demonstrated by the consistent number of bifacial thinning/rejuvenation blanks (Table 24-2), as well as in the condition of the bifacial tools. If there were only a single bifacial preform, exhausted and reutilized bifacial tools would not be so rare (Tables 24-1, 24-17; Figures 24-1; 24-12: *1*; 24-15: *3, 4, 7*). During their "life," bifacial tools became narrower and shorter, while maintaining about the same thickness as the non-exhausted pieces (Figures 24-7; 24-23). Thus, after a number of resharpening/rejuvenation episodes, bifacial tools became short, narrow, and relatively thick. The number of bifacial tools with such characteristics is about 50% of the assemblages. The abandoned bone and pebble retouchers, as well as the rare hammerstones, appear to be indirect evidence of the dominance of reshaping/rejuvenating processes at the site.

Another result of reshaping/rejuvenation was a number of relatively small blanks. Some (circa 20%) show a combination of attributes that are usually expected from these types of pieces: curved and twisted lateral profiles, lipping, and obtuse platform angles. For the most part, the other blanks show the same attributes, but not necessarily in the combination seen for bifacial thinning pieces. It is unlikely that this indicates another, non-bifacial origin for these blanks. The sizes of most of the "regular" and bifacial thinning blanks are identical (Figure 24-5). So, there is no reason to believe that they derived from different reduction processes. The blank, obtained from bifacial tool reshaping were intensively used for unifacial tool production (Table 24-16; Figures 24-9: *3, 5*; 24-10: *1-4, 14*).

There are some blanks that do not look like the result of on-site raw material reduction. They are significantly larger in all dimensions, including platform size (Figures 24-5; 24-6; 24-7), than most blanks at Chokurcha I Unit IV. They also usually exhibit dorsal surface cortex. It is likely these "big" blanks were the result of off-site raw material reduction. Usually, "big" blanks were used to produce complex tools, such as points and convergent scrapers of various shapes (Figure 24-8: *1, 2, 10*).

In sum, the raw material exploitation in the Unit IV occupations was based on some bifacial and unifacial tool importation into the site area, with the majority of unifacial tools being produced on the by-products of bifacial tool reshaping/rejuvenation. A number of assemblages, especially from the levels that have thick lenses, contain both reduced and "fresh" tools. This might have resulted from numerous visits to the same surface during the "life" of the level.

Chokurcha I Unit IV in the Context of the Crimean Micoquian

The Chokurcha I Unit IV assemblages show strong affinities with the Ak-Kaya facies of the Crimean Micoquian, both typologically and technologically. The subdivision of the toolkits into simple, convergent, and bifacial tools, used in Crimean Middle Paleolithic studies as criteria for facies attribution (Chabai and Marks 1998), shows that the Chokurcha I Unit IV assemblages exhibit all possible varieties of the Ak-Kaya facies (Figure 24-24). Level IV-I has one of the highest percentage of bifacial tools (35.4%) within the Ak-Kaya facies, while the percentage of bifacial tools in Level IV-O (13.3%) places it at the other extreme of the Ak-Kaya cluster. This low percentage is more typical of the Starosele facies. The variability in the proportion of convergent tools is also significant. While the percentage of convergent tools in Level IV-I (16.7%) is the lowest for the Ak-Kaya facies, that of Level IV-M (39.4%) is close to the upper limit of its proportional distribution among Ak-Kaya facies assemblages. Finally, the simple tool distribution is bounded by Level IV-M (30.3%) on one side of the Ak-Kaya cluster, and by Level IV-O (57.5%) on the other. In spite of the seemingly significant differences in percentages, these variations are not terribly important when content is considered; that is, these typological ranges reflect the same or about the same technological and typological patterns.

As stressed in the introductory chapter (Chabai, Chapter 21), the characteristic feature of the Chokurcha I Unit IV sediments is the combination of at least two types of deposits: those from the in situ weathering of soft, Middle Eocene nummulitic limestones and those from river alluviation. So, the Chokurcha I Unit IV sedimentary rate appears to have been one of the most rapid in Paleolithic Crimea. This resulted in excellent preservation of both fauna and artifacts, as well as a clear separation of the numerous occupations by sterile sediments. In fact, there is no direct analogy for such an archeological sequence in Crimea. To some extent, the Chokurcha I Unit IV stratigraphic sequence might be viewed as a model for the extremely thick cultural layers at Zaskalnaya V. Zaskalnaya V is a collapsed rockshelter in same kind of limestone as Chokurcha I. The sediments comprising up to 4.5 m of the stratigraphic sequence were mainly from the weathering of the limestone wall and roof. As described by Kolosov (1983:45, 70), cultural layers II and III of Zaskalnaya V were each 35 to 45 cm thick. These horizons consisted of numerous ashy and burned bone lenses with fauna material and artifacts. The thickness of each lens did not exceed even a few centimeters. Yet, there were no sterile lenses in between the ashy/burned bone lenses. This absence was taken as evidence for a continuous occupation of the rockshelter. On the basis of this interpretation, the layers V and VI of Zaskalnaya V were evaluated as long-term base camps, with a large variety of on-site activities, including: primary flaking, tool production, meat consumption, and the creation of numerous constructions such as pits and hearths. Excluding primary flaking and intensive tool production, the range of activities at Chokurcha I Unit IV and Zaskalnaya V are identical. The significant primary flaking at Zaskalnaya V was because there were high quality flint sources nearby, which was not true at Chokurcha I. At the same time, the structure of the lenses that comprise the Zaskalnaya V cultural

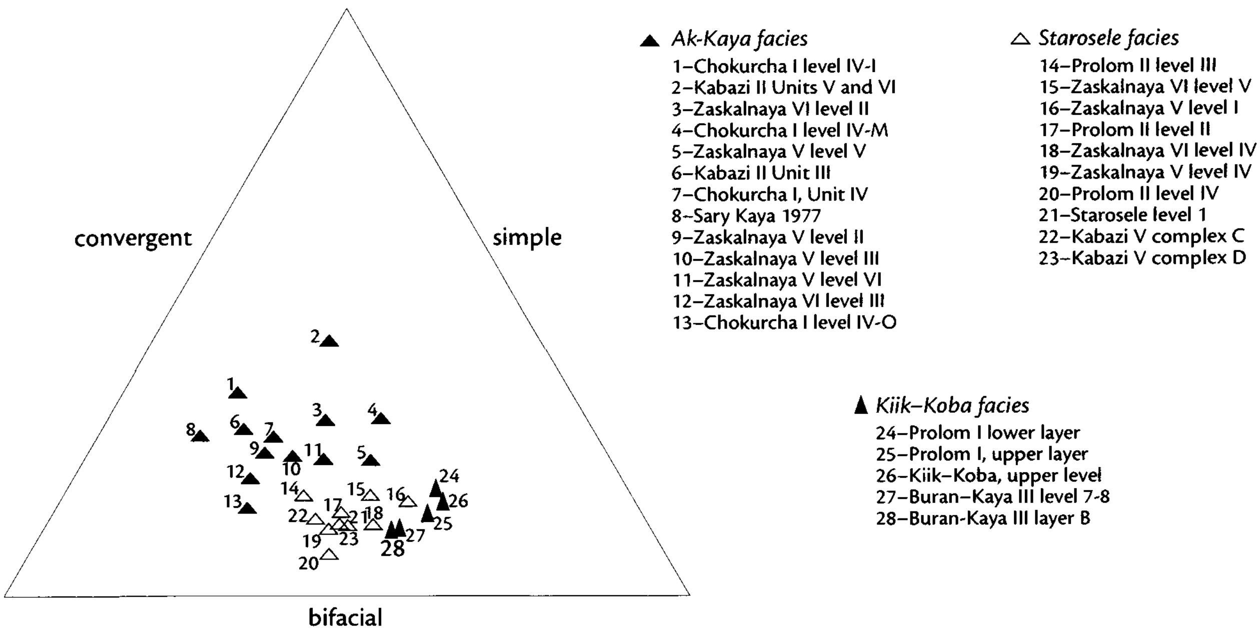


Figure 24-24—Facies distribution of the Crimean Micoquian assemblages.

layers is not much different from what was found in Chokurcha I Unit IV, especially for Levels IV-B, IV-F, IV-I, IV-M, and IV-O. All of these contain clusters of ash and burned bones, some of them exhibit pits and fireplaces. So, the ashy/burned bone lenses of cultural layers II and III of Zaskalnaya V are the "depositional analog to the archeological levels of Chokurcha I Unit IV." The only clear difference between the Zaskalnaya V and Chokurcha I Unit IV sequences is that, because of rapid sedimentation, the Chokurcha I Unit IV occupations were separated by sterile sediments in several archeological levels, while the Zaskalnaya V occupations, due to the relatively low sedimentation rate, were condensed into thick cultural layers. Thus, the Chokurcha I Unit IV data might be a basis for reevaluating the definition of the Zaskalnaya V settlement type.

The model of raw material exploitation employed at Chokurcha I Unit IV does not suggest any long-term occupation of the site area. To some extent, the Chokurcha I Unit IV raw material exploitation resembles that employed at Sary-Kaya and Kabazi II Unit III (Chabai and Marks 1998; Marks and Chabai 2001). At these sites, raw material exploitation was based on both bifacial and unifacial tool importation, which was slightly augmented by some on-site primary flaking. Yet, the difference between Chokurcha I, Sary-Kaya, and Kabazi II Unit III is seen in the rarity or even complete absence of tool resharpening/rejuvenation at the latter sites. Unlike Chokurcha I Unit IV, no traces of fireplaces or other kind of construction activity were ever found at Sary-Kaya or Kabazi II Unit III. Finally, the Sary-Kaya and Kabazi II Unit III occupations were killing/butchering stations, which is not the case for Chokurcha I Unit IV (Patou-Mathis, Chapter 22). Given the relative intensity of tool resharpening and the presence of some structures (pits, fireplaces) in a few of the archeological levels, the duration of the Chokurcha I Unit IV occupations may have been somewhat longer than those at the ephemeral killing/butchering stations.

Another analogy to the raw material exploitation seen at Chokurcha I Unit IV is the Kabazi II Units V and VI assemblages (Chabai, in press). These assemblages, as well as Chokurcha I Unit IV, were based on the importation of both bifacial and some unifacial tools into the site, with some weak evidence for core reduction and bifacial tool production. Also, fireplaces were present in the site area, and the pattern of faunal exploitation was very close to that found at Chokurcha I Unit IV. At the same time, resharpening/rejuvenating processes were not as intensively undertaken at Kabazi II Units V and VI as they were at Chokurcha I Unit IV.

The resharpening/rejuvenation processes at Chokurcha I Unit IV might have been as frequent as at Buran-Kaya III Layer B—a Kiik-Koba facies. For instance, at Buran-Kaya III Layer B, the bifacial thinning flakes comprise 29.3% of blank types (Demidenko, Chapter 9), while in the Chokurcha I Unit IV assemblages, bifacial thinning flakes comprise 25.2% of the total number of flakes with complete butts. The density of artifacts at Buran-Kaya III Layer B is considerably higher than for any level at Chokurcha I, plus the average dimensions of artifacts are much smaller than in the Chokurcha I Unit IV occupations.

The main reason for these differences might be the rate of sedimentation; that is, the unburied artifacts at Buran-Kaya III Layer B were utilized and reduced each time the site was revisited.

So, the Chokurcha I Unit IV occupations belong to a variety of short-term stations (Chabai and Marks 1998; Marks and Chabai 2001), which exhibit a number of common, as well as disparate, features for raw material and faunal exploitation. The most pronounced similarities are on-site importation of bifacial and unifacial tools, the absence or rarity of evidence for on-site tool production, and the presence of fireplaces.

In spite of the small excavated area, Chokurcha I Unit IV has added new information to our understanding of Crimean Micoquian variability. The ranges of typological variation in the Crimean Micoquian, and even within the facies of the Crimean Micoquian, may be relatively significant. Chokurcha I assemblages such as Level IV-M contain characteristic features of both Ak-Kaya and Kiik-Koba facies. Though the bifacial leaf-shaped points and bifacial backed scrapers that are characteristic of both the Staroselian and Ak-Kaya facies were found in Level IV-I, as a whole, the Chokurcha I assemblages exhibit a toolkit more characteristic of the Ak-Kaya facies, as well as the same raw material exploitation. So, in the case of the Crimean Micoquian, there is no reason to believe that this variability was caused by stylistic factors derived from three "paleo-ethnic groups": Ak-Kaya, Staroselian, and Kiik-Koba. In spite of seemingly sufficient differences in tool frequencies, the assemblages of the Crimean Micoquian exhibit technological and typological continuity that lasts about 100,000 years in the southern regions of Eastern Europe.

Part IV:
Synthesis & Conclusions

25

Crimea in the Context of the Eastern European Middle Paleolithic and Early Upper Paleolithic

Victor P. Chabai, Anthony E. Marks, & Katherine Monigal

Crimean and Eastern European Paleolithic studies have traditionally taken place within a cultural-historical paradigm. On the basis of often no more than proportional variations within shared toolkits, Middle and Upper Paleolithic assemblages have been divided into a number of "archeological cultures" (Gladilin 1976, 1985; Praslov 1984b; Rogachev and Anikovich 1984; Kolosov 1986; Anikovich 1992; Sytnyk 2000; Anissutkine 2001) or, even, "paleo-ethnic groups" (Stepanchuk 1999). To explain typological variability among seemingly different industries, the advocates of the cultural historical approach have appealed to "interactions" between cultures/paleo-ethnic groups. This has been most clearly manifest in studies of the Middle to Upper Paleolithic "transition," where, as for Western Europe (Mellars 1996; Gamble 1986), an acculturation hypothesis between local Middle Paleolithic and Aurignacian "invaders" has been incorporated into Eastern European Paleolithic studies to account for local, specific Early Upper Paleolithic industries (Amirkhanov et al. 1993; Cohen and Stepanchuk 1999, 2000; Anikovich 2000; Vishnyatsky 2000: 261).

"Interactions," if not acculturation, certainly must have taken place during the Paleolithic, but the huge area and the apparent very low Paleolithic population densities in Eastern Europe argue for only limited ones; too limited to serve as an overarching explanatory model for either typological or technological variability. While such might have occurred, there is very little archeological evidence for externally driven change. The one exception may have been, perhaps, in regions rich in needed and variable resources, which may have served as refugia during particularly harsh climatic conditions.

Climatic warming events are assumed to be a primary factor in the dispersal of humans, allowing them freer and more widespread access to fruit-bearing trees and the mammalian diversity that accompanies the spread of warm-temperate forest and woodlands (Speleers 2000; Gamble 1999). In contrast, occupation of environmentally hostile areas with restricted carrying capacities, due to limited availability of consumable flora and fauna, would require accurate and detailed knowledge of resources, be they raw material, food, or habitable places. The flat, monotonous topography of most of Eastern Europe provided few natural shelters, and the generally more harsh climatic conditions, as compared to other parts of Europe, seems to have resulted in a relatively late and "marginal" occupation by humans (Hoffecker 2002:xvii).

Although regional clustering of sites may be more often than not a reflection of archeological fieldwork, it is necessary to identify all local environmental factors that might lead to an area appearing as a favorable habitat to Late Pleistocene people. Unfortunately, not every archeological site can be unequivocally linked to even a major climatic phase. Even in cases where palynological analyses have been conducted, it is not unusual for their interpretation to conflict with that of sedimentary or microfaunal studies. The reader will note that the following discussion is limited to in situ, and often, stratified sites. The great many surface sites and redeposited localities are important—once they can be correlated with more secure sites having biostratigraphic and chronometric data—but are outside the scope of this chapter. Of all Eastern European regions, Crimea now provides the most complete and varied data, at least for the Middle and Early Upper Paleolithic. Therefore, out of necessity, this synthesis will focus on Crimean data. If at times it appears that a more appropriate title might have been "Eastern European Middle and Early Upper Paleolithic in the Context of Crimea" this merely reflects the present state of Eastern European Paleolithic research, not prehistoric realities.

Lacunae in the knowledge base about environmental, chronometric, settlement, and technological systems during the time of the Last Interglacial through the Middle Pleniglacial are sorely evident. This has always been and will always be the case even as our research designs become increasingly refined. Yet, if even the limited nature of our current data allows for speculative syntheses such as this, our working hypotheses may lead to new research designs, provide impetus for carrying out region-specific broad spectrum analyses (that include palynology, absolute dating, micro- and macro-faunal programs, e.g.), and otherwise invite prehistorians to look outside their specific local area towards the commonalities that the Middle and Early Upper Paleolithic of Eastern Europe must necessarily share.

Geographic Limits

The geographic limits of Eastern Europe are the Ural Mountains to the east and Scandinavia, the Baltic Sea, the Carpathian Mountains, and the Lower Danube to the west. The northern border of Eastern Europe is the southern shore of the Arctic Ocean, while the southern border lies along the Ural River, the Caspian Sea shore, the Main Ridge of the Caucasus Mountains, and the northern Black Sea shore (Figure 25-1). Eastern Europe occupies a huge expanse, over 4.5 million square kilometers, or about the size of the contiguous United States. The entire area represents the eastern portion of the Great European Plain,

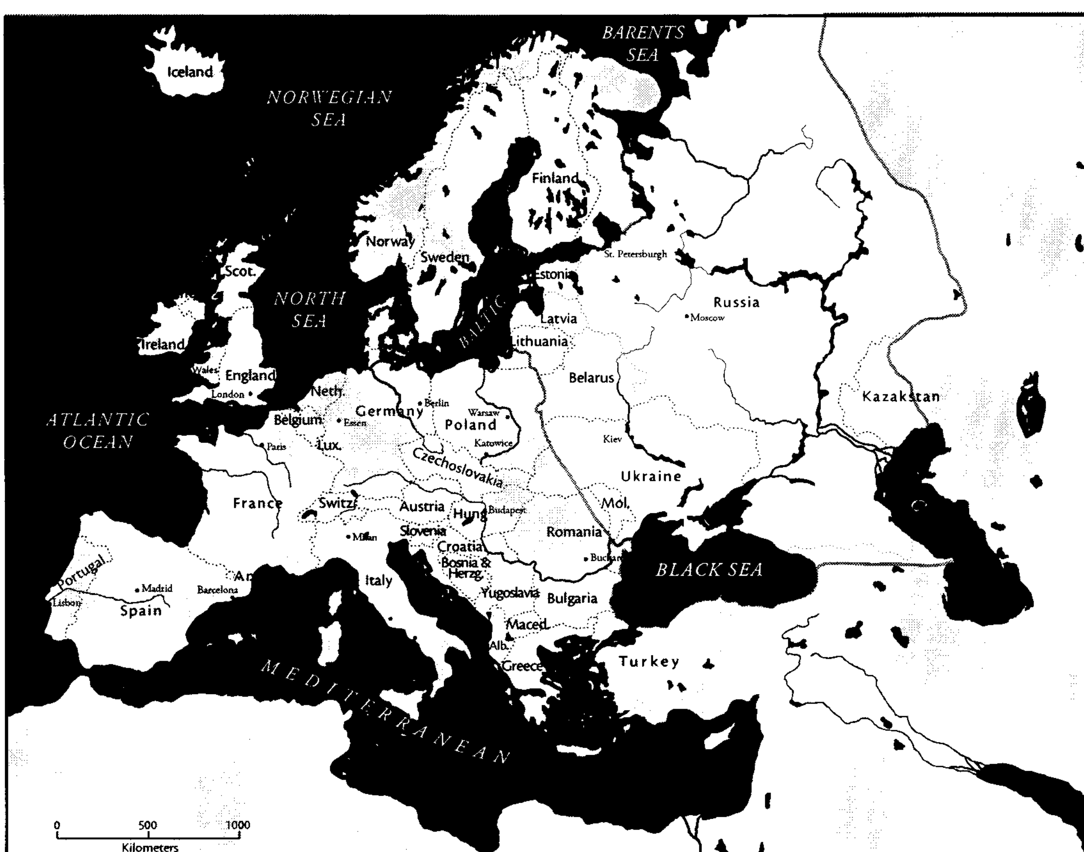


Figure 25-1—The limits of Eastern Europe.

which arcs across Europe and widens north to south between the Carpathian and Ural Mountains. This rolling plain is largely flat, with an average elevation of 200 meters above sea level (asl), broken up by a series of semi-circular hills of the terminal moraine that forms the Valdai Hills (maximum elevation 321 m asl), Central Russian Upland (340 m asl), and Volga Hills (330 m asl). To the southeast, the Oka-Don and Caspian Lowlands form depressions, with a minimum altitude of 28 m below sea level. The northern part of the European plain is poorly drained, with many swamps, marshes, and lakes. In contrast, the southern half of the plain is well drained with fertile soils. The extensive river system of Eastern Europe has a generally radial pattern of drainage, with the most important rivers (Dniester, Dnieper, Volga) draining to the south.

While the relentlessly flat topography of Eastern Europe might suggest an overall uniformity in those resources essential to Paleolithic peoples, this is far from the case. There were marked latitudinal environmental belts during the Pleistocene, from the ice sheet in the northern third of Eastern Europe to open steppe in the south. Not only did plant and animal resources differ according to these belts, but also the belts expanded and contracted with shifting stadial and interstadial conditions. On the other hand, environmental shifts, so strong on the Russian Plain, were relatively muted in Crimea, even under extreme cold conditions. Crimea was always habitable and it is therefore not surprising that there is evidence for human occupation throughout the Middle and Early Upper Paleolithic. This contrasts with the northern third of Eastern Europe, which was only habitable during the Last Interglacial—as hinted at by Eemian age finds in Finland (Schulz 2000–2001)—or in small unglaciated pockets just west of the northern Urals (Guslitzer and Pavlov 1993).

Partly following natural geographic boundaries and partly reflecting the history of Paleolithic field work in Eastern Europe, the following Middle Paleolithic and Early Upper Paleolithic "regions" of varying size traditionally have been recognized (Rogachev and Anikovich 1984; Gladilin 1985): the Mid and Lower Volga, the Mid and Lower Don, the Northern Caucasus, the Donbass (Donets Basin)-Azov region, Crimea, the Desna and Dnieper Rivers, the Polesye (Volynska), and the Prut-Dniester (Podolia) area. These regional divisions are likewise used in this report. The amount of information from each region varies considerably because of a combination of geological and historical factors. In spite of the large number of sites (Figure 25-2) often cited in syntheses of Eastern European Middle and Early Upper Paleolithic (e.g., Praslov 1984b; Cohen and Stepanchuk 1999; Hoffecker 2002), most cannot be used for detailed comparative analyses. The vast majority of sites lack stratigraphic and/or geological context, even many in situ sites are undated, and the problems of artifact mixture at surface sites is no different from other parts of the world. While such sites may provide supplementary information on site distributions, for instance, they cannot be used in temporal, regional, or developmental constructs. Therefore, although such sites will be mentioned, when useful, only in situ dated sites will be used as the framework of our understanding of the Eastern European Middle and Early Upper Paleolithic.

Past Environments: the Last Interglacial through the Middle Pleniglacial

Environmental and paleogeographic data from the Last Interglacial through the Denekamp (Arcy) Interstadial (ca. 128,000 to 28,000 BP) derived from various regions of Eastern Europe have allowed the reconstruction of past environments in ever-increasing detail. These reconstructions rely on pollen, bird and small mammal, medium- and large-sized faunal, and malacological analyses. In some regions, however, such analyses are spotty; the Prut-Dniester basins, Crimea, and the Don River Valley are the best documented.

Last Interglacial

During the Last Interglacial, the Karangat transgression—the result of eustatic oscillations in the Mediterranean Sea—caused sea levels in the Black Sea to rise 8 to 12 m higher than today (Dodonova et al. 2000; Chepalyga 1984:230). As a consequence, the mouths of the Danube, Dniester, Dnieper, and Don rivers were completely flooded, often replaced by brackish lagoons and extensive deltaic systems (Dodonova et al. 2000). At the same time, the Caspian Sea may have been connected to the Black Sea by the postulated Manych Strait. If so, the Northern Caucasus was separated from the rest of Eastern Europe by this channel (Chepalyga 1984:230) and Crimea may have been an island (Lazukov et al. 1981). To the far north, the Eemian Sea occupied the entire Baltic basin, turning Fennoscandia into an island and flooding the northwestern-most part of Eastern Europe (van Andel and Tzedakis 1996) (Figure 25-1).

In Crimea and around the northern Black Sea coast (south of 45°N), a steppe mammal community presided, typified by such small mammal fauna as *Ochotona pusilla* (steppe pika), *Spermophilus* (ground squirrel),

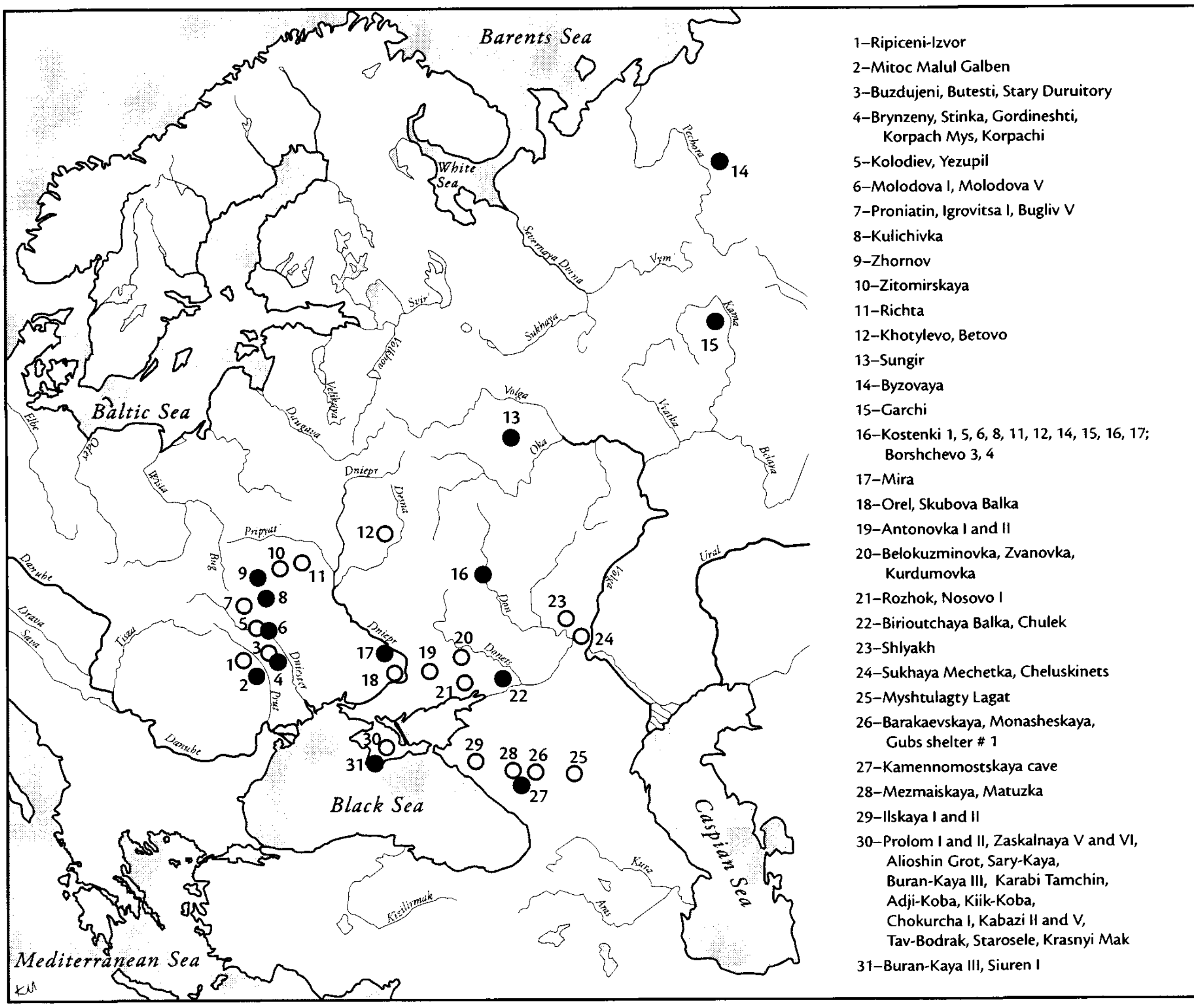


Figure 25-2—Eastern European Middle (○) and Upper Paleolithic (●) sites mentioned in text.

Spalax (Ukrainian blind mole-rat), *Allactaga major* (great jerboa), *Sicista subtilis* (southern birch mouse), *Ellobius talpinus* (northern mole-vole), *Lagurus* and *Eolagurus* (steppe lemming), *Microtus (Stenocranius) gregalis* (narrow-skulled vole), and *Microtus obscurus* ("obscurus" vole) (Markova 2000b).

In the Caucasus during the Last Interglacial, environments were warm and humid in the areas below 1,000 m asl, with deciduous and frequent exotic arboreal species reflecting a tropical to sub-tropical climate (Golovanova and Doronichev 2003:76). In the higher areas, the climate was also warmer than the present-day and forests were dominated by mixed coniferous firs (Golovanova and Doronichev 2003:79).

The Eastern European part of the Great European Plain saw the expansion of woodland and forest, further north than at present. First, it was colonized by *Betula* (birch), quickly followed by *pinus* (pine). During the temperate phase of the Last Interglacial, *Ulmus* (elm), then *Quercus* (oak) rapidly became the dominant forms of deciduous taxa, which were then mainly replaced by *Corylus* (hazel). The late-temperate stage of the Last Interglacial in this area was characterized by the swift spread of *Carpinus betulus* (hornbeam), which soon dominated the landscape, although *Alnus* (alder), *Quercus* (oak), *Albies* (silver fir), *Fraxinus* (ash), *Taxus* (yew), and other temperate trees remained in the forest spectra (Turner 2000: 223; Bolikhovskaya and Molodkov 2002). The gradual cooling at the end of the Last Interglacial resulted in the formation of boreal forest, heaths, and bogs. In general, the rapid expansion of all of these taxa during the Last Interglacial indicates that there were no short-lived climatic oscillations during this period, but rather there was only a continual warming (Turner 2000). This enabled the speedy migration northward of thermophilous flora and fauna, including humans, from their more southerly habitats and refugia. Large mammal fauna on the East European Plain included *Mammuthus primigenius* (mammoth), *Palaeoxodon antiquus* (forest elephant), *Coelodonta antiquitatis* (woolly rhinoceros), *Bison priscus* (steppe bison), and *Bos trochoceros* (aurochs) (Markova 2000b).

Early Glacial and Early Pleniglacial

During the Early Glacial and Early Pleniglacial, the post-Karangat (pre-Surozh) regression caused the Black Sea to drop 100–110 m below its present day level (Chepalyga 1984). This resulted in a dry shelf from the mouth of the Dniester to Crimea, where deflation and loess sedimentation was rampant. The northern bank of the Black Sea was 250–300 km south of the present-day mouths of the Dniester, Dnieper, and Don (Dodonova 2000). The Caspian Sea shrank, the Azov Sea disappeared, and the Northern Caucasus was joined to an enlarged northern Black Sea Plain that included Crimea (Alekseev et al. 1986).

Further north, the Scandinavian ice sheet expanded, covering the land adjacent to the Barents and Baltic Seas. While it did not cover nearly as large an area as it did during the Penultimate Glacial, the climate of Eastern Europe became significantly colder and drier. During the climatic oscillations of the OIS 5d–5a interval, open vegetation and forest conditions alternated. In response to the extension of the Scandinavian ice sheet during OIS 4, polar desert appeared at the sheet's margins. South of this, tundra and cold-arid steppe expanded, at the expense of thermophilous vegetation throughout the area, even in refugia (van Andel and Tzedakis 1996:491).

In Crimea during this period, neither fauna nor flora reflect such harsh climatic conditions, as boreal flora and fauna were uncommon (Gerasimenko 1999, 2003; Markova 1999; Mikhailesku 1999). The small mammal community of Crimea was typical of open, arid steppe, including *Eolagurus luteus, Spermophilus pygmaeus,* and *Microtus obscurus* (Markova 1999). Many of these were also present in the Last Interglacial community, indicating that there was only a moderate change toward more open and drier environments during this period. The pollen of OIS 4 indicates a sharp drop in broad leaved taxa, corresponding to a sharp increase in non-arboreal pollen. *Pinus* and *Alnus* mainly lead the arboreal taxa, while non-arboreal taxa include the xerophytic Chenopodiaceae (goosefoot, thistle), *Artemisia* (sagebrush), and *Ephedra* (ephedra) (Gerasimenko 1999:124).

Middle Pleniglacial

During most of the Middle Pleniglacial (from Moershoofd to Arcy), there was a significant rise in the Black Sea sea level during the Surozh transgression, to what was probably equivalent to its present-day size (Chepalyga 1984:234). The Azov Sea most likely did not exist at this time (Alekseev et al. 1986: 172–176). Instead, the Don River Valley extended into the area (Alekseev et al. 1986:172), and the northeastern-flowing Crimean rivers became tributaries of the Don. Due to the warming climate and the resultant increased evaporation, the Caspian Sea shrank considerably (Yenotayevka regression), with strandlines 45–60 m lower than today (Chepalyga 1984).

Middle Pleniglacial environments differed considerably by region but, in general, they were not as harsh as during the Early Pleniglacial. In Crimea, no boreal flora or fauna are found for this period (Gerasimenko 2003). Crimean landscapes were characterized by forms of forest-steppe/steppe, with mainly pine as the arboreal vegetation. In the Prut-Dniester, pine was also important in forest-steppe and steppe landscapes, although boreal forms such as spruce were common (Bolikhovskaya and Pashkevich 1982; Pashkevich 1987; Păunescu 1993). The reconstruction of forest-steppe and steppe environment for Crimea and the Prut-Dniester region is supported by faunal remains, including *Saiga tatarica, Equus hydruntinus, Equus caballus, Mammuthus primigenius,* with only rare *Cervus elaphus* and *Rangifer tarandus* (Alekseeva 1987; López Bayón 1998; Burke 1999a; Patou-Mathis 1999; Patou-Mathis, Chapter 22; Laroulandie and d'Errico, Chapter 7). According to Alekseeva (1987:160), the presence of reindeer in a Dniester Valley site might be explained by its fall/winter migration from more northerly habitats.

The environment of the Mid Don region during the Middle Pleniglacial was quite distinct from those contemporary environments in Crimea and in the Prut-Dniester regions. During the first part of the Middle Pleniglacial, the area had humid forest vegetation of northern taiga type, dominated by spruce, along with birch and pine (Malyasova and Spiridonova 1982:237–238). By the Arcy (Bryansk) Interstadial, this boreal forest was somewhat drier and of southern type, dominated by birch and pine with an overall decrease in arboreal pollen (Malyasova and Spiridonova 1982: 241–245). Markova et al. (2002:394) have reported that the taiga communities during the Bryansk were discontinuously distributed, forming "islands," and were also present in protected areas in the Russian Plain highlands. The fauna was dominated by *Equus latipes* and *Lepus tanaiticus,* which were adapted to the taiga forest-steppe and forest biotopes (Vereshchagin and Kuzmina 1982:227). At the onset of the Late Pleniglacial, the taiga forests were replaced by open forest-steppe and steppes (Malyasova and Spiridonova 1982:245).

To the north of the Mid Don region, the numerous warming events during this period saw the northward expansion of conifer woodland, while north of 55°N latitude, shrub tundra prevailed, characterized by *Betula nana* (dwarf birch), *Salix* (willow), and *Juniperus* (juniper) (Van Andel and Tzedakis 1996). In the Northern Caucasus, meadow steppes and mixed coniferous forests gave way during the Denekamp to deciduous forests with rare exotic arboreal species (Golovanova and Doronichev 2003).

The Eastern European Middle and Early Upper Paleolithic in Time and Space

Regional chronological syntheses for Eastern Europe (Kolesnik 1994; Chabai et al. 1998, 1999; Sytnyk 2000; Golovanova and Hoffecker 2000) have reported that: (1) no known Middle Paleolithic assemblage can be dated before the Last Interglacial (Boguckyj et al. 2001; Chabai in press); (2) the latest manifestation of the Middle Paleolithic occurred during the Denekamp (Arcy) Interstadial (Monigal, Chapter 1); and (3) from about 38,000 to 28,000 BP, Middle and Early Upper Paleolithic industries co-existed (Chabai 1996, Chabai et al. 1998).

The chronological and geographical distribution of Middle Paleolithic and Early Upper Paleolithic assemblages in Eastern Europe share some commonalities but also exhibit regional differences. There are only two regions, the Prut-Dniester and Crimea, that contain evidence for more or less continuous occupation from the Last Interglacial to the Denekamp (Arcy) Interstadial (Tables 25-1 and 25-4). In the Volga and Donbass-Azov regions, only early Middle Paleolithic is known, presumably dating to the Last Interglacial, Early Glacial, and Early Pleniglacial, while in the Northern Caucasus the known Middle Paleolithic dates only to the Middle Pleniglacial (Tables 25-2 and 25-3). There are no certain Early Upper Paleolithic sites known in the regions of the Volga and Donbass-Azov, or in the Northern Caucasus, for that matter. Only in Crimea, the Prut-Dniester, and the Mid Don regions are unequivocal Early Upper Paleolithic assemblages known.

There are three Middle Paleolithic entities defined for Eastern Europe: the Micoquian, a Levallois-Mousterian, and a Blade Mousterian (Chabai 2003). The only one found throughout Eastern Europe is the Micoquian: it extended from the Prut-Dniester region in the west, to the Volga region in the east, and from Crimea in the south to the Northern Urals in the north. In spite of its wide distribution, only in Crimea, where it lasted from the Last Interglacial to the Arcy Interstadial, does it appear to have had such a long continuous presence (Table 25-1). The Levallois-Mousterian has been found in two regions, the Prut-Dniester, where it lasted from the Last Interglacial through the Moershoofd, and Crimea, where it occurred in two periods: from the stadial preceding the Hengelo through the Hengelo and during the latter part of Würm III through the Denekamp (Arcy). The Blade Mousterian has been found only in the Don Basin, where it lasted from roughly the Brörup to OIS 4.

There are five entities defined for the earlier part of the Upper Paleolithic in Eastern Europe: the Streletskaya, Spitsynskaya, Gorodtsovskaya, Aurignacian, and the Early Gravettian. The Aurignacian was the most widespread of these, with unquestionable in situ sites in Crimea, the Prut-Dniester, and the Mid Don, and lasted roughly from 33 to 24,000 years BP. The Streletskaya was limited to the Don and Crimea, and appears to have lasted from 36 to 28,000 years BP. The Spitsynskaya is known only from the Mid Don and dates to between 36 and 32,000 years BP. Likewise, the Gorodtsovskaya is only known from the Mid Don, where it dates to between 28 and 25,000 years BP. The Early Gravettian was restricted to the Prut-Dniester and Mid Don and first appeared ca. 28,000 years BP.

Based on chronostratigraphic data from throughout Eastern Europe, the Middle and Early Upper Paleolithic may be divided into three temporal units (Chabai 2003): a 1st Period dating from the Last Interglacial through the Moershoofd Interstadial, (i.e., Riss/Würm to Würm I/II); a 2nd Period including the Hengelo Interstadial and the previous stadial (i.e., from Würm II to Würm II/III); and a 3rd Period including Denekamp (Arcy) Interstadial and the preceding stadial (i.e., Würm III–Würm III/IV).

The 1st Period (Last Interglacial through the Moershoofd Interstadial)

The 1st period, approximately spanning 125,000 to 60,000 years ago, saw the appearance of the Micoquian, Levallois-Mousterian, and Blade Mousterian in the various regions of Eastern Europe, often simultaneously in multiple locations. Crimea and the Prut-Dniester have an especially high number of occupations during this time in comparison to the other areas (Figures 25-3 and 25-4).

Crimea

During the 1st Period in Crimea, with the exception of the problematic assemblage from Starosele level 3, the Micoquian was the only Middle Paleolithic known (Table 25-1). Taking into account the probable geographic isolation of Crimea during the Last Interglacial (Lazukov et al. 1981), it is possible to divide this period into two stages: the Last Interglacial

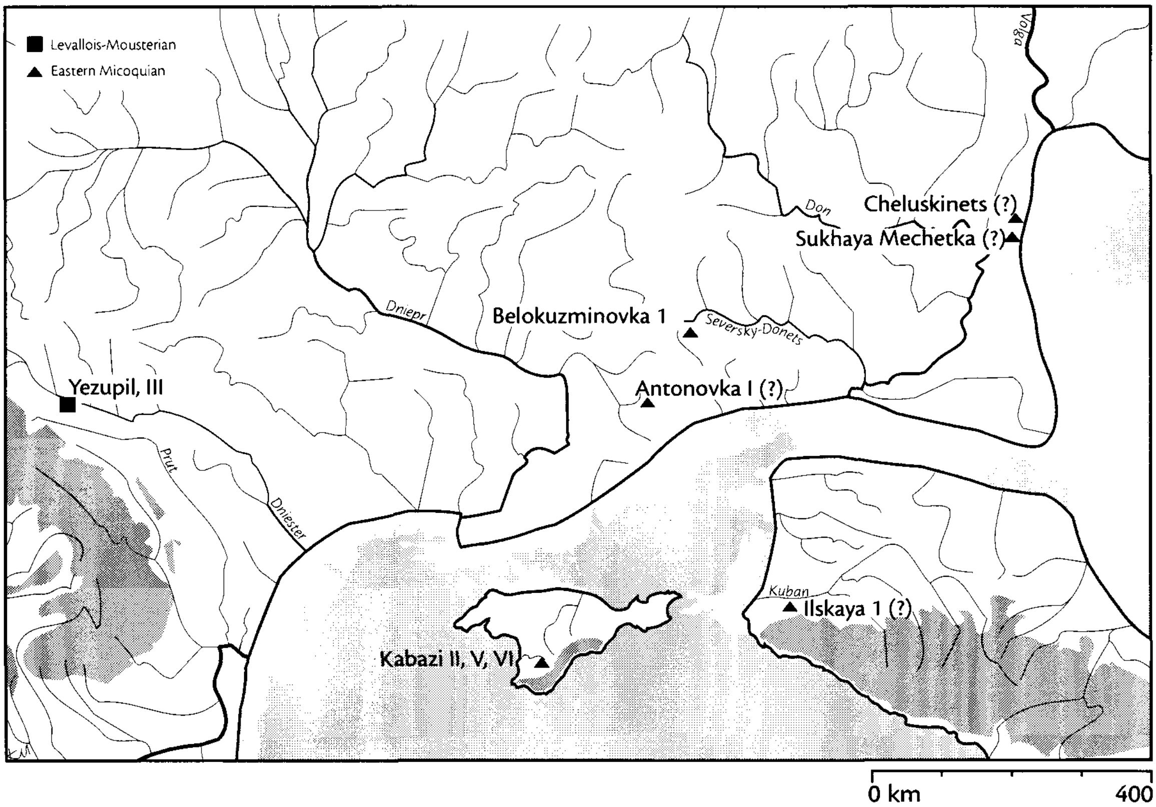


Figure 25-3—Sites of the Last Interglacial stage of the 1st Period of the Eastern European Middle Paleolithic.

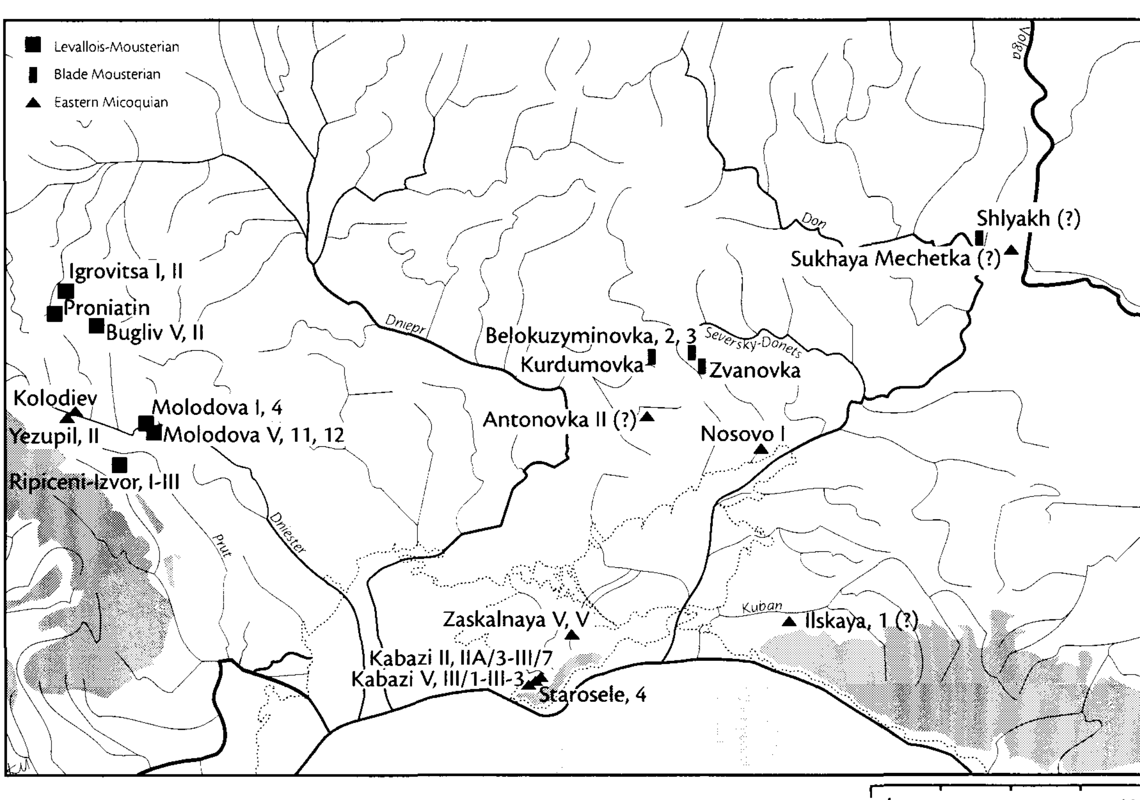


Figure 25-4—Sites of the Early Glacial–Moershoofd stages of the 1st Period of the Eastern European Middle Paleolithic.

Table 25-1
Chronology of the Crimean Middle Paleolithic and Early Upper Paleolithic (shaded areas are warm periods)

Industries	*Sites*	*Dates*			*Geochronology*
		Radiocarbon	*ESR*	*U-series*	
Aurignacian	Siuren I, Fb2	OxA-5155 29.95±0.7			Arcy (Denekamp)
	Siuren I, Ga	OxA-5154 28.45±0.6			
	Siuren I, H	OxA-8249 28.2±0.44			
Micoquian	Buran-Kaya III, B	OxA-6674 28.52±0.46			
		OxA-6673 28.84±0.46			
	Zaskalnaya VI, II	OxA-4131 30.11±0.63			
	Prolom I, upper layer	GrA-13917 30.51±0.58/0.53			
		GrA-13919 31.3±0.63/0.58			
	Zaskalnaya V, I				
Western Crimean Mousterian	Kabazi II, A3A-A4				
	Kabazi II, II/1A		30±0.2		Stadial +
	Kabazi II, II/1	OxA-4770 31.55±0.6			Les Cottés
Streletskaya	Buran-Kaya III, C	OxA-6672 32.35±0.7			
		OxA-6869 32.2±0.65			
		OxA-6868 36.7±1.5			
Western Crimean Mousterian	Kabazi II, II/2	OxA-4771 35.1±0.6			
	Kabazi II, II/3				
	Kabazi II, II/4	OxA-4858 32.2±0.9			
	Kabazi II, II/5	OxA-4859 33.4±1			
	Kabazi II, II/6-II/7				
	Kabazi II, II/7AB		36±3		
			38±4		
	Kabazi II, II/7C-II/7E				
Micoquian	Zaskalnaya VI, III	OxA-4772 35.25±0.9			
	Zaskalnaya VI, IIIa	OxA-4132 30.76±0.69			
		OxA-4773 39.1±1.5			
	Zaskalnaya V, II		41.8±3.1		
	Starosele, 1	OxA-4775 41.2±1.8	41.2±3.6		Hengelo
		OxA-4887 42.5±3.6			
	Starosele, 2			about 45	
Western Crimean Mousterian	Kabazi II, II/8			44±5	
	Kabazi II, IIA/1-II/8C				
	Kabazi II, IIA/2				Stadial
Micoquian	Zaskalnaya V, III				
	Zaskalnaya V, IV	GrA-13916 >46			
	Chokurcha I, IV	OxA-10877 >45.4			
	Kabazi II, IIA/3-IIA/4B				Moershoofd
	Kabazi V, II/3-II/4A				
Starosele Level 3	Starosele, 3			about 67.5	Stadial
Micoquian	Kabazi V, III/1-III/3			73.4±6	
	Kabazi II, III/1A; III/1				
	Zaskalnaya V, V				Odderade
	Starosele, 4		77±6	about 80	Brörup
	Kabazi II, III/2		74-85		Amersfoort
	Kabazi II, III/2A				Stadial
	Kabazi II, III/3		82±10		
	Kabazi II, III/4-III/7				
	Kabazi II, V/3-VI/17				Last Interglacial

TABLE 25-2
Middle Paleolithic chronology of the Northern Caucasus (shaded areas are warm periods)

Industries	*Site*	*Dates*		*Geochronology*
		Radiocarbon	*U-series*	
Micoquian	Mezmaiskaya, 2	ЛЕ-4735 32.23±0.74		Stadial (Würm III)
	Mezmaiskaya, 2A	Beta-53896/CAMS-2999 35.76±0.4		
		Beta-53897/ETH-9817 36.28±0.54		
	Matuzka, 4B-C	ЛУ-3692 34.2±1.41		
	Mezmaiskaya, 2B-1, 2, 2B-3			Stadial (Würm II)
	Mezmaiskaya, 2B-4	ЛЕ-3599 40.66±1.6		
	Mezmaiskaya, 3	ЛЕ-3841 >45		
	Monasheskaya, 2-4			
	Barakaevskaya, 3			
	Ilskaya	??? 37.2±1.8; ??? 40.8±1.2	47±2 135±2.5	???

(Riss/Würm) and the Early Glacial (Early Würm). The Last Interglacial Micoquian is only known from Kabazi II (Chabai in press).

A number of other Crimean assemblages have been attributed to a Last Interglacial age. The suggestion that the "Kiik-Koba lower layer type industry" is, in fact, "Eastern Taubachian" was made by V. N. Stepanchuk (1994a, 1994b) on the basis of heavily rounded and naturally broken artifacts from redeposited Last Interglacial alluvium at Kabazi II Unit IV (Chabai in press). At Kiik-Koba, the lower layer does contain a large number of denticulated and notched artifacts, but this assemblage is not dated and has little relationship to either the Taubachian or the Last Interglacial (Chabai et al. 2000:10). Other finds attributed to a "Crimean Taubachian" come from surface collections at Krasnyi Mak 1 and 2 and an undated assemblage from Zalesnoye (Stepanchuk 1994a, 1994b). The last might not even be of Pleistocene age. Thus, as in Central Europe, the purported Taubachian of Last Interglacial has yet to be documented in Crimea.

Northern Caucasus

In the Northern Caucasus, there is only one probable site of Last Interglacial age: Ilskaya I. Liubine (1994: 157) referred to this site as "the talk of the town, the subject of quite contradictory opinions and evaluations." The best example of Liubine's characterization is an article where its authors twice established the age of Ilskaya I: the first time as Early Würm–Würm I/II, and then, some pages later, as Riss/Würm (Golovanova and Hoffecker 2000:37, 61). The latter postulated Riss/Würm age of Ilskaya I is supported by one of the soils and by the presence of warm adapted insects found in bitumen puddles (Praslov and Muratov 1970; Praslov 1984a). The stratigraphic correlation between the bitumen puddles and the artifacts is not clear, however, and there are no absolute dates for Ilskaya I that correspond to the commonly accepted age of the Last Interglacial (Table 25-2).

The stratigraphic sequence at Ilskaya II, situated near Ilskaya I, shows the complex character of the Pleistocene depositional processes of the Kuban River terraces (Schelinskij 1998). At the same time, the stratigraphic correlation of Ilskaya I with II is still an open question.

Donbass-Azov

Chronological controls in the Donbass-Azov region are based only on geological and pollen interpretations (Gerasimenko and Kolesnik 1989, 1992; Gerasimenko 1993, 2003; Kolesnik 1993). There are neither absolute dates nor faunal assemblages. The archeological record is quite incomplete for the period: there are no in situ Middle Paleolithic occupations dated to after the Early Pleniglacial and there is no evidence, at all, for any Early Upper Paleolithic. Almost all Middle Paleolithic occupations, both Micoquian and Blade Mousterian (Kolesnik 1994), are in derived contexts, having been found in redeposited colluvial sediments or in layers disturbed by colluviation. Thus, the interpretation of the local Middle Paleolithic chronology poses a number of problems. The known sequence is limited to the 1st Period—from the Last Interglacial through the Early Pleniglacial.

The main archeological sequence occurs at Belokuzminovka (Table 25-3) and contains the remains of three archeological occupations, including Micoquian and Blade Mousterian, which, according to the pollen analysis, are datable from the Last Interglacial (Kaydaky soil) to the Early Pleniglacial (Uday loess). The middle layer at Belokuzminovka corresponds to the Early Glacial (Pryluky, b2 soil). The Pryluky, b2 soil in the Novotroitsky quarry south of Donetsk was dated by TL to 102/103,000 BP (89Д-Geo-TL) (Gerasimenko 2003).

TABLE 25-3
Middle Paleolithic chronology of the Donbass-Azov region

Industries	*Sites*	*Geochronology*
Blade Mousterian	Belokuzminovka, 3	Early Pleniglacial
	Zvanovka	
	Belokuzminovka, 2	Early Glacial
	Kurdumovka	
Micoquian	Nosovo I	
	Antonovka II (?)	
	Antonovka I (?)	Last Interglacial
	Belokuzminovka, 1	

At Kurdumovka, artifacts were found in both the Uday loess and Pryluky, b2 soil. Kolesnik initially suggested that the artifacts were deposited in the Pryluky, b2 soil and then redeposited during "Uday times" (Kolesnik 2000:67). At Nosovo I and Rozhok I, artifacts were recovered from loess that overlies a Last Interglacial soil (Praslov 1968, 1984a:32; Schelinski 1999). At Zvanovka, there is a clear association of an archeological occupation and the Uday loess. There are two more sites: Antonovka I and II. The geo-chronological position of the redeposited layers at Antonovka I and II (Table 25-3) were defined a long time ago (Gladilin 1969) based on the geological description of available profiles but has never been supported by additional evidence.

Mid Don

In the Mid Don region, the stratigraphic sequence of the Middle Paleolithic site of Shlyakh consists of nine Upper Pleistocene layers. Artifacts were found in layer 8, which underlies a pronounced soil in layer 7. According to pollen analyses, environmental conditions during the sedimentation of layer 8 were milder than in layer 7. The investigators of Shlyakh suggest that the artifact-bearing layer 8 was formed "in the early or middle parts of the Upper Pleistocene" (Nehoroshev and Vishnyatsky 2000:259). There are three radiocarbon dates for this layer: >26,000 (ЛЕ-5522), 46,300 ± 310 (OxA-8306), and 45,700 ± 300 BP (OxA-8307). Obviously, the age of this occupation is very close to the limits of radiocarbon dating. Thus, taking into account the available radiometric chronology and environmental studies, it is possible to suggest that Shlyakh layer 8 might have been deposited during either the Moershoofd Interstadial or the following stadial. If not actually falling into the 1st Period, it dates very close to its end.

Volga

In the Volga region, there are two important Middle Paleolithic localities in the Lower Volga basin: Sukhaya Metchetka and Cheluskinets. Neither can be placed securely in a chronological position, but it is clear that both fall into the 1st Period. There are two main points of view on the Sukhaya Mechetka chronology. Praslov (1984a) and Kuznetsova (1985) think that the single occupation of Sukhaya Metchetka comes from a Last Interglacial soil. Grischenko (1965) and Velichko (1988), on the other hand, argue for an Early Glacial age of this locality. Pollen data support the later point of view (Chiguryaeva and Khvalina 1961). In addition, a Last Interglacial age for the Cheluskinets artifact assemblage is problematic. Most of the artifacts were found near the studied section, but not in the soil of supposed Last Interglacial age (Kuznetsova and Sergin 1999:103). Also, only one of four TL dates corresponds broadly to the commonly accepted age of the Last Interglacial, making it doubtful that any of them are good: (84,000 ± 9,000, 145,000 ± 18,000, > 160,000, and >215,000 BP).

Prut-Dniester

In the Prut-Dniester region, the earliest well-documented manifestation of Middle Paleolithic is found in Yezupil layer III (Sytnyk 2000; Boguckyj et al. 2001). This layer is in the "horizon A2 of the Gorohiv soil complex," which consists of two soil horizons with solifluction above them (Sytnyk 2000:253, 316). The Gorohiv soil complex is associated with the Last Interglacial and has been TL dated at other localities from 96,000 ± 1000 to 133,000 ± 1500 (Shelkoplias and Christoforova 1991), while, presumably, the solifluction reflects climatic oscillations during the following stadial and the Amersfoort Interstadial. In spite of the clear stratigraphic position of Yezupil layer III's artifact and fauna assemblages, its TL date of 155,000 ± 1100 does not correspond well to the commonly adopted chronological limits of the Last Interglacial (Table 25-4). The faunal remains, *Bos* and *Bison*, do not support—but do not contradict—a Last Interglacial date for the layer. At the same time, there are no arctic/boreal species, which are common for the faunal complexes from the soliflucted part of Gorohiv soil complex (Sytnyk 2000:318, Table 24). Weighing these various lines of evidence, it appears that Yezupil layer III most likely dates to the Last Interglacial.

TABLE 25-4

Chronology of the Middle Paleolithic and Early Upper Paleolithic of the Prut-Dniester river basins (shaded areas are warm periods)

Industries	*Sites*	*Dates* *Radiocarbon*	*TL*	*Geochronology*
???	Ripiceni-Izvor, "Aurignacian" Ib	Bln-809 28.4±0.4		Denekamp (Arcy)
Gravettian	Molodova V, 8	ЛУ-14 >24.6		
	Molodova V, 9	ЛУ-15а 29.65±1.32		
		ЛУ-15б 28.1±1		
	Mitoc Malul Galben, 7b	GrN-13006 23.07±0.18		
		OxA-2033 24.8±0.43		
		GrN-14913 25.33±0.42		
	Mitoc Malul Galben, 7b mid	GrN-18815 26.5±0.46/0.44		
		GrN-18880 26.02±0.65/0.6		
		GrN-18881 26.38±0.6/0.5		
		GrN-18879 26.3±0.45/0.43		
		GrN-18882 25.08±0.5/0.47		
		GrN-18883 26.11±1.05/0.93		
	Mitoc Malul Galben, 7b	OxA-1778 27.5±0.6		
		GrN-12636 28.91±0.48		
Gravettian / Aurignacian	Mitoc Malul Galben, 8b	GrN-15453 27.1±1.5		
		GrN-14914 27.41±0.43		
		GrN-12637 31.85±0.8		
Aurignacian	Mitoc Malul Galben, 9b	GrN-13007 >24		
		GrN-15451 26.53±0.4		
		GrN-14037 26.91±0.45		
		GrN-15454 29.41±0.31		
		GrA-1355 25.38±0.12		
	Mitoc Malul Galben, 10b	GrN-15456 25.93±0.45		
		GrA-1648 31±0.33		
	Mitoc Malul Galben, 11 sup.	GrN-15457 24.4±2.2/1.7		
		GrN-20443 30.24±0.47/0.44		
		GrN-20700 31.16±0.57/0.53		
	Mitoc Malul Galben, 11 sup.,hearth	OxA-1646 31.1±0.9		
	Mitoc Malul Galben, 11 inf.	GrN-20442 30.92±0.39		
	Mitoc Malul Galben, 12a	GrN-20444 31.16±0.55/0.51		
	Mitoc Malul Galben, 12b	GrA-1357 32.73±0.22		
Micoquian	Ripiceni-Izvor, "Mousterian" IV			Stadial
	Ripiceni-Izvor, "Mousterian" V			Hengelo
	Ripiceni-Izvor, "Mousterian" VI	GrN-9210 40.2±1.1/1		Stadial
		GrN-9209 42.5±1.3/1.1		
		GrN-9207 43.8±1.1/1		
		GrN-9208 44.8±1.3/1.1		
Levallois-Mousterian	Ripiceni-Izvor, "Mousterian" III	GrN-11571 45±1.4/1.2		Moershoofd
		GrN-11230 46.4±4.7/2.9		
		GrN-14367 46.2±1.1		
	Molodova V, 11a	ЛГ-16 >35.0		
	Ripiceni-Izvor, "Mousterian" II			Odderade
	Molodova V, 11b			
	Molodova I, 4	GrN-3659 >44.0		Stadial
	Molodova V, 11	??? >40.3		Brörup (end)
	Molodova V, 12	ЛГ-17 >45.6		Brörup (?)
	Ripiceni-Izvor, "Mousterian" I			Amersfoort + Brörup
	Proniatin		85±7	Amersfoort+Stadial
Micoquian	Kolodiev, depth 12.5-12.9 m			
	Yezupil, II		100±7	
Levallois-Mousterian	Igrovitsa I, II		135±9	
	Bugliv V, II		140±12	
	Yezupil, III		155±11	Last Interglacial

There are a number of other assemblages that appear to be coeval with the soliflucted part of the Gorohiv soil (stadial + Amersfoort): Bugliv V layer II, Igrovitsa I layer II, Yezupil layer II; Kolodiev depth 12.5–12.9 m, and Proniatin. Some of these locations produced arcto-boreal species, such as reindeer, polar fox, and lemming (Sytnyk 2000: 144, 317-318). Two of the four available TL dates (Yezupil II and Proniatin) more or less fit into the commonly accepted age of the Early Pleniglacial Interstadials (Table 25-4). Correlations among these Dniester-Prut sites are tentative, however, because of different geo-chronological schemes used in the region. Sites in the upper Dniester, including Bugliv V, Igrovitsa I, Yezupil, Kolodiev, and Proniatin, were described by A. Bogutskij using his own Upper Pleistocene systematics (Bogutskij et al. 1997). Sites from the mid Dniester (Molodova) and Prut (Ripiceni-Izvor and Mitoc Malul Galben), however, were described using North European terms (Ivanova 1982, 1987; Păunescu 1993; Damblon et al. 1996; Damblon 1997; Damblon and Haesaerts 1997).

There are, in addition, some basic differences in the stratigraphic successions among sections in the Prut, the Upper Dniester, and the Mid Dniester Valleys. The Gorohiv soil complex, found in the Upper Dniester and thought to date to the Last Interglacial–Amersfoort interval, has no analogies in the Mid Dniester and Prut areas. On the other hand, there is no geological equivalent in the Prut and the Upper Dniester to the ashy horizon (Moershoofd) found in the Mid Dniester. The thick and monotonous "Upper Pleistocene loess" found in the Upper Dniester has no analogies in either the Mid Dniester or the Prut Valleys. Thus, in spite of the small size of the Prut-Dniester region, there are no regional geological benchmarks present at these Upper Pleistocene localities.

The continuation of the chronological and stratigraphic sequence of the Upper Dniester is seen at locations in the Mid Dniester and Prut valleys: Ripiceni-Izvor, Molodova I, and Molodova V (Table 25-4). Based on geological and bio-stratigraphical data, an Amersfoort/Brörup/Odderade age for the "Mousterian" layers I and II from Ripiceni-Izvor was proposed (Păunescu 1993). The proposed Moershoofd date for Ripiceni-Izvor layer III was based not only on bio-stratigraphic evidence, but also on radiocarbon dates (Table 25-4). Taking into account that the commonly accepted age for the Moershoofd Interstadial is beyond the limits of radiocarbon chronology, this series of dates is more or less acceptable. Less successful was an attempt to date the Middle Paleolithic occupations at Molodova I and V by radiocarbon (Table 25-4). At the same time, the chronological position of the Molodova occupations was established on the basis of extensive environmental studies (Ivanova 1982, 1987). The earliest Middle Paleolithic occupations at Molodova correspond to the Brörup Interstadial, while the end of Molodova Middle Paleolithic sequence corresponds to the Moershoofd Interstadial.

In the Molodova sites, the relatively thick ashy layer of the Moershoofd deposits, which has been found at a number of other Mid Dniester localities, may be considered a temporal and industrial benchmark. This Moershoofd ashy layer is the upper stratigraphic limit for the Middle Paleolithic occupations at the Molodova sites, as well as the upper chronological boundary for all of the Levallois-Mousterian assemblages in the whole Dniester-Prut region. That is, all assemblages of this early Middle Paleolithic period (or 1st Period) in the Dniester-Prut region are Levallois-Mousterian (Chernysh 1982, 1987; Păunescu 1993; Sytnyk 2000), with the exception of the Micoquian at Yezupil layer II and Kolodiev depth 12.5–12.9 m (Sytnyk 2000).

In sum, while there are only a few sites clearly attributable to the Last Interglacial, they are found throughout Eastern Europe. Without question, there is an increase of known sites datable to the Early Glacial and even more to the Early Pleniglacial. To some extent, this may reflect differences in extant, exposed geological sediments of different ages, but it is likely to also reflect an increase in the number of sites and, perhaps, some increase in Eastern European population size. Even with relatively few sites, by the Late Interglacial, there were two different archeological industries/complexes present in Eastern Europe: the Micoquian, which was widespread, and the Levallois-Mousterian, which was limited to a single occurrence in the Upper Dniester. Between the end of the Last Interglacial and the end of the Moershoofd, a third lithic industry, the Blade Mousterian, appears in the Donbass region.

The 2nd Period (Post-Moershoofd Stadial through the Hengelo Interstadial)

The 2nd period correlates with the Western European Würm II through Würm II/III. It is relatively short, compared with the previous period, from ca. 55,000 BP to 38,000 BP. In spite of the shorter duration, more in situ sites are known from all regions, with the exception of the Donbass and the Lower Volga (Figure 25-5). There are, as well, more absolute dates to aid in interregional correlations. The Micoquian continues in many areas during this period, while the Levallois-Mousterian makes its initial appearance in the south. There are no known Blade Mousterian assemblages that date to this period.

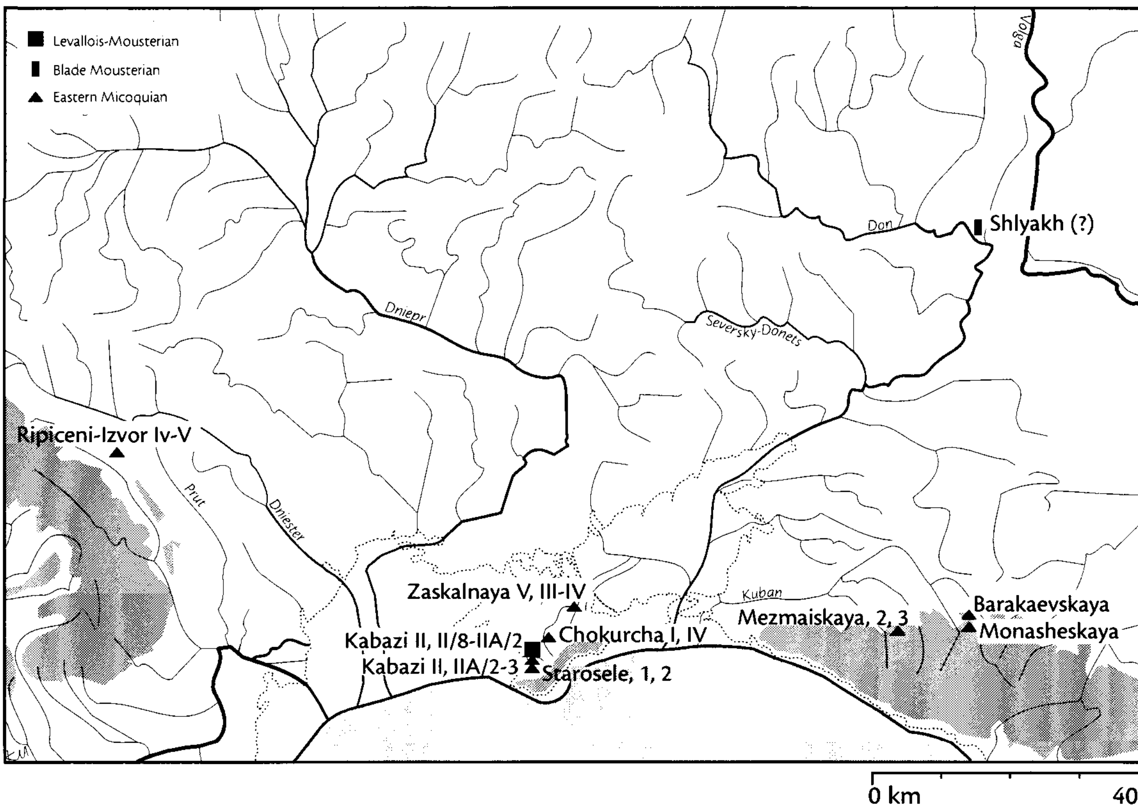


Figure 25-5—Sites of the 2[nd] Period of the Eastern European Middle Paleolithic.

Crimea

In Crimea, the Western Crimean Mousterian (part of the Levallois-Mousterian) appears during the 2[nd] Period, while the Micoquian continues (Table 25-1). Assemblages dating to this period have been found at Kabazi II levels IIA/1-II/8, Starosele levels 1 and probably 2, Zaskalnaya V layers III and IV, Chokurcha I unit IV, and Karabi Tamchin levels 2, 3, 4 (Table 25-1). The Western Crimean Mousterian always overlies Micoquian assemblages where they are found stratified together. At the same time, some Micoquian assemblages, as those from Zaskalnaya V layers III and IV, contain some typical Western Crimean Mousterian tools and cores, which has been interpreted as a mechanical mixture of Western Crimean Mousterian (Levallois-Mousterian) and Micoquian occupations (Chabai 2000a).

The small assemblage from Buran-Kaya III level E, stratigraphically overlain by at least one Middle Paleolithic assemblage (the Micoquian of Layer B) and dating to some time before 36,000 BP, is a problem. Its blade technology is clearly Upper Paleolithic but the few tools recovered are non-diagnostic (Monigal, Chapter 4). If it were Upper Paleolithic, it would represent the earliest evidence for such in Crimea and, in fact, in all of Eastern Europe.

Northern Caucasus

In the Northern Caucasus, there are three sites that fall into the 2[nd] Period: Barakaevskaya layer 3, Monasheskaya level 2-4, and Mezmaiskaya levels 2B-1 through 3, all of which contain Micoquian assemblages. Radiometric dates are only available for Mezmaiskaya levels 2B-4 and 3 (Table 25-2). The dating of the other sites is based on the similarity of their bio-stratigraphical sequences to the well-studied sediments of Barakaevskaya Cave. These extensive multidisciplinary studies suggest that the artifact-bearing layer 3 of Barakaevskaya Cave dates to Würm II (Liubine, ed. 1994). Based on environmental similarities, E. V. Belyaeva proposed that Barakaevskaya layer 3 and Monasheskaya layer 2-4 were contemporaneous and belong to OIS stage 3 (Belyaeva 1999:70, 152, 154).

The temporal interpretation of the Mezmaiskaya sequence made by L. Golovanova and J. Hoffecker is in disagreement with the radiometric dates and the environmental studies of this location. The lowest archeologically sterile layers, 5 and 4, belong to a period of climatic warming. Forest-dwelling microfauna were found in layer 5 and forest soil was identified in layer 4. Layer 3, with a radiocarbon date of >45,000 BP, contains forest and alpine meadow rodents. The pollen spectrum of layer 2B-4 (dated to 40,660 ± 160 BP) is dominated by grasses and bushes, while the arboreal composition is poor and xerophytic. The uppermost layers, 2A and 2, (ca. 36–32,000 BP) exhibit about the same environmental conditions seen in layers 2B-4 and 3. That is, after the relatively mild conditions of layers 5 and 4, there was a shift to a relatively cold and arid environment in layers 3 through 2. Thus, it is not clear why Golovanova and Hoffecker suggested layers 3 and 2B-4 date to the interstadial conditions of Würm I/II (Moershoofd) but, at the same time, suggested that layer 2B-4 could also be dated to Würm II (stadial) (Golovanova and Hoffecker 2000: 37). This last suggestion is more in agreement with radiocarbon chronology and environmental studies.

Prut-Dniester

In the Prut-Dniester region a clear Micoquian has been found at Ripiceni-Izvor layers IV to V (Păunescu 1993), the temporal position of which was established by bio-stratigraphical studies and radiocarbon dates (Table 25-4). Recently, these assemblages have been referred to as "Eastern Micoquian" (Yevtushenko 1998c, 1999).

In sum, the Micoquian is well represented during the 2nd Period. The Levallois-Mousterian is present only as the Western Crimean Mousterian in Crimea, having disappeared from the Prut-Dniester region. In addition, there is a hint of a very early Upper Paleolithic in Crimea. There are no stratified Middle Paleolithic sites in Northern Ukraine or in the Polesye region, although there are two localities with redeposited artifacts: Richta and Zitomirskaya (Smirnov 1979; Kukharchuk 1989; Kukharchuk and Mesiats 1991). The absence of Middle Paleolithic materials from the Donbass, Lower Volga, and the Mid Don regions, particularly during the stadial preceding Hengelo, may well reflect the extremely cold and dry conditions that pertained in those areas.

The 3rd Period (Post-Hengelo Stadial through the Denekamp Interstadial)

In absolute time, the 3rd Period ranges from ca. 38,000 BP until somewhat less than 28–27,000 BP. It also includes a number of different Middle Paleolithic and Early Upper Paleolithic industries: Micoquian, Levallois-Mousterian, Gorodtsovskaya, Spitsynskaya, Streletskaya, Aurignacian, and Gravettian. These appear discontinuously in time and space, with only Crimea and the Prut-Dniester region showing continuous occupation from the previous period through the 3rd Period (Table 25-1). There appears to have been no occupation of the Donbass-Azov region during this period (Figures 25-6 and 25-7).

Crimea

In Crimea, this period is remarkable for an early appearance of a clear Upper Paleolithic assemblage, coeval with Western Crimean Mousterian and Micoquian occupations. Upper Paleolithic assemblages are known from Buran-Kaya III level C (stadial) and Siuren I units F, G, and H (Denekamp/Arcy Interstadial) (Table 25-1). Middle Paleolithic assemblages that continued during the stadial and Denekamp (Arcy) are known from Kabazi II levels A3A–II/7E, Zaskalnaya V layers I and II, Zaskalnaya VI layers II–IIIA, Prolom I upper level, and Buran-Kaya III layer B. The coexistence of the Middle and Upper Paleolithic in Crimea is documented by microfaunal and palynological studies, radiocarbon chronology (Table 25-1), and stratigraphy. At Buran-Kaya III, an Early Upper Paleolithic assemblage from level C underlies the Middle Paleolithic from layer B (Monigal, Chapters 1, 5; Demidenko, Chapter 9). At Siuren I, in units G and H, the Middle Paleolithic artifacts recovered from numerous Aurignacian levels have been interpreted by Demidenko (2000) as the result of mechanical mixture of Middle Paleolithic and Aurignacian occupations.

Northern Caucasus

In the Northern Caucasus, the Middle Paleolithic occupation at Matuzka layer 4C (radiocarbon dated to 34,200 ± 141 BP) took place within a high altitude forest environment. It is not clear why Golovanova and Hoffecker (2000) have ascribed this layer to Würm II/III (Hengelo). This interpretation contradicts the radiocarbon date (Table 25-2), and the environmental definition "high altitude forest" does not help much to establish a temporal position, because there is no regional environmental framework for the Upper Pleistocene of the Northern Caucasus. The comparison of the environmental characteristics identified in Matuzka layer 4C with those of Mezmaiskaya and Barakaevskaya is highly problematic because the latter is undated and because the three sites vary greatly in their altitude. The sites only contain Micoquian assemblages. The radiocarbon dates for Mezmaiskaya layers 2A and 2 do overlap with that from Matuzka layer 4C (Table 25-2), indicating that these three occupations date to ca. 36–32,000 BP.

Mid Don

In the Mid Don region, assemblages belonging to the 3rd Period have been found in numerous open-air localities around the villages of Kostenki and Borshchevo in the Don Valley. These assemblages all belong to the Early Upper Paleolithic Streletskaya, Spitsynskaya, Gorodtsovskaya, Aurignacian, and Gravettian industries (Tables 25-5, 25-6).

There are three benchmark geological events in Kostenki-Borshchevo that are usually used in chrono-

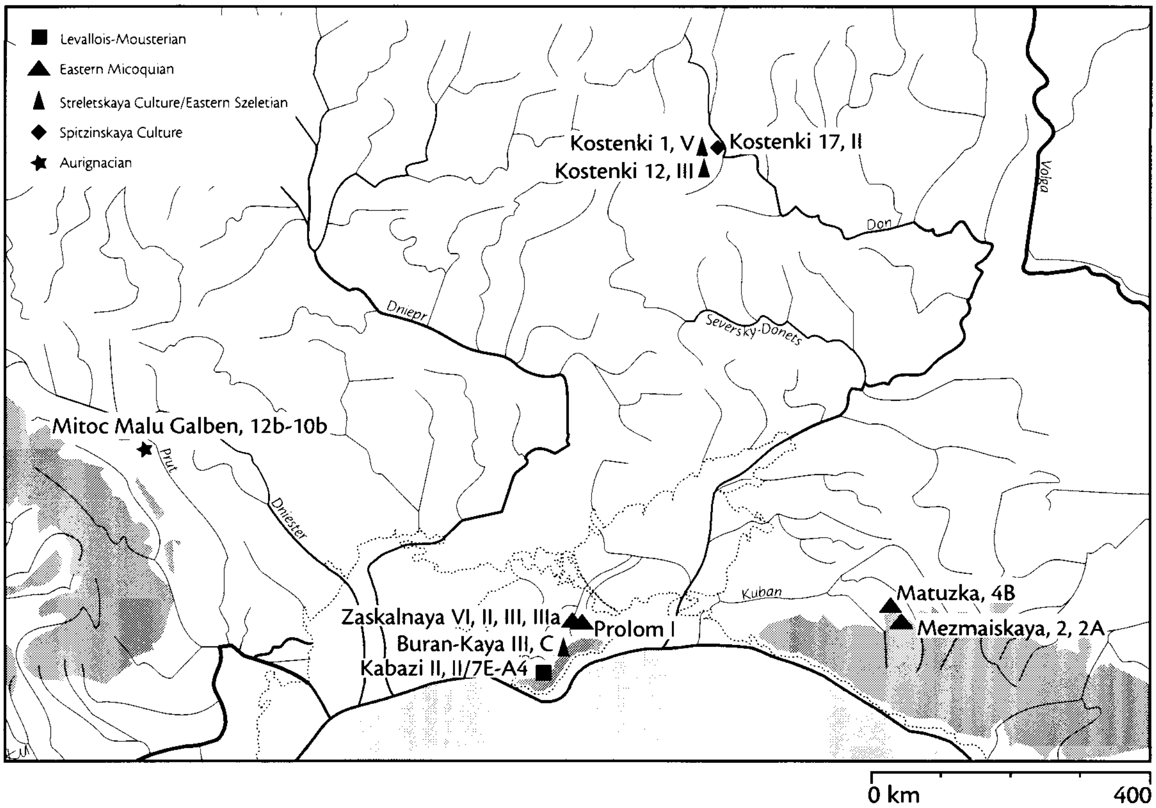


Figure 25-6—Sites of the Early Stage of the 3rd (Transitional) Period of the Eastern European Paleolithic.

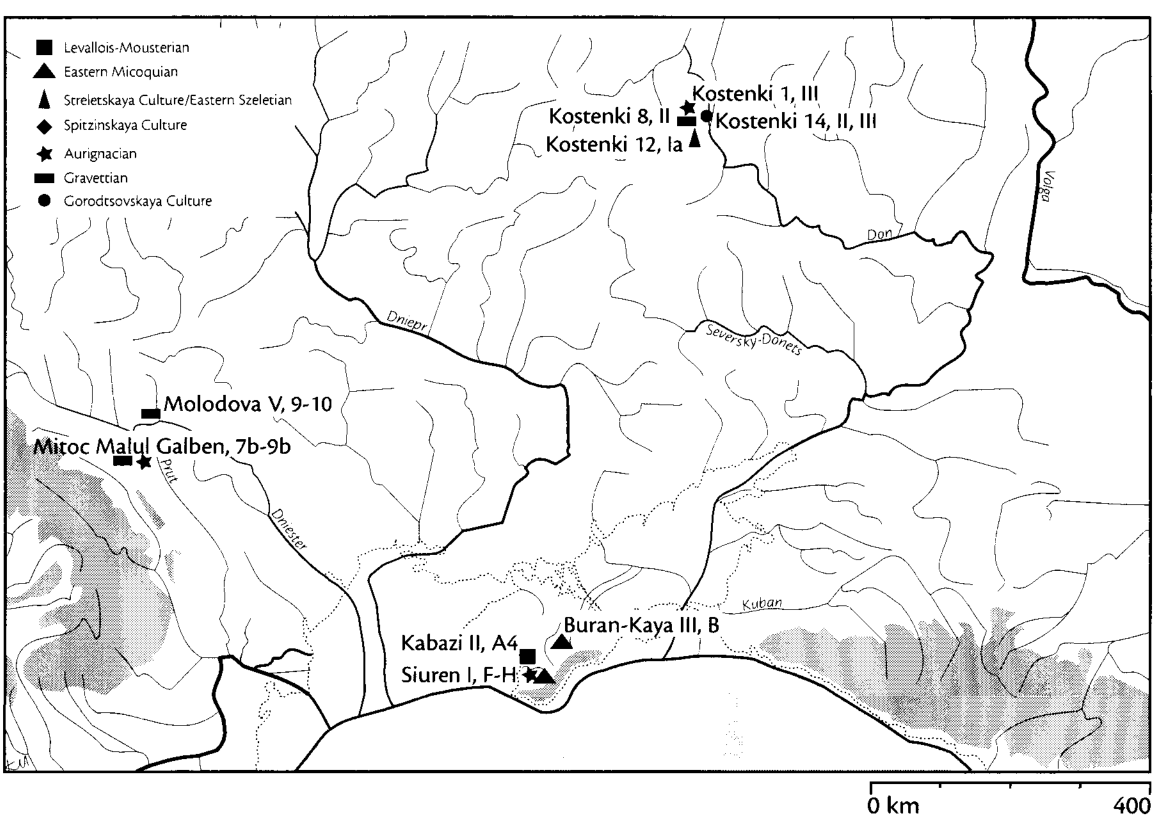


Figure 25-7—Sites of the Late Stage of the 3rd (Transitional) Period of the Eastern European Paleolithic.

TABLE 25-5
Early Upper Paleolithic chronology of the Mid Don river valley: Kostenki Ancient Chronological Group

Industries	*Site*	*Radiocarbon dates*	*Stratigraphy*
Streletskaya	Kostenki 1, V	ГИН-6247 >18800	Lower Humic Bed
		ЛЕ-2030 27.39±0.3	
		ЛЕ-3542 30.17±0.57	
		GrA-5557 32.3±0.22	
		GrA-5245 34.9±0.35	
		GrA-5245 37.9±2.8/2.1	
	Kostenki 6	ГИН-8023 21.1±0.2	redeposited Lower Humic Bed
		ГИН-8572 31.2±0.5	
	Kostenki 12, III	ГИН-8021 >31	Lower Humic Bed
		GrA-5551 36.28±0.36/0.35	
Upper Paleolithic	Kostenki 14, IV	OxA-4116 27.46±0.39	
		OxA-4117 27.71±0.41	
	Kostenki 14, IVa	ЛЕ-5271 27.4±5.5	
		ГИН-8025 29.7±0.4	
		GrN-22277 33.28±0.65/0.6	
		GrA-13301 33.2±0.51/0.48	
		GrA-13297 34.55±0.61/0.56	
	Kostenki 14, IVb	??? 34.94±0.63/0.59	
		GrA-10948 37.24±0.43/0.4	
Spitsynskaya	Kostenki 17, II	ЛЕ-1436 32.78±0.3	
		GrN-10512 32.2±2/1.6	
		GrN-12596 36.78±1.7/1.4	

logical and stratigraphic studies: the Lower and Upper Humic Beds and the layer of volcanic ash in between. The Lower Humic Bed dates to 36–32,000 BP, the volcanic ash layer to 38–33,000 BP, and the Upper Humic Bed to 32–27,000 BP (Sinitsyn et al. 1997:27–29). The archeological occupations from the Lower Humic Bed have been combined into an "Ancient Chronological Group," while those from the Upper Humic Bed have been combined into a "Middle Chronological Group." The Lower Humic Bed has been correlated with the Hengelo Interstadial, while the Upper Humic Bed with the Denekamp (Arcy) Interstadial (Rogachev and Anikovich 1984:166; Sinitsyn et al. 1997:28). Such correlations are not supported by palynological investigations, however, which show that both Humic Beds reflect harsh environmental conditions (Malyasova and Spiridonova 1982). Sinitsyn has likewise noted that there is no basis for correlating either of the Humic Beds to warm interstadial conditions (Sinitsyn et al. 1997:26).

The "Ancient Chronological Group" includes the following assemblages: Kostenki 1 layer V, Kostenki 6, Kostenki 8 layer IV, Kostenki 11 layer V, Kostenki 12 layers II and III, Kostenki 14 layers IV, IVa, and IVb, and Kostenki 17 layer II (Sinitsyn et al. 1997: 27; Sinitsyn 2000). There are no radiometric dates for Kostenki 8 layer IV, Kostenki 11 layer V, Kostenki 12 layer II. The artifacts and bones from Kostenki 6 were in derived position (Rogachev and Anikovich 1982b: 90) and its dates contradict the postulated age of the "Ancient Chronological Group" (Table 25-5, Figure 25-8). Even more of a problem is the stratigraphy of Kostenki 11 layer V: the scant archeological material of that layer was found in a silty level overlain by the Upper Humic Bed and underlain by a thin humic lens (Rogachev and Popov 1982: 130). While this silty level is claimed to be of Lower Humic Bed age, it has not been reported at other Kostenki sites and it is not clear whether the thin humic lens underlying it is also part of the Lower Humic Bed. In fact, the silty level may be a local, stratigraphically intrusive deposit *within* the Upper Humic Bed. The absence of absolute dating for this sediment makes it impossible to know its real age. On the other hand, the stratigraphic and chronological positions (Table 25-5) of Kostenki 1 layer V, Kostenki 12 layer III, Kostenki 14 layers IV, IVa, and IVb, and Kostenki 17 layer II appear to be well grounded (Lazukov 1982:23; Sinitsyn et al. 1997:51).

The assemblages from Kostenki 1 layer V and Kostenki 12 layer III belong to the "Streletskaya culture," while that from Kostenki 17 layer II belongs to the "Spitsynskaya culture." Rogachev and Anikovich (1982c:138) additionally include the Kostenki 12 layer II assemblage as Spitsynskaya. If this is so, then the

TABLE 25-6
The Early Upper Paleolithic chronology of the Mid Don river valley: Kostenki Middle Chronological Group

Industries	*Sites*	*Radiocarbon*	*Stratigraphy*
Aurignacian	Kostenki 1, III	ГИН-4848 20.9±1.6	above Upper Humic Bed
		ГИН-2942 >22	
		ГИН-4850 24.5±1.3	
		ГИН-6248 25.4±0.4	
		ГИН-4852 25.6±0.1	
		ГИН-4902 25.7±0.6	
		ЛЕ-3541 25.73±1.8	
		ГИН-4849 25.9±2.2	
		GrN-22276 25.82±0.4	
		ГИН-4885 26.2±1.5	
		GrN-17117 32.6±0.4	
		OxA-7073 32.6±1.1	
		AA-5590 38.08±5.46/3.2	
Telmanskaya (Gravettoid)	Kostenki 8	OxA-7109 23.02±0.32	Upper Humic Bed
		ГИН-7999 24.5±0.45	
		GrN-10509 27.7±0.45	
Gorodtsovskaya / Streletskaya	Kostenki 12, I-Ia	TA-154 20.9±0.39	
		ЛУ-1749 24.42±0.31	
		ЛУ-1821 29.03±0.56	
Gorodtsovskaya	Kostenki 12, I	ГИН-89 23.6±0.3	
		ГИН-8019 24±0.8	
		ГИН-8574 26.3±0.3	
Streletskaya	Kostenki 12, Ia	GrN-5552 28.5±0.14	
		ЛЕ-1428а 28.7±0.4	
		ЛЕ-1428б 30.24±0.4	
		ЛЕ-1428в 31.15±0.15	
		ЛЕ-1428г 31.9±0.2	
		GrN-7758 32.7±0.7	
Gorodtsovskaya	Kostenki 14, II	ЛЕ-1400 19.3±0.2	
		the same in ЛУ 25.09±0.31	
		ГИН-8030 25.6±0.4	
		ЛУ-59а 26.4±0.66	
		ЛУ-59б 28.2±0.7	
		GrN-12598 28.38±0.22	
		OxA-4115 28.58±0.42	
	Kostenki 14, II-III	AA-4798 14.355±0.12	
		GrN-10510 15.26±0.26	
	Kostenki 14, III	ГИН-79 14.3±0.46	
		GrN-21802 30.08±0.59/0.55	
	Kostenki 16	ЛЕ-1431 25.1±0.15	
		ЛЕ-5270 27.4±0.1	
		ГИН-8033 26.8±0.6	
		ГИН-8031 28.2±0.5	
Spitsynskaya ?	Kostenki 17, I	ГИН-8076 21.1±0.6	
		ГИН-8074 23±0.8	
		ГИН-8075 24.3±0.5	
		GrN-10511 26.75±0.7	
Gorodtsovskaya	Kostenki 15	ЛЕ-1430 21.72±0.57	below Upper Humic Bed
		ГИН-8020 25.7±0.25	

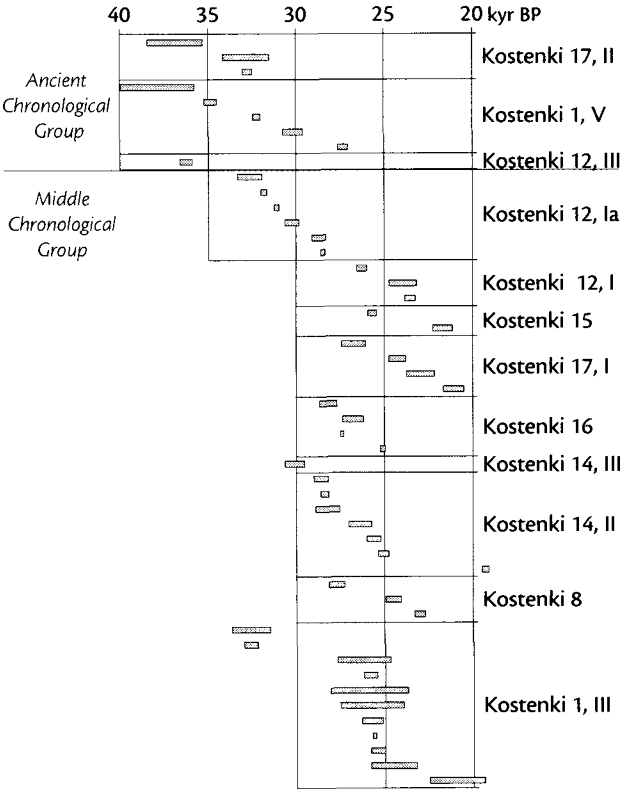


Figure 25-8—Distribution of radiocarbon dates (one standard deviation) for the Kostenki Ancient and Middle Chronological Groups.

Kostenki 12 sequence shows a stratigraphic correlation between Streletskaya (layer III) and Spitsynskaya (layer II) assemblages. Unfortunately, only a few Upper Paleolithic artifacts have been recovered from Kostenki 8 layer IV and Kostenki 14 layers IV, IVa, and IVb and these have not been attributed to any particular "culture" (Sinitsyn 2000).

The Middle Chronological Group consists of following assemblages: Kostenki 1 layer III, Kostenki 5 layer III, Kostenki 8 layers II and III, Kostenki 11 layer IV, Kostenki 12 layers I and Ia, Kostenki 14 layers II and III, Kostenki 15, Kostenki 16, Kostenki 17 layer I, and Borshchevo 3 and 4 (Sinitsyn et al. 1997: 28). A number of these assemblages do not comfortably fit the stratigraphic and chronological definitions of the Middle Chronological Group (Figure 25-3). The small, undated artifact assemblage of Kostenki 11 layer IV, for instance, was found "in the base of brown silt and humic lenses" (Rogachev and Popov 1982:130) and its connection to the Upper Humic Bed is not clear. Also undated and clearly redeposited are the artifacts from Kostenki 5 layer III (Rogachev and Anikovich 1982a:87). The correlation of the Upper Humic Bed with the "*middle part of the brown loess-like silt*" of the Aurignacian occupation of Kostenki 1 layer III is questionable (Rogachev et al. 1982: 62). According to G. I. Lazukov (1982: 23), layer IV but not layer III occurred in the Upper Humic Bed at Kostenki 1. Ten of 13 radiocarbon dates for Kostenki 1 layer III contradict the assumed age of the Middle Chronological Group, while 7 of 13 dates place the age of this assemblage at ca. 25,000 BP (Table 25-6). Thus, taking into account Lazukov's description of Kostenki 1 layer III's stratigraphic position and the range of radiocarbon dates, it is likely that this assemblage post-dates the age of the Middle Chronological Group. The dates for Kostenki 8 layer II, Kostenki 12 layers I and Ia, Kostenki 14 layers II and III also appear to be younger than assumed age of the Middle Chronological Group (Table 25-6). The artifacts of Kostenki 15 were found in the lower part of Upper Humic Bed and in the underlying silt (Rogachev and Sinitsyn 1982b:162). Thus, stratigraphically it was thought to be the oldest assemblage of the Middle Chronological Group, but this is contradicted by the available radiocarbon dates (Table 25-6). The stratigraphic position of Kostenki 17 layer I, in the upper part of the Upper Humic Bed, is likewise contradicted by the dates (Table 25-6). Unfortunately, the information now available for Borshchevo 3 and 4, said to be of this period, does not permit any judgments concerning their stratigraphy, chronology, or industrial attribution (Rogachev 1982a, 1982b; Sinitsyn et al. 1997:28).

The large number of sites at Kostenki, the various permutations of the sedimentary sequences, the different "archeological cultures," and the large number of often discordant radiocarbon dates, suggests that additional work will modify the present Middle Chronological Group, both as to the number of sites and their chronology.

Prut-Dniester

In the Prut-Dniester region, the 3rd period saw the continuation of the Micoquian at Ripiceni-Izvor during the stadial preceding Denekamp (Arcy) (Table 25-4). The Upper Paleolithic appears during the Denekamp (Arcy) Interstadial: Aurignacian and Gravettian from Mitoc Malul Galben and Molodova V layers 8-10 (Table 25-4). In the lower part of Mitoc sequence (cycles 13 to 8), incipient soils are related to brief warm periods, while in the upper part of the sequence (cycles 7–1), they are mostly tundra-gley and associated with permafrost (Damblon and Haesaerts 1997:266). The three Aurignacian occupations at Mitoc Malul Galben were in the lower cycles 12-8, and date to between 33–27. The four Gravettian occupations in the upper cycles 7–2 date to between 27 to 23,000 BP (Damblon and Haesaerts 1997:266). There are more than 60 radiocarbon dates from the 14 m of deposits at Mitoc Malul Galben, and their interpretation in connection with the stratigraphic and lithic analyses has resulted in some confusion (Damblon et al. 1996;

Damblon and Haesaerts 1997; Otte 1997). Borziac and Kulakovskaya (1998:55), for example, have proposed an earlier date for the Gravettian sedimentary cycles of 29–25,000 BP, based on some technological and typological similarities between the Mitoc Gravettian of sedimentary cycle 7 and Molodova V layers 9 and 8. The dates for the lower part of the Gravettian sequence (cycle 7b) permits either interpretation. At the same time, the radiocarbon dates for Molodova V have sufficiently large standard deviations (Table 25-4) that they might be interpreted as younger than 29,000 BP. Furthermore, the sedimentary cycles containing Gravettian assemblages are of tundra-gley type, which is associated with permafrost (Damblon et al. 1996). It is unlikely that this kind of sediment formed about 29,000 BP during interstadial conditions.

In sum, during the 3rd Period, there were a great number of sites in most of the regions of Eastern Europe representing a diverse set of lithic industries. Despite the fact that many more dates are available for this period than there were for the previous periods, as well as many stratigraphically sound sites, the exact chronology and interaction, if any, between these Late Middle Paleolithic and Early Upper Paleolithic peoples is still very much unanswerable. There are, furthermore, a number of other sites and specific, localized "cultures" that have been purported to belong to the 3rd Period. They will be given a brief mention here because so many are widely cited, but all are, to the authors, without solid foundation.

The attribution of the Northern Caucasus assemblage of Mezmaiskaya layer 1C to the Levantine Ahmarian (Golovanova 2000:175), as well as its chronological position (ca. 32,000 BP), are very curious. This assemblage contains numerous backed bladelets and micro-blades that are not like those of the Levantine Ahmarian (Gilead 1981; Marks 1981; Coinman 1998). Also, in spite of a noted depositional break between the lowermost Middle Paleolithic layer 2 and the "Ahmarian" layer 1C, the radiocarbon dates are identical: 32,230 ± 740 BP and 32,010 ± 250 BP (Golovanova 2000:166, 172).

The open-air site of Sungir, situated on the northwestern tributary of the Volga, is often cited as an example of a Late Streletskaya occupation or even as a specific "Sungirian" industry. The primary flaking was based on "prismatic" blade cores. The toolkit consists of bifacial Streletskaya-type points, "Mousterian forms," endscrapers, burins, and backed bladelets. Bone artifacts and adornments are numerous and variable (Bader 1978). Rogachev and Anikovich (1984: 180) noted, however, the absence of characteristic Streletskaya endscrapers and that the abundant burins and backed bladelets are uncommon in the Streletskaya, as was blade core reduction, bone artifacts, and adornments. On the other hand, all of these are characteristic of the Gravettian. The single "cultural layer" at Sungir was significantly disturbed by frost action and solifluction and radiocarbon dates have a considerable range: from 19,790 ± 800 to 25,500 ± 200 BP (Svezhentsev 1993). The Sungirian burials were recently directly dated to 23–24,000 BP (Pettitt and Bader 2000). Thus, it is most likely that the "Sungirian" contains a mixture of Streletskaya and Gravettian assemblages and should not be considered culturally homogeneous.

The Brynzeny "culture" from the Dniester-Prut region is both chronologically and typologically suspect. It is often used as an example of "Szeletian influence" in the Moldova area (e.g., Chirica and Borziac 1996:167). At the same time, the oldest date for this "culture" is only 26,000 ± 300 BP (OxA-4122) obtained from Brynzeny, layer 3. That date is too young to relate to the Szeletian in Central Europe but is consistent with local Gravettian dates. The co-occurrence of bifacial bi-convex leaf points, bifacial plano-convex scrapers, and thick endscrapers, along with backed bladelets and micro-blades is most parsimoniously explained as a mechanical mixture of Micoquian, Szeletian, Aurignacian, and Gravettian materials. This "Szeletian" appears to be the easternmost known at this time, and the Central European Szeletian seems to have had a little influence on Eastern European developments.

There is little information about the stratigraphy and chronology at Kulichivka in the Polesye region (Savich 1975), which is reported to contain both Bohunician (Demidenko and Usik 1993a, 1993b) and Gravettian assemblages. The date 31,000 BP, without lab number, is often cited for the Bohunician level, but appears to be too young for this kind of assemblage. Information about the typological structure of the Kulichivka assemblages is not available. Likewise, although they are frequently cited, the stratigraphical sequences and typological characteristics of such "transitional" assemblages as Zhornov (Polesye) and Mira (Mid Dnieper) are known only from preliminary publications (Piasetski 1991, 1992; Stepanchuk et al. 1998).

The cultural attribution to the "Aurignacian-related Prut culture" of assemblages at Gordineshti, Korpach Mys, Korpachi layer 4, and Ripiceni-Izvor layers 1a, 1b, 2a, and 2b is highly questionable (Borziac and Chetraru 1996). The only available date, from Korpachi layer 4, is 25,250±3000 BP (GrN-9758). The Aurignacian elements in Ripiceni-Izvor are few (Aurignacian index = 3.29), its Gravettian diagnostics are dubious, and half of the tool assemblage consists of notches and denticulates (Păunescu 1993:137–138).

The longest and most detailed chronological and stratigraphic sequences are found in Crimea and the Prut-Dniester Basins (Tables 25-1 and 25-4). Both regions include all periods of the Middle and Early Upper Paleolithic known in Eastern Europe. The main difference between the Crimean and the Prut-Dniester sequences is that a more complex Early Upper Paleolithic succession is present in the Prut-Dniester, while a richer and more detailed Middle Paleolithic sequence is found in Crimea. Both the Donbass-Azov (Table 25-3) and Lower Volga Middle Paleolithic sequences are limited to the 1st Period, while there are no reliably dated locations of this period in the Northern Caucasus, at all. More or less well dated Northern Caucasus assemblages belong to the 2nd and 3rd Periods (Table 25-2). Middle Paleolithic occupations in the Mid Don Valley are datable to either the 1st or 2nd Periods, while the 3rd Period is represented by an incredible variety of Early Upper Paleolithic assemblages (Tables 25-5 and 25-6). At the same time, Middle Paleolithic assemblages belonging to the 3rd Period are also found in the Mid Don Valley, but are absent in adjacent regions.

If the chronological borders of the 1st and 2nd Periods do not have many problems, mainly due to the relatively small number of available radiometric dates, the chronological limits of the 3rd Period (Transitional) are less secure. The chronology of this period was defined on the basis of radiocarbon dates for the oldest Early Upper Paleolithic occurrences in the Mid Don Basin, on the one hand, and by the latest Middle Paleolithic assemblages in Crimea, on the other.

The radiocarbon chronology of the 3rd Period in Crimea is supported by bio-stratigraphic studies. It is chronologically limited to the stadial preceding the Denekamp (Arcy) Interstadial and the Denekamp (Arcy) itself. It is probably most reasonable to suggest a 30,000 BP border between the assemblages of the Ancient and Middle Chronological Groups of the Kostenki-Borshchevo Early Upper Paleolithic. The distribution of radiocarbon dates for these sites at one standard deviation shows that the majority of dates for the Middle Chronological Group are younger than 30,000 BP, while almost all dates for the Ancient Chronological Groups are older than 30,000 BP (Figure 25-8). In archeological terms, a 30,000 BP chronological border would correspond to the appearance of the Gorodtsovskaya in the Mid Don region. Also, after 30,000 BP, there is evidence for Aurignacian occupations in Crimea and Gravettian ones in the Prut-Dniester Basins. Thus, the chronological limits of the 3rd Period should be 38,000 to 28/27,000 BP. Within these limits, it is possible to propose two temporal divisions: an early stage from 38,000 BP to 30,000 BP and a late stage from 30,000 BP to 28/27,000 BP (Figure 25-18).

Archeological Variability

As in Western Europe, there is a considerable variety of both Middle and Upper Paleolithic industries defined for Eastern Europe. The Eastern European Middle Paleolithic may be viewed as including, at least, three quite distinct archeological groups, distinguished by technological and/or typological characteristics: the Micoquian, Levallois-Mousterian, and the Blade Mousterian (Chabai 2003). The Early Upper Paleolithic has even a larger number of differently named groups: the Streletskaya, Spitsynskaya, Gorodtsovskaya, Aurignacian, and the Early Gravettian, as well as at least two, unnamed Early Upper Paleolithic assemblages.

Not all named entities are comparable. The Eastern Micoquian, for instance, is known from many sites, spanning considerable time and space and might well be considered a complex. When grouped with the Micoquian from Central Europe, both its geographic range and its technological and typological variability increase markedly so, together, the Central and Eastern Micoquian (the Micoquian, *sensu lato*) might well be considered a technocomplex. On the other end of the spectrum, there is the Spitsynskaya, consisting of, at most, two assemblages clustered at a single locus, and dating to a very brief interval. At best, the Spitsynskaya might be considered an industry but one that is more hypothetical than documented.

The Eastern Micoquian Complex

For a long time, the Central European Micoquian was viewed as the standard for typological and chronological definitions of the Eastern European Micoquian (Gladilin 1985; Yevtushenko 1999). Yet, investigations in Bavaria, the Prâdnik Valley, and the Brno district demonstrated that the typological structure of the Central European Micoquian itself was very complex in each area and in Central Europe, as a whole (Kozłowski and Kozłowski 1977; Valoch 1988; Richter 1997, 1999; Conard and Fischer 2000). In spite of that internal variability, research also shows typological and technological similarities among some Eastern and Central European Micoquian assemblages (Kozłowski and Kozłowski 1977). Symmetric and asymmetric plano-convex bifacial tools (Figure 25-9: *1-4, 7, 8*) were recognized as a shared characteristic of the Micoquian in every area (Bosinski 1967; Chmielewski 1969; Kulakovskaya 1990; Kulakovskaya et al. 1993; Yevtushenko 1998c; Burdukiewicz 2000). In fact, the presence of these bifacial plano-convex tools and the specific method of their manufacture became the diagnostic criterion that differentiates the Micoquian from other Central and Eastern European Middle and Early Upper Paleolithic industries.

Within the Eastern European Micoquian technology and its ever-present, shared plano-convex method of bifacial tool production and its paucity of purposeful blade production, there is significant variability in typological structure (the proportional occurrences of different tool groups). Sometimes these typological differences seem to overwhelm the similarities. For instance, the typological structures of Ripiceni Izvor and Barakaevskaya are very different, as are those of Antonovka I and Gubs shelter #1. As isolated occurrences, these differences were even considered sufficient to place the assemblages into different "cultures." Yet, when viewed as part of the known, rather limited, variability of most Eastern Micoquian assemblages, they can be seen as merely the extremes within a cluster of varying typological structures. There are now a significant number of dated and published Crimean Micoquian assemblages, and they are used here to define chronological, technological, and typological variability found in the Eastern Micoquian of the Northern Caucasus, Lower Volga, Donbass-Azov, and Prut-Dniester regions.

Crimea

The Crimean Micoquian apparently fails to exhibit any typological or technological changes during the 100,000 years of its existence. Both chronologically early and late Micoquian assemblages are characterized by a dominance of the plano-convex method of bifacial tool production within the bifacial reduction, as well as flake blank production based on the reduction of cores without supplementary striking platforms or volumetric flaking surfaces (Chabai 1998d, in press). When blades occur, they are only the unintentional results of invasive reduction of the convex surfaces of plano-convex tools.

Differing ratios of simple (transverse, simple, and double scrapers), convergent (points and convergent scrapers), and bifacial tools (all types of bifacial tools) have been used to subdivide the Crimean Micoquian into three facies: Ak-Kaya, Starosele, and Kiik-Koba (Chabai and Marks 1998; Chabai et al. 1998). These facies are thought to reflect different patterns of economic activities and different adaptations to varying raw material availability (Chabai et al. 1995; Marks and Chabai 2001). The proportional variation in bifacial tools, relative to simple and converging tools, is truly marked, from very low to over one-third (Table 25-7).

Bifacial scrapers and points (Figure 25-9: *1, 4, 8*) have a variety of shapes, most often semi- and sub-leaf and semi- and sub-crescent. Backed bifacial scrapers, resembling Prondnik and Klausennische types occur mainly in the Ak-Kaya facies but occur in other facies, as well. The semi-leaf, sub-leaf, semi-crescent, sub-crescent, semi- trapezoidal, and sub-trapezoidal shapes (Figure 25-9: *6*) are dominant among points and convergent scrapers. Unifacial tools often have different kinds of ventral thinning that, while not truly bifacial, adds to the already marked tendency for modification of both blank faces.

Northern Caucasus

The core reduction strategy of Northern Caucasus assemblages is based on the use of parallel multi-platform, unsystematic, and radial cores (Belyaeva 1999; Golovanova and Hoffecker 2000). The distinctive features of the Micoquian assemblages, said to separate them from the other Middle Paleolithic industries of the Caucasus, are bifacial triangular and leaf-shaped points (Figure 25-9: *7*), bifacial scrapers, and "knives," resembling Bockstein, Klausennische, and Sukhaya Mechetka types (Golovanova and Hoffecker 2000: 38).

Bifacial tools vary from as low as 1% (Barakaevskaya and Monasheskaya) to a high of only 12.6 % (Mezmaiskaya layer 3), convergent tools vary from 14% to 53%, and simple tools from 16% to 45%. Different trapezoid (Figure 25-9: *5*) and crescent shapes occur among convergent scrapers. Only in Matuzka layer 4B-C do convergent tools outnumber simple tools. Thus, most Northern Caucasus Micoquian assemblages are characterized by low proportions of bifacial tools relative to simple and convergent tools. On this basis, the proposed typological similarity of some Northern Caucasus assemblages specifically with Prolom I (Liubine 1994:161), or with the Kiik-Koba facies, as a whole (Golovanova and Hoffecker 2000: 47), is without foundation. Rather, the Northern Caucasus Micoquian assemblages of Mezmaiskaya layers 2-2A, 2B-4, and 3, Barakaevskaya, and Gubs Shelter # 1, among others, can be linked with the Crimean Micoquian of Staroselian facies (Table 25-8).

Donbass-Azov

The Micoquian of the Donbass-Azov region is known from Antonovka I and II, Belokuzminovka level 1, Cherkasskoe, Nosovo I, and, probably, Rozhok I. The most typical assemblages were found at Antonovka I and II (Gladilin 1976).

The core reduction strategy at both Antonovka sites was based on the reduction of parallel and multi-platform cores. Bifacial tools range from 21% to 24% of all tools (Gladilin 1976:89) and most were made on flakes and called "semi-bifacial" by Gladilin.

Simple tools dominate the tool assemblage. Points are very rare and convergent scrapers include a variety of crescent, triangular, trapezoidal, and leaf shapes (Gladilin 1976: 71-76). Different kinds of ventral thinning were used in convergent scraper manufacture and

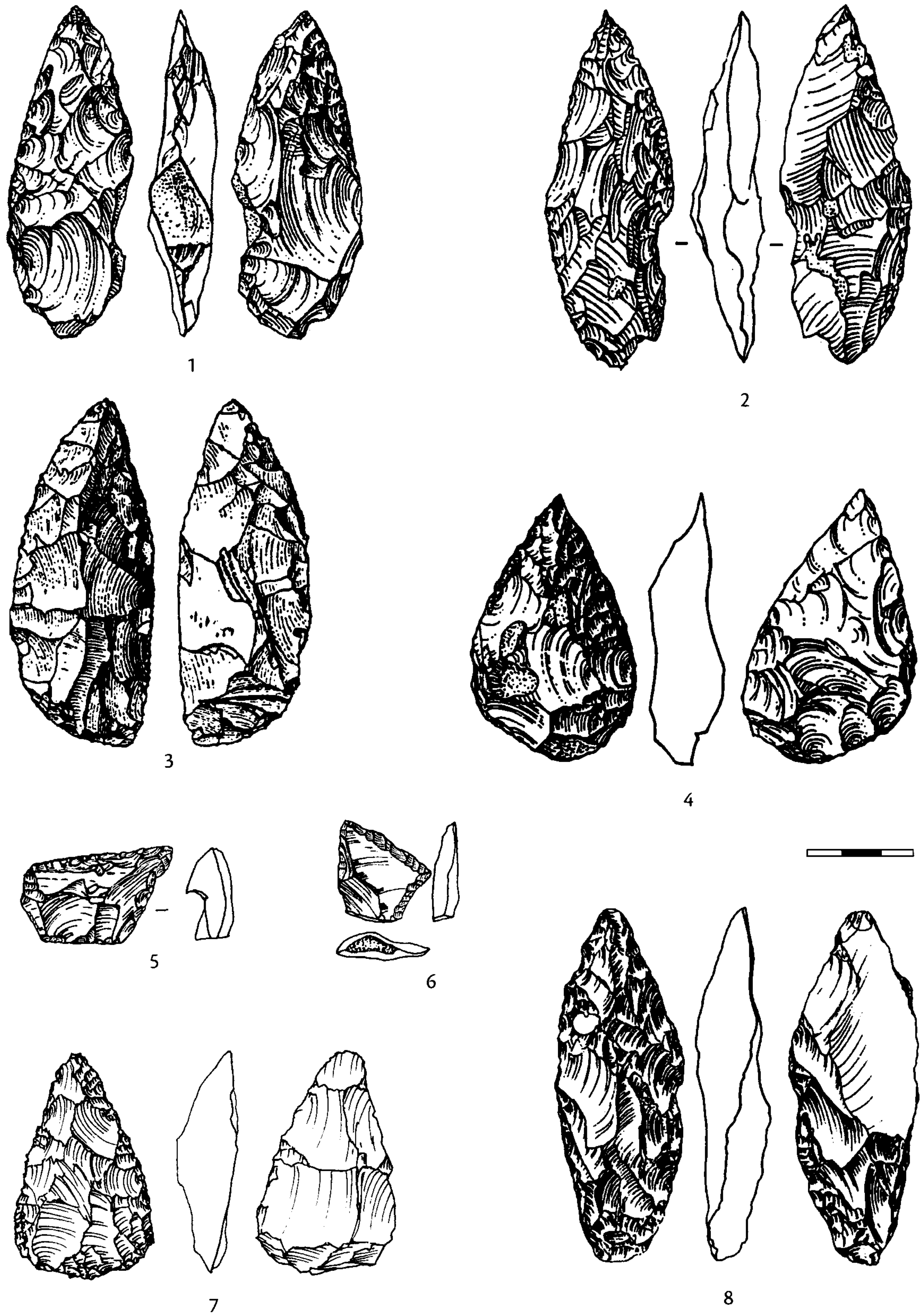


Figure 25-9—Eastern European Micoquian bifacial leaf-shaped points and scrapers (1–4, 7, 8) and sub-trapezoidal scrapers (5, 6) from Zaskalnaya V layer III (1, 4); Antonovka I (2); Ripiceni-Izvor, Mousterian layer IV (3); Mezmaiskaya layer 2A-2 (5); Buran-Kaya III layer B (6); Barakayevskaya (7); and Kabazi II level III/2 (8) (after Kolosov 1984; Gladilin 1976; Chabai 1998b; Golovanova and Hoffecker 2000).

TABLE 25-7
Facies of the Crimean Micoquian: ratios of simple, convergent, and bifacial tools

		Simple	*Convergent*	*Bifacial*
Ak-Kaya	Chokurcha I, IV-I	47.9	16.7	35.4
	Kabazi II, V-VI	31.4	25.5	43.1
	Zaskalnaya VI, II	37.8	32.1	30.1
	Chokurcha I, IV-M	30.3	39.4	30.3
	Zaskalnaya V, V	28.2	42.3	29.5
	Kabazi II, III	51.3	20.5	28.2
	Chokurcha I, IV	47.3	25.8	26.9
	Sary-Kaya, 1977	58.5	15.3	26.6
	Zaskalnaya V, II	49.9	26.2	23.9
	Zaskalnaya V, III	46.1	30.4	23.5
	Zaskalnaya V, VI	41.7	35.4	22.9
	Zaskalnaya VI, III	53.9	26.1	20.0
	Chokurcha I, IV-O	57.5	27.5	15.0
Starosele	Prolom II, III	48.3	34.8	16.9
	Zaskalnaya VI, V	37.9	45.4	16.7
	Zaskalnaya V, I	33.3	50.7	15.9
	Prolom II, II	43.6	42.6	13.8
	Zaskalnaya V, IV	39.9	47.7	12.4
	Zaskalnaya VI, IV	46.9	42.4	10.6
	Prolom II, IV	48.6	44.3	7.1
	Starosele, 1	44.3	43.4	12.3
	Kabazi V, C	48.1	38.9	13.3
	Kabazi V, D	44.6	42.1	12.2
Kiik-Koba	Prolom I, lower layer	27.8	54.1	18.1
	Prolom I, upper layer	30.9	55.3	13.7
	Kiik-Koba, upper layer	27.5	56.2	16.3
	Buran-Kaya III, 7-8	37.0	51.9	11.1
	Buran-Kaya III, B	38.0	51.2	10.8

rejuvenation. The shapes of bifacial tools (Figure 25-9: *2*) are about the same as for convergent scrapers. Tools resembling Bockstein and Klausennische knives were defined among the bifacial tools (Gladilin 1976:71).

On a whole, the Antonovka I and II assemblages are characterized by the dominance of simple tools (35.9% to 50%), very high proportions of bifacial tools (33.7% to 28.7 %), and moderate proportions of convergent tools (30.3% to 21.8%). This typological structure differs from that of the Northern Caucasus and Lower Volga Micoquian but falls with the range of the Ak-Kaya facies of the Crimean Micoquian (Table 25-8).

There are a few other Donbass-Azov sites that appear to be Micoquian, but their tool samples are poor and the reports preliminary, preventing their placement within the three Crimean facies. At Belokuzminovka layer 1, about 200 artifacts were recovered but few were retouched. The toolkit consists of transverse scrapers, one "asymmetric" point, denticulates, as well as bifacial crescent and ovoid scrapers (Kolesnik 1993:123). The tools found in Nosovo I include simple, diagonal, and *déjeté* scrapers, "crescent-shaped knives," bifacial backed knives, and triangular scrapers (Schelinskij 1999:123, 126-127).

Lower Volga

The most representative Micoquian assemblage in the Lower Volga Valley is from the open-air site of Sukhaya Mechetka. The core reduction strategies are based on the reduction of radial and "multi-platform parallel" cores. Bifacial tools account for 9% of the retouched tools, and all of them are plano-convex (Kuznetsova 1985:8-10).

The toolkit is dominated by unifacial simple lateral scrapers and transverse, diagonal, and double scrapers are common. There are symmetric and asymmetric points, many semi-trapezoidal scrapers, and the bifacial tools are mainly leaf-shaped and crescent. Kuznetsova (1985:10) also noted the presence of backed bifacial tools, typologically close to Klausennische knives.

The proportional occurrences of the three tool groups (convergent tools ca. 36%, simple tools ca. 48%, and bifacial tools ca. 16%) links the Sukhaya Mechetka assemblage to the Staroselian facies of the

TABLE 25-8
Distribution of Eastern European Micoquian assemblages according to ratios of bifacial, simple, and convergent tools

High amount of bifacial tools; simple dominating the convergent tools	*High-mid amount of bifacial tools; simple dominating the convergent tools*	*Mid-Low amount of bifacial tools; simple dominating the convergent tools*	*Low amount of bifacial tools; simple dominating or equal to convergent tools*
Sary Kaya, 1977	Zaskalnaya VI, II	Sukhaya Mechetka	Prolom II, IV
Ripiceni-Izvor, IV, V	Kabazi II, III		Zaskalnaya VI, IV
	Chokurcha I, IV		Chokurcha I, IV-O
	Antonovka I		Mezmaiskaya, 2-2A
	Antonovka II		Barakaevskaya
			Gubs shelter #1
			Prolom II, II
			Prolom II, III
			Mezmaiskaya, 2B-4
			Mezmaiskaya, 3

Crimean Micoquian, as well as being very similar to Mezmaiskaya layers 2B-4 and 3 in the Northern Caucasus (Table 25-8).

The Cheluskinets II assemblage was called Micoquian based on a single bifacial tool found in the scree near the site profile (Kuznetsova and Sergin 1999:103). While it may be related to the archeological layer, additional data are required before any judgment can be made about this site's industrial status.

Prut-Dniester

The most representative Micoquian assemblages in the Prut-Dniester region are from Ripiceni-Izvor Mousterian layers IV and V. The core reduction strategy was based on the reduction of parallel and unsystematic cores. A few Levallois tortoise cores were also reported. The bifacial tools in the assemblages were plano-convex.

The layer IV tool assemblage is dominated by simple scrapers, including some with "bifacial retouch," as well as denticulates, notches, and bifacial leaf-shaped points. In Layer V, simple scrapers also are most numerous, followed by denticulates and notches, while "scrapers with bifacial retouch" and bifacial leaf-points are rare (Păunescu 1993:92, 118). Convergent scrapers, including *déjeté* scrapers, are not numerous. The bifacial leaf-points are both symmetric and asymmetric (Figure 25-9: *3*) (Păunescu 1993:107), and most bifacial scrapers are triangular and ovoid. In addition, there were backed bifacial tools, referred to as Prondniks (Păunescu 1993:113, 126). Păunescu provided several values of bifacial tool indices (Păunescu 1993:93, 120), but the percentage of bifacial tools, in our terms, approaches 20%.

Thus, the assemblages from Ripiceni-Izvor Mousterian layers IV and V, are characterized by a relatively high percentage of bifacial tools (among all scrapers, points, and bifacial tools). One of the closest analogies to this Micoquian might be the assemblage found in 1977 at the Crimean Micoquian Ak-Kaya facies site of Sary-Kaya (Table 25-8).

It is also most likely that the few bifacial plano-convex tools found in the small artifact collections from Ripiceni-Izvor Mousterian layer VI, Kolodiev (depth 12.5-12.9 m), and Yezupil layer II belong to the Eastern Micoquian complex (Păunescu 1993: 126–130; Sytnyk et al. 1996:90–91; Sytnyk 2000:336), but to which facies is unknowable.

Micoquian Variability

In sum, the Eastern European Micoquian is technologically homogeneous but typologically proportionately variable (Figure 25-9). The raw material exploitation technologies of all assemblages are based on both non-Levallois flake core reduction and the plano-convex method of bifacial tool production. All the known facies—defined by proportional variations in toolkits—are found in Crimea, where the largest number of Micoquian occupations are known and extensively published (Table 25-8). It is most likely that the toolkit varieties of Micoquian assemblages in other regions reflect the same economic status of settlements and differential availability of raw material, just as they do in Crimea. The facies of the Eastern Micoquian in Crimea exhibit more typological variability than in all other Eastern European Micoquian assemblages combined. For instance, there is no analogy to the typological structure of the Kiik-Koba facies in any assemblage outside of Crimea. This might well reflect the unique combination of natural and anthropological events on the peninsula that were responsible for the development of the Kiik-Koba facies (Chabai 1999a:71–73).

The Levallois-Mousterian Industry

The Levallois-Mousterian is found in two regions: in Crimea and the Prut-Dniester Basins. Assemblages with a pronounced Levallois component in Crimea were called "Western Crimean Mousterian," while in the Prut-Dniester region they were called "Molodova Mousterian Culture" (Chabai 2000b; Sytnyk 2000). For both regions, the common technological and typological characteristics of these Levallois-Mousterian assemblages are: a combination of Levallois tortoise and uni- and bidirectional blade technologies; a dominance of simple scrapers and a relative rarity of convergent scrapers, denticulates, and notches; and the use of flat, non-invasive scalar retouch (Figure 25-10). During core reduction, supplementary platforms and main platform(s) preparation were widely used. There is no evidence for any bifacial tool technology (biconvex or plano-convex) in the Levallois-Mousterian in Eastern Europe. The most salient difference between the Eastern European Levallois-Mousterian and Micoquian lies in the fundamentally dissimilar technologies used for blank and tool production.

Crimea

There are two chronological stages seen in the Western Crimean Mousterian (Chabai 1998b, 1998c, 2000b). The early stage is found at Shaitan-Koba upper level and Kabazi II level IIA/2 through II/7. The late one occurs in Kabazi II levels II/6 through A3A. The technological difference between these stages lies in the use of Levallois and/or blade technologies. During the early stage, both technologies were used. The Levallois technology utilized tortoise cores, and unidirectional and bidirectional parallel cores were used for blade production. In the early Western Crimean Mousterian, these blade cores have supplementary platforms and faceted striking platforms. Some volumetric blade

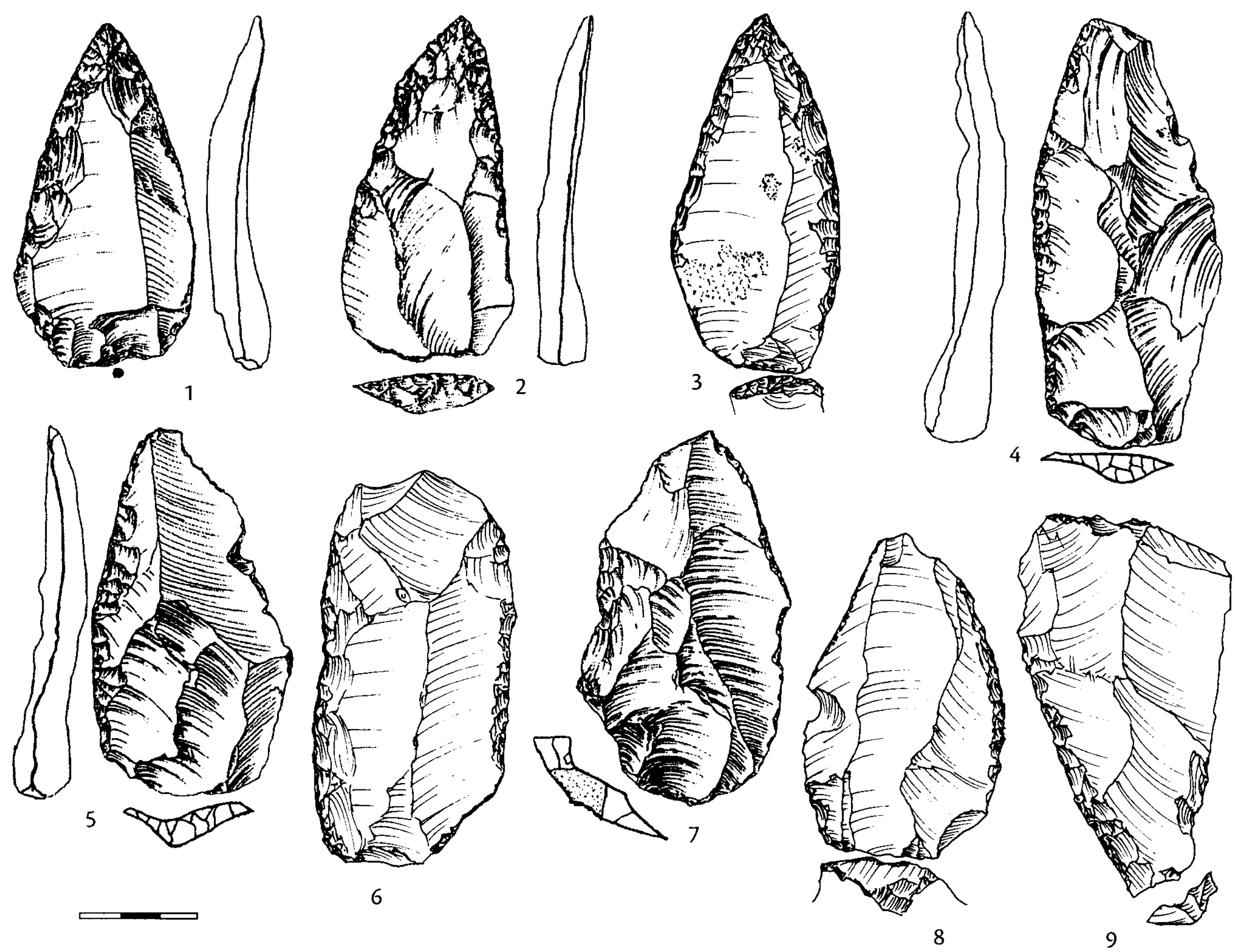


Figure 25-10—Eastern European Levallois-Mousterian semi-leaf (1, 3) and semi-crescent (2) points, convex scrapers (4, 5, 8), straight scraper (9), double straight scraper (6), retouched piece (7). Tools made on Levallois blanks (2, 4, 6) and on enlèvements II (5, 7). Kabazi II level II/8 (1, 2, 4, 5, 7); Molodova I layer 4 (3, 6, 8, 9) (after Chabai 1998b, 1998c; Chernysh 1982).

cores were also found in the early stage. There is no Levallois technology used in the late Western Crimean Mousterian; blank production was limited to the use of parallel blade cores, some of which are conceptually volumetric. The technological differences between the early and late stages are reflected by the proportions of blades and faceted platforms. In the early stage, the average blade index is 19 and the average faceting indices are IFs = 52 and IFl = 69. In the late stage, the blade index rises sharply to 35, while the faceting indices drop to 37 and 58, respectively.

In spite of these technological differences, the typological structure of the toolkits is almost identical. In both stages, simple lateral scrapers (Figure 25-10: *4, 5*) account for between 55% and 70% of all tools, while convergent scrapers are rare. Points vary from 14% to 25% but, unlike in the Micoquian, most are distal and lateral, although some sub-triangular, semi-crescent, and semi-leaf points (Figure 25-10: *1, 2*) occur. Denticulates and notches never exceed 15% of the toolkits. More than one-half of the tools are on either blades or elongated Levallois blanks (Figure 25-10: *2, 4, 5, 7*). Usually, tools have non-invasive, flat scalar retouch. In spite of the marked elongation of the tools, Upper Paleolithic types are very rare and in most assemblages are not present, at all.

Prut-Dniester

The Levallois-Mousterian of the Prut-Dniester region is found in the following assemblages: Yezupil layer III, Proniatin, Ripiceni-Izvor layers I–III, Molodova I layers I–IV, Molodova V layers 11–12, Bugliv V layer II, and Igrovitsa I layer II (Chernysh 1965, 1982, 1987; Păunescu 1993; Sytnyk 2000).

Differences do occur among assemblages in the proportion of core types and the percentage of blades produced. The cores at Yezupil layer III are mainly uni- and bidirectional (Sytnyk 2000:254), while Levallois tortoise cores are most pronounced at Proniatin, Molodova I layers I–IV, Molodova V layers 11–12, and Ripiceni-Izvor layers I–III. In fact, the oldest assemblage, Yezupil layer III, has the highest blade component: Ilam = 25. Blade indices for other assemblages range from about 13 to 15, and rarely exceed 20. All of the Levallois-Mousterian assemblages, except Ripiceni Izvor layers I–III, have high faceting indices (IFs = 45–55, IFl = 60–70). In spite of the pronounced Levallois element in core and blank production, platform preparation at Ripiceni-Izvor layers I–III is relatively low (IFs 28–40, IFl = 31–44). It is likely that these variations within a shared technology reflect minor differences in raw material economy brought about by distance from raw materials, raw material packaging, and the intensity and duration of occupations.

The toolkits of these assemblages are dominated by simple lateral scrapers (Figure 25-10: *8, 9*), with points, mainly sub-triangular and semi-leaf (Figure 25-10: *3*), varying from 5% to 20%. There are a few Levallois points, scrapers made on Levallois blanks are common (Figure 25-10: *6*), while denticulates and notches are rare. "Upper Paleolithic" tool types are uncommon. Almost all tools have non-invasive, flat scalar retouch (Figure 25-10: *3, 6, 8, 9*).

Levallois-Mousterian Variability

It is possible to divide the Eastern European Levallois-Mousterian into two groups, one of which has only rare blade production and the other where blade technology is very developed. These groupings, however, seemingly have no chronological significance. At least, the earliest Levallois-Mousterian assemblage from Yezupil layer III has about the same level of blade technology as the assemblages of the late Western Crimean Mousterian, despite their ca. 100,000-year time difference. Thus, it appears that blade technology in the Levallois-Mousterian has no evolutionary significance. Most likely, the degree to which blade technology was used was an adaptation to different economic and environmental conditions.

The Blade Mousterian

Blade Mousterian assemblages are found only during the 1st Period in the Don River Basin and its tributary, the Seversky Donets Basin. The Blade Mousterian is found in the following sites: Kurdumovka, Belokuzminovka layers 2 and 3, Zvanovka, and Shlyakh (Kolesnik 1993, 1994a, 1995; Nehoroshev 1996; Nehoroshev and Vishnyatsky 2000).

The core reduction strategy in the Blade Mousterian is based solely on unidirectional and bidirectional volumetric cores (Figure 25-11: *6, 7*), on which supplementary platforms and faceted platforms are uncommon. Blades (Figure 25-11: *1-5, 8*) account for 20% to 30% of all blanks, while blanks with faceted platforms are uncommon: IFs = 22–40, IFl = 40–60. According to Kolesnik (2000:78), the core reduction strategy was based on that described for Rocourt (Otte et al. 1990). On the other hand, according to Nehoroshev and Vishnyatsky (2000:265), the core reduction strategy is very close to that described for Roc-de-Combe layer 8 by (Pelegrin 1990). In any case, both the Rocourt and Roc-de-Combe methods are very different from the early and late Western Crimean Mousterian blade technology, as described above.

Toolkits include points (Figure 25-11: *1-3*), simple (Figure 25-11: *9, 10*) and double scrapers, denticulates, and notches. Convergent scrapers are rare. The most characteristic tool type is the truncated-faceted and bi-truncated-faceted piece (Kolesnik 1994b), which was widely used. Even some points and scrapers have truncated-faceted bases. Nehoroshev and Vishnyatsky (2000:260) reported some atypical endscrapers and

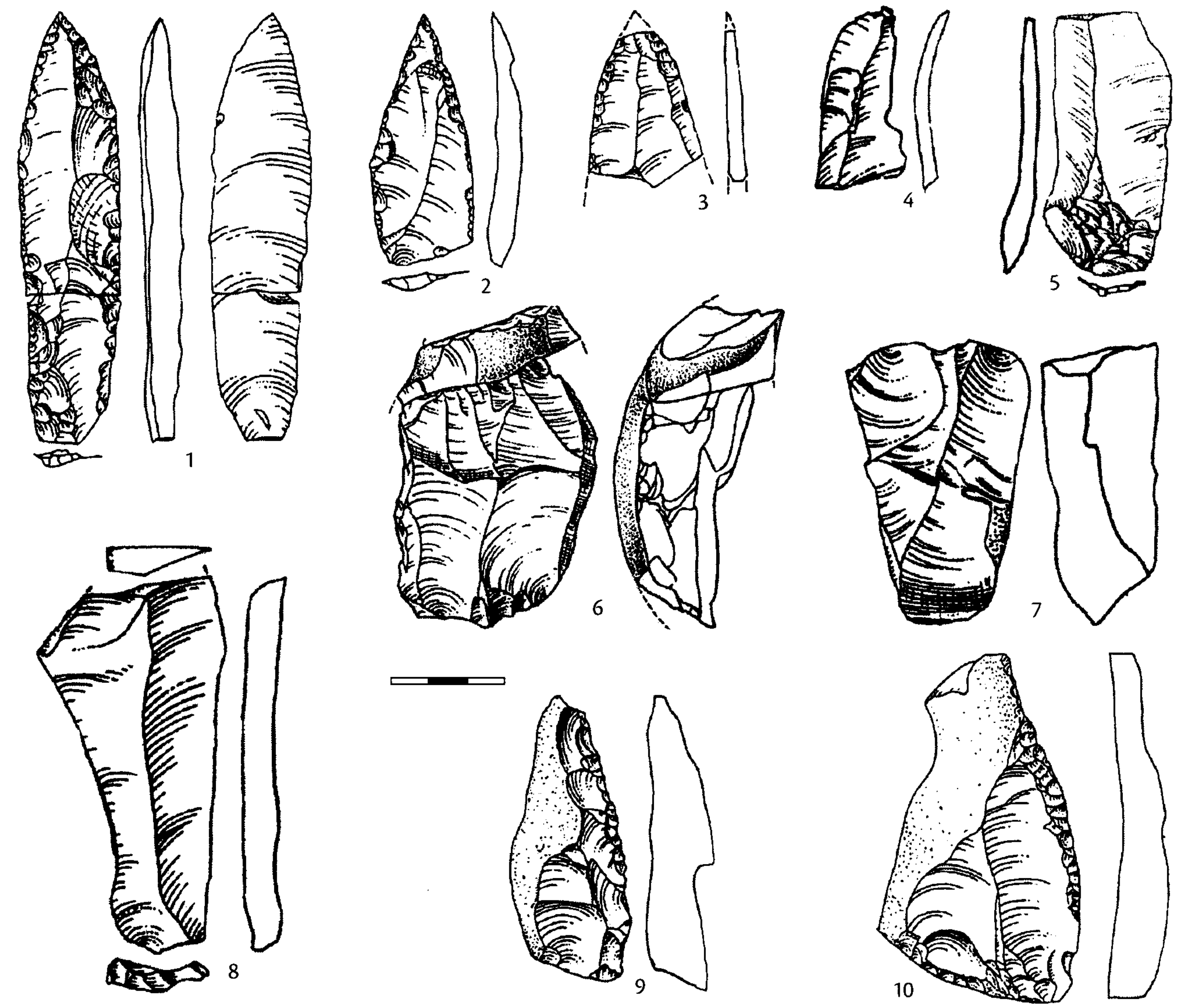


Figure 25-11—Eastern European Blade Mousterian points on blades (*1, 2, 3*), blades (*4, 5, 8*), cores (*6, 7*), and convex scrapers (*9, 10*) from Kurdumovka (after Kolesnik 1994a, 2000).

burins at Shlyakh but, according to them, these tools "are crude and inexpressive." Usually, non-invasive, flat scalar retouch was used in tool production.

Thus, the Blade Mousterian assemblages have both a typological and technological distinct repertoire when compared to the Micoquian or Levallois-Mousterian. Unlike the Micoquian and Levallois-Mousterian, Blade Mousterian assemblages are very homogeneous and do not show any significant technological, typological, chronological, or geographic variations.

The Streletskaya

Streletskaya assemblages are found in the Mid Don, the Lower Don, Crimea, and Central and Northern Urals; the largest distribution for any 3rd Period industry. They all share the common technological and typological features of the production of thin, bi-convex bifacial tools; the presence of bifacial leaf-shaped and triangular points (many of the latter with concave bases); and fan-shaped and laterally retouched endscrapers on flakes, sometimes with thinned base (Figure 25-12). In spite of its Upper Paleolithic attribution, there is no blade technology and there are very few burins.

This combination of technological and typological traits is unique in Eastern Europe and without obvious, direct connections to earlier, contemporary, or succeeding industries. Anikovich (1991) proposed the term "Eastern Szeletian" for the Streletskaya assemblages to underline the presence of bifacial tools in this Upper Paleolithic industry. The same rational was

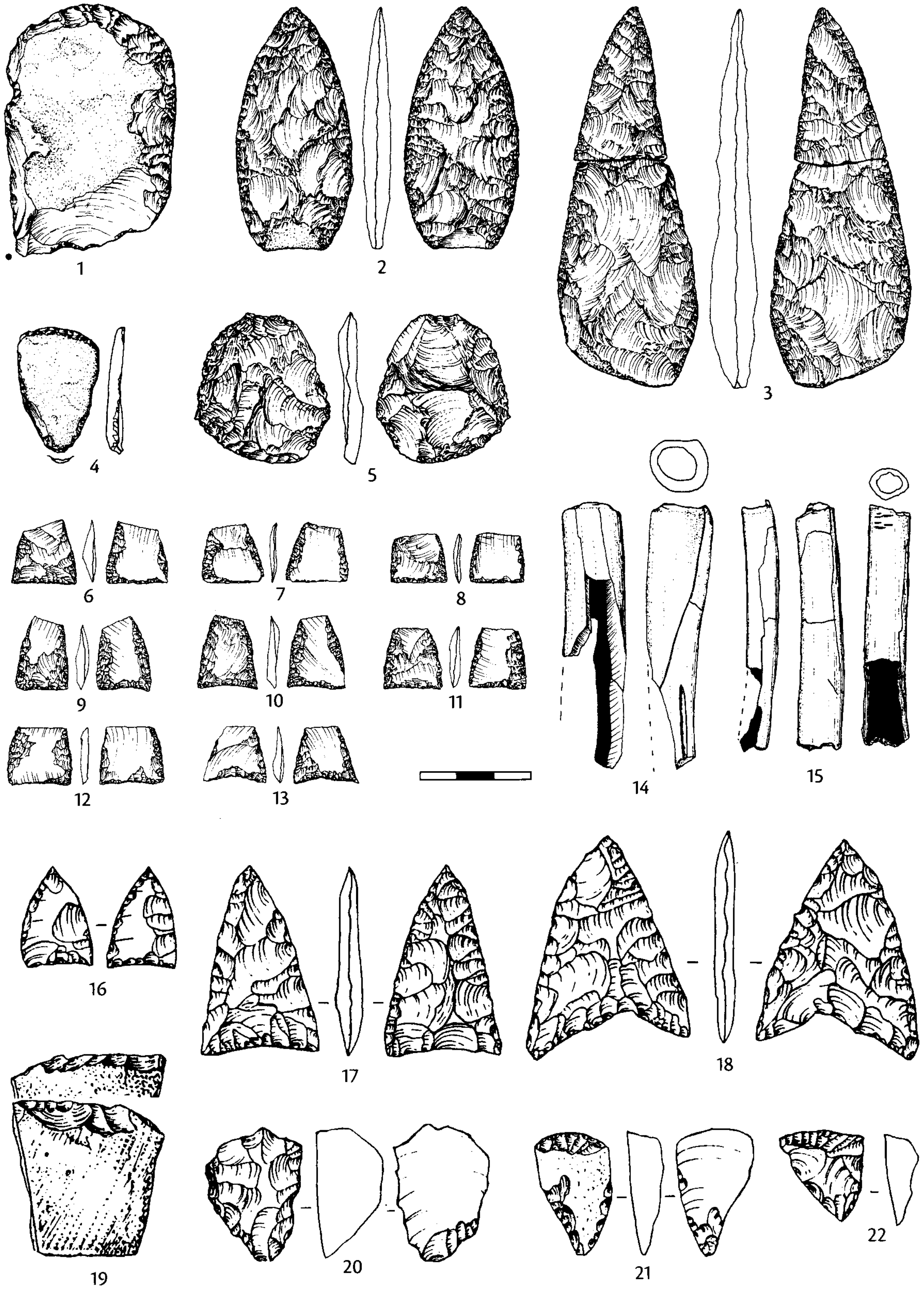


Figure 25-12—Streletskaya complex endscrapers (1, 4, 20, 21, 22), bifacial leaf-shaped points (2, 3), core (5), bifacially retouched "trapezoids" (6–13), worked bones (14, 15), bifacially retouched micro-point (16), bifacial triangular points with concave base (17, 18), and retouched flint plaquette (19) from Buran-Kaya III level C (1–15), Kostenki 1 layer V (16–18, 20–22), and Kostenki 12 layer III (19) (after Monigal 2001; Rogachev and Anikovich 1984).

used in reference to the assemblage from Buran-Kaya III level C (Marks 1998:362; Chabai et al. 1998:29-30; Monigal 2001:61). No suggestion of any direct connections between the Crimean Early Upper Paleolithic with bifacial tools and the Central European Szeletian was intended, although it confused some (e.g., Kozlowski 2000a:90).

Crimea

The only Crimean Streletskaya assemblage occurs at Buran-Kaya III level C. There is little evidence for any reduction strategy other than bifacial (Marks 1998; Monigal 2001, Chapter 5). Bifacial tool production technology, carried out by soft-hammer, was complex and involved a final thinning stage incorporating edge abrasion. The toolkit of Buran-Kaya III level C includes bifacial foliates (Figure 25-12: *2, 3*), endscrapers on laterally retouched flakes (Figure 25-12: *1, 4*), retouched pieces, and the most peculiar of artifacts—bifacially retouched microlithic trapezoids (Figure 25-12: *6–13*) (Marks 1998; Marks and Monigal 2000, 2003; Monigal 2001, Chapter 5). If the bifacial foliates and endscrapers (Figure 25-12: *4*) clearly resemble the same types in the Mid Don Streletskaya assemblages, the bifacial trapezoids are a new typological element in the European Early Upper Paleolithic. These bifacially retouched trapezoids have either straight (Figure 25-12: *6-8*) or concave (Figure 25-12: *9-13*) bases. The latter might be interpreted as similar to the bifacial micro-points found in most Streletskaya assemblages (Chabai 2000a:78). In addition, a few clearly worked bone tubes (Figure 25-12: *14, 15*) were recovered (Yanevich et al. 1997; d'Errico and Laroulandie 2000; Laroulandie and d'Errico, Chapter 7).

Mid Don

The largest Streletskaya assemblages come from Kostenki 12 layer III (108 tools) and Kostenki 1 layer V (119 tools) (Rogachev and Anikovich 1982c:139; Rogachev et al. 1982:65). The reduction strategies of both assemblages include bifacial and true flake-core exploitation. Bifacial tool production is characterized by soft hammer removals and edge abrasion. A special "thinning flake" method was also applied (Bradley et al. 1995, Anikovich et al. 1997). This technology produced bifacial points that are thin and wide, bi-convex, triangular, and leaf-shaped. The cores have mainly parallel single and double platforms and with flat flaking surfaces (Rogachev and Anikovich 1984:179).

The dominant tool classes in Kostenki 12 layer III and Kostenki 1 layer V are bifacial tools (17.6%–36.1%), endscrapers (16.6%–20.2%), and retouched pieces (ca. 30 %). Other tools include scrapers (5%–11.9%), points (< 3 %), perforators (< 3 %), burins (0.9%–6.7%), and *pièces esquillées* (1.9%–3.4%) (Rogachev and Anikovich 1982c:139; Rogachev et al. 1982:66).

Bifacial tools include unfinished forms, triangular and leaf-shaped points, asymmetric double pointed tools, "ovoid-shaped discoidal tools," knives, leaf-shaped points with convex bases shaped by abrupt retouch, and triangular points with concave bases (Figure 25-12: *17, 18*) (Rogachev and Anikovich 1982c: 139). At Kostenki 1 layer V, there were bifacial micro-points (Figure 25-12: *16*), which ranged in size between 2.0 and 2.5 cm (Rogachev and Anikovich 1984:181).

Endscrapers share a number of attributes: they are mainly small, their working ends are convex or straight, they are triangular-shaped with the scraping end on the wide distal extremity, and the bases of some have ventral retouch (Figure 25-12: *20, 21, 22*) (Rogachev and Anikovich 1982c:139). Two forms were noted: sub-triangular endscrapers with straight lateral and distal edges and heart-shaped endscrapers (Rogachev et al. 1982: 65).

Scrapers are mainly straight, convex, or wavy and are closer to retouched pieces, rather than to Middle Paleolithic scrapers. The few burins are transverse plan.

Rogachev and Anikovich (1984:179–181) thought that the Kostenki 1 layer V and, especially, Kostenki 12 layer III assemblages had significant "archaic Mousterian forms," including "ovoid shaped discoidal tools," scrapers (Figure 25-12: *19*), points, and bifacial "knives." The scrapers in question do not differ from the retouched pieces and can hardly be considered an "archaic Mousterian element." In addition, technological studies by E. Giria (1999) document that the "archaic Mousterian" bifacial tools are merely preforms for bifacial triangular point production and that the Streletskaya bifacial technology was wholly Upper Paleolithic, showing no "transitional" features (Giria 1999:51–52).

Streletskaya Variability

There are a number of poorly dated Streletskaya assemblages, both north and south of the Kostenki-Borshchevo area. The most northern, from the north-eastern extremity of Eastern Europe, near the western slopes of the Northern and Central Ural Mountains (Guslitzer and Pavlov 1993: 182), are at Garchi I and Byzovaya and are thought to date to ca. 25,000 BP. Halfway between Kostenki-Borshchevo and Crimea in the lower Seversky Donets Valley, another Streletskaya assemblage was found at Birioutchia Balka 2 layer 3 (Matioukhine 1998), above the Bryansk-Arcy soil (Figure 25-2).

All Streletskaya assemblages are based on the same bifacial technology. Yet, there are some variations in tool typology. Birioutchia Balka 2 layer 3 contains a more pronounced component of the characteristic bifacial triangular points with straight and slightly concave bases than reported for Kostenki 12 layer III and Kostenki 1 layer V. This feature makes Birioutchia

Balka 2 layer 3 more similar to the mixed assemblage from Sungir, which is considered by some to be a late form of the Streletskaya (see above). Birioutchia Balka 2 layer 3 also contains more micro-points than the Mid Don assemblages. Along with trapezoidal microliths, Buran-Kaya III level C differs from the other Streletskaya toolkits by the presence of bone artifacts. At the same time, all homogeneous Streletskaya assemblages lack Micoquian and Aurignacian typological and technological elements. An attempt to link the triangular bifacial and unifacial scrapers, found in the Micoquian of Zaskalnaya V layers II through IV, with the bifacial triangular points of Streletskaya (Anikovich 2000:27) is not supported by comparative technological analyses of Micoquian and Streletskaya bifacial technologies. Thus, quite apart from their partial contemporaneity, there is no archeological evidence for the origin of the Streletskaya in an acculturation of Crimean and Northern Caucasus Micoquian peoples by Aurignacian "newcomers," as proposed elsewhere (e.g., Anikovich 1992, 2000; Cohen and Stepanchuk 1999, 2000).

The Spitsynskaya

There is only one reliable Spitsynskaya assemblage, Kostenki 17 layer II, although there is an additional candidate at Kostenki 12 layer II (Boriskovski et al. 1982: 186). According to Rogachev and Anikovich (1982c), however, the typological definition of this latter assemblage is far from clear.

Only blade technology was used in the Spitsynskaya and it was based on parallel, prismatic, single and double platform cores with volumetric flaking surfaces (Figure 25-13: *13*). While there is only a single assemblage, there are about 330 tools from layer II of Kostenki 17. Burins dominate, comprising about 48% of the toolkit, and include burins on oblique truncations, double opposed burins on oblique truncations ("parallelograms" according to Boriskovski), plus dihedral and angle burins in fewer numbers (Figure 25-13: *5-12*). Endscrapers, comprising about 7% of the toolkit, are typically ovoid on flake with retouched edges and simple blade endscrapers (Figure 25-13: *1-4*). There are points on blade (ca. 3%), scaled pieces (5%), and nongeometric microliths (1.2%: one obversely retouched micro-blade, and three fragments of backed microblades/bladelets) (Boriskovski et al. 1982: 185-186).

Bone and ivory artifacts are represented by two awls made on hare and polar fox humeri, three fragments of bone points, and one fragment of worked mammoth tusk (Figure 25-13: *21, 22*).

Personal adornments include pendants made on polar fox teeth, stone, belemnites, shells, and fossil corals (Figure 25-13: *14-20*). According to S.A. Semenov, the holes in the teeth and stone were drilled, although there is no indication that this was done with a bow drill (Boriskovski et al. 1982:186).

Two cultural linkages for the Spitsynskaya have been proposed: Gravettian (Kozlowski 1986) and Aurignacian (Anikovich 1993). It seems clear, however, that Sinitsyn (2000:141) was correct when he commented that these attributions were based on the "desire of both authors to find in this material the support for their constructions, rather than its real context." It does seem clear that the Spitsynskaya is typologically distinct from all so far defined Upper Paleolithic industries.

The Gorodtsovskaya

The Gorodtsovskaya assemblages are also limited to the Mid Don region: Kostenki 15, Kostenki 14 layer II, Kostenki 12 layer I, Kostenki 16, and, probably, Kostenki 14 layer III (Rogachev and Anikovich 1982c; Rogachev and Sinitsyn 1982; Rogachev and Anikovich 1984; Sinitsyn 1996:284).

Technologically, the Gorodtsovskaya assemblages are characterized by the production of flakes and blades from unsystematic and parallel cores, the latter usually exhibiting a volumetric flaking surface (Figure 25-14: *22*). Bifacial tools are rare and unstandardized. There are some technological variations within the Gorodtsovskaya. Such assemblages as Kostenki 15 and Kostenki 14 layer II were based on flake cores (Figure 25-14: *23*), while the assemblages from Kostenki 12 layer I and Kostenki 14 layer III have a dominant blade technology. This difference was considered developmental and "progressive" through time (Rogachev and Anikovich 1984:185). Yet, the "progressive" assemblage from Kostenki 14 layer III is stratigraphically lower than the "archaic" assemblage from layer II of the same site.

The largest Gorodtsovskaya toolkits were found in Kostenki 15, Kostenki 14 layer II, and Kostenki 12 layer I. Endscrapers are most numerous, followed by good numbers of scaled pieces at Kostenki 15, "archaic Mousterian" tools at Kostenki 14 layer II, and by burins at Kostenki 12 layer 1. Another "progressive" change is seen in the appearance of 11 microliths (7 backed micro-blades and 4 points on micro-blades) at Kostenki 12 layer 1 (Rogachev and Anikovich 1982c: 136).

Endscrapers include those with parallel edges made on blades (Figure 25-14: *6-8*) and those with expanding edges made on flakes (Figure 25-14: *1-5*). The most common parallel-edged endscrapers are thick and abrupt, while the fan shaped endscrapers often have ventral thinning. Double endscrapers with retouched lateral edges are also common (Figure 25-14: *9*) and are similar to limaces (Figure 25-14: *10*), which are also present in Gorodtsovskaya assemblages.

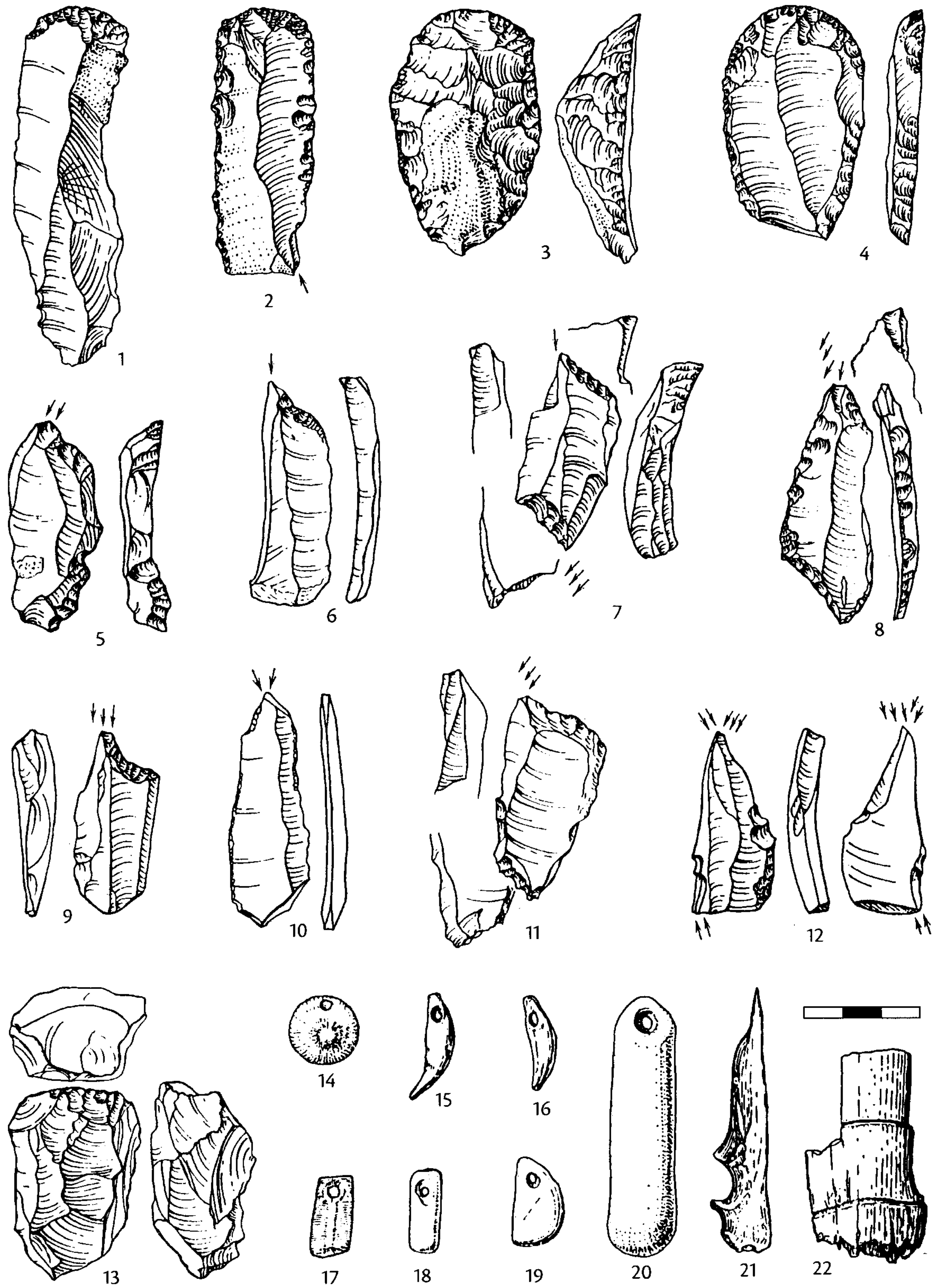


Figure 25-13—Spitsynskaya endscrapers (*1–4*), burins (*5–12*), core (*13*), adornments made on shell (*14*), teeth (*15, 16*), stone (*17–20*), awl (*21*), and worked mammoth tusk (*22*). All from Kostenki 17 layer II (after Boriskovski et al. 1982).

Other tools include scaled pieces (Figure 25-14: *11-18, 21, 23*) of various forms (Rogachev and Sinitsyn 1982a:154, 1982b:168;), dihedral burins at Kostenki 15, and both dihedral and angle burins at Kostenki 12 layer I, but no burins in Kostenki 14 layer II (although three burin spalls were found) (Rogachev and Sinitsyn 1982a:154).

The bone and ivory artifacts of the Gorodtsovskaya are characterized by a striking variety of shapes: "shovels" with nail-like heads made on mammoth long bones; points of different types, including needle-like ones; awls; retouchers; polishers; and pendants (Rogachev and Sinitsyn 1982a, 1982b; Sinitsyn 1996). The shafts of the "shovels," bone points, and tube bone fragments were decorated with complex bands of geometric incisions (Figure 25-15: *1, 2, 6, 8, 12, 14, 15, 16*). Three types of pendants have been reported: decorated bird bones, drilled stone pieces, and drilled shells (Figure 25-15: *2, 8, 12*) (Rogachev and Sinitsyn 1982a, 1982b).

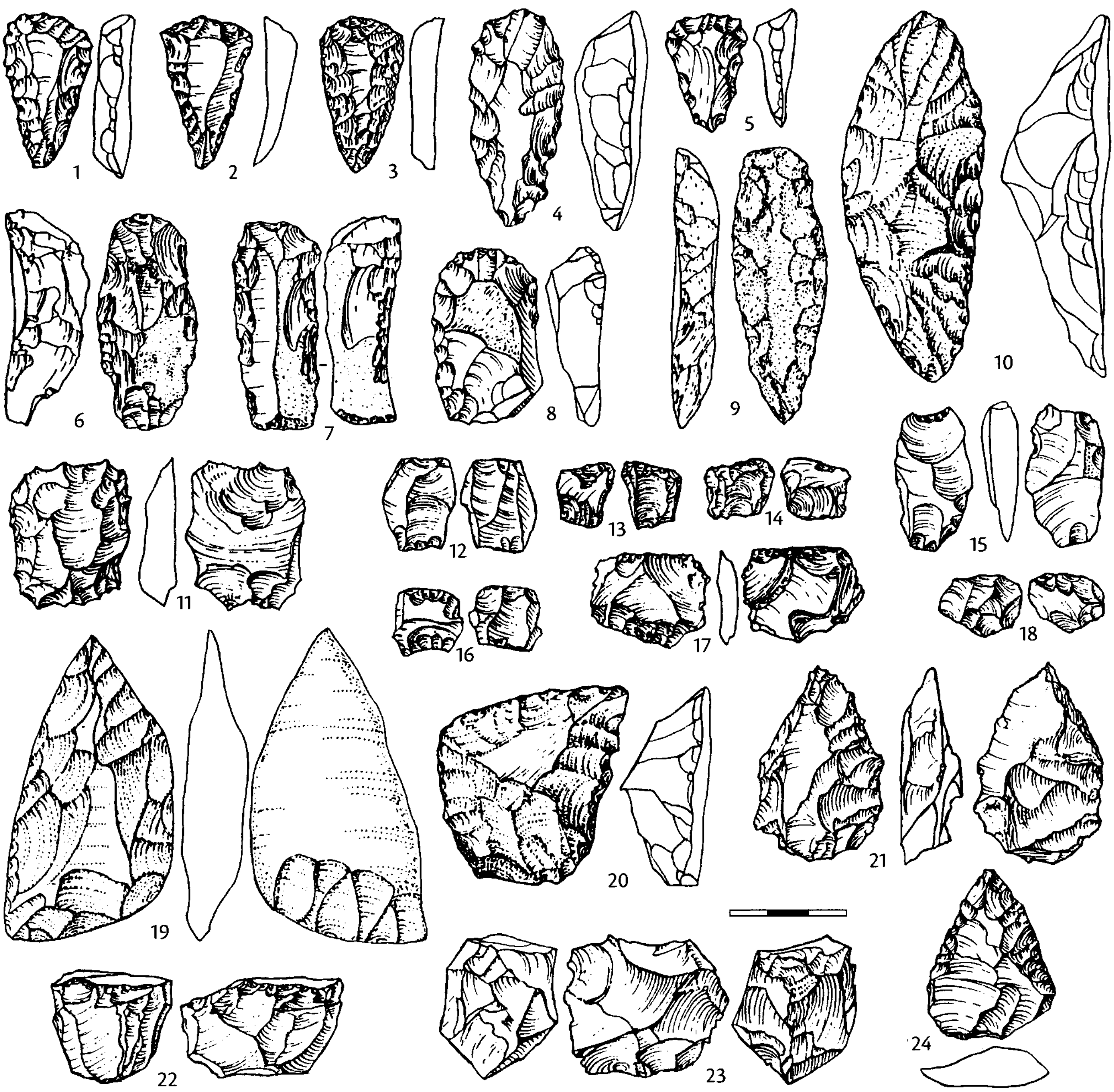


Figure 25-14—Gorodtsovskaya endscrapers (*1–9*); limace (*10*); scaled pieces (*11–18*); points (*19, 24*); scraper (*20*); bifacial tool made on scaled piece (*21*); and cores (*22, 23*) from Kostenki 14 layer II (1, 3–11, 17, 20–24); Kostenki 15 (2, 12, 15, 16, 18, 19); Kostenki 12 layer I (13, 14) (after Rogachev and Sinitsyn 1982a, 1982b; Rogachev and Anikovich 1984).

The perceived "archaic Mousterian elements" include simple, transverse, canted and double canted scrapers (Figure 25-14: *20*), convergent scrapers, points (Figure 25-14: *19, 24*), limaces (Figure 25-14: *10*), and small bifacial tools (Figure 25-14: *21*). As already noted, some of these are very similar to scaled pieces and end-scrapers and Sinitsyn (1996:283) has remarked that the Mousterian tools "have the same kind of retouch and were made in the same way as other unquestionably Upper Paleolithic type tools."

The mere presence of tool forms in the Upper Paleolithic that also are found in the Middle Paleolithic does not imply the *continuation* of any "archaic" element. After all, pebble choppers are known in the

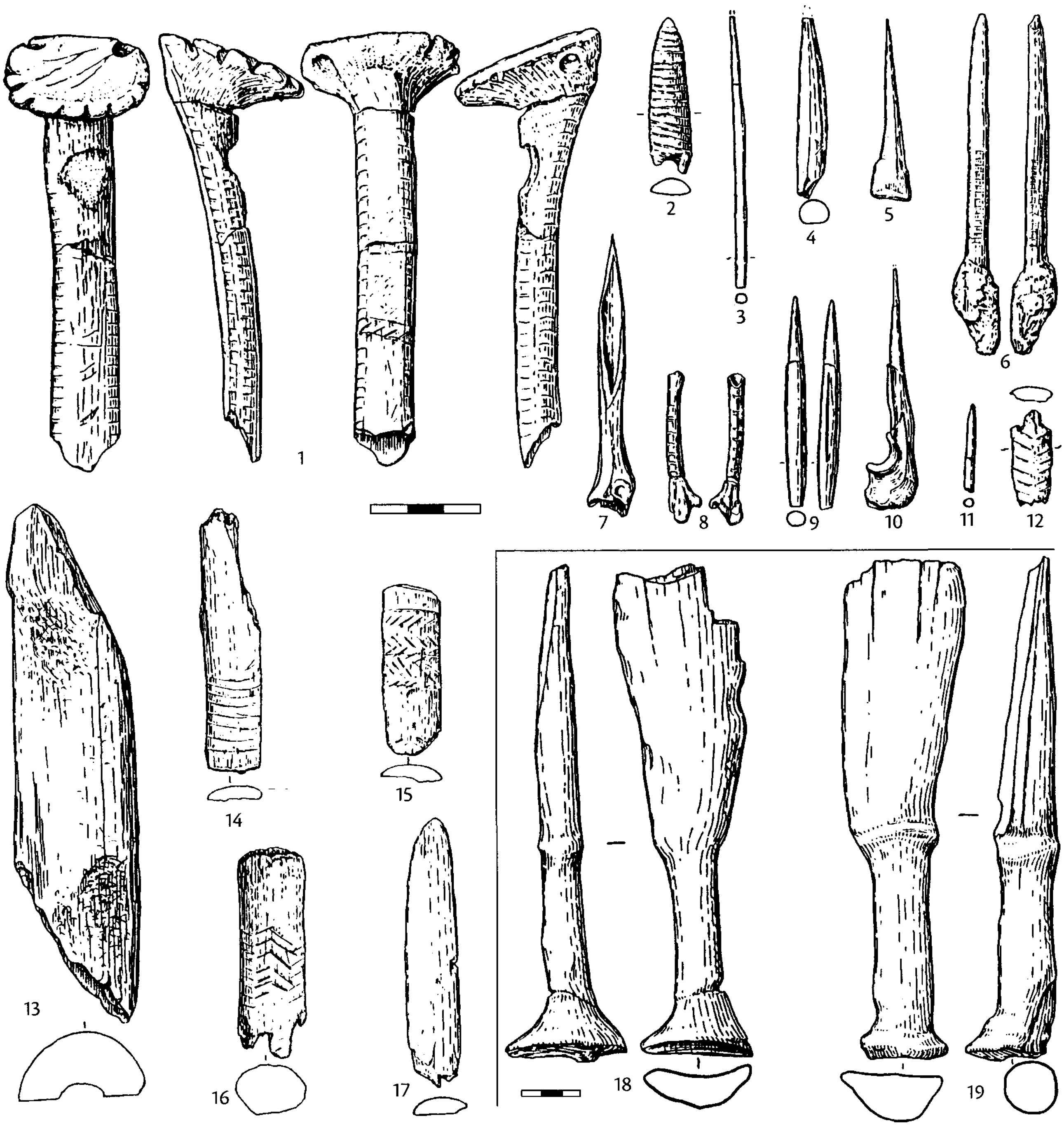


Figure 25-15—Gorodtsovskaya assemblages decorated handle with nail-like head (*1*); pendants (*2, 8, 12*); needles (*3, 11*); points (*4, 9*); awls (*5, 7, 10*); point with zoomorphic head (*6*); retoucher (*13*); decorated bone fragments (*14–16*); "polisher" (*17*); "shovels" on long mammoth bones with nail-like heads (*18, 19*) from Kostenki 14 layer II (*1–17*) and Kostenki 15 (*18–19*) (after Rogachev and Sinitsyn 1982a, 1982b).

Neolithic (Bordes 1961:47) and Middle Paleolithic-like sidescrapers have been found in sufficient numbers in Upper Paleolithic contexts to have been included in the de Sonneville-Bordes type list for the Western European Upper Paleolithic (de Sonneville-Bordes and Perrot 1953, 1956). Yet, here it is striking that such elements as ventral thinning and invasive retouch, seen so commonly in the local Micoquian, also occur in this clearly Upper Paleolithic context. The "archaic" character of Kostenki 14 layer II might be due to the low quality of raw material used by the inhabitants of this occupation (Rogachev and Sinitsyn 1982a:149), since in the other Gorodtsovskaya assemblages raw material of much better quality was utilized. Thus, whether these "archaic" forms imply continuity must be balanced against the possible effects of flaking different raw materials, since virtually all the proposed "archaic elements" occur on low quality gray flint, while all the "typical" Upper Paleolithic elements are on high quality flint (Rogachev and Sinitsyn 1982a:157, 1982b:163).

The stone and bone material culture of the Gorodtsovskaya has a distinct character both technologically and typologically. No true Micoquian bifacial plano-convex tools, no Aurignacian carinated technology, and no bone points characteristic of the Aurignacian are seen in the Gorodtsovskaya. In spite of this, Gorodtsovskaya origins have been accounted for by acculturation of the Micoquian by the Aurignacian (Cohen and Stepanchuk 2000). The variability among the Gorodtsovskaya assemblages might be explained in terms of different economic activities and different sources of raw exploitation, rather than by developmental changes.

The Aurignacian

Stratified *in situ* Aurignacian assemblages in Eastern Europe occur in the Prut River Valley, in Crimea, and in the Mid Don Valley. The assemblages from Crimea (Siuren I) and the Mid Don (Kostenki 1 layer III) belong to the Krems-Dufour variant of Aurignacian (Hahn 1977; Demidenko et al. 1998), while the typological definition of Mitoc Malul Galben from Prut is more complicated.

Crimea

Technologically, the Siuren I Aurignacian assemblages have a pronounced component of bladelets and microblades. Together, these account for about 40% to 50% of all blanks, while only 20% of the blanks are true blades. The bladelets and microblades are associated with both carinated cores (Figure 25-16: *14, 17*) and endscrapers, as well as with "regular" bladelet/ microblade cores. Dufour (Figure 25-16: *2, 4, 5, 6, 9*) and pseudo-Dufour bladelets and microblades make up about half of all toolkits. A few Krems points occur (Figure 25-16: *1, 3, 7, 8*), while the rest of the tools are typically Aurignacian: blades with "Aurignacian-like" retouch (Figure 25-16: *20*), carinated endscrapers and burins (Figure 25-16: 12, *13, 15, 16, 18, 19*), and thick nosed/ shouldered scrapers (Figure 25-16: *10, 19*). Moreover, bone points and awl fragments, as well as marine shell pendants are common (Demidenko et al. 1998; Demidenko and Otte 2000–2001).

Some of the occupational levels of units G and H of Siuren I contain about 10% Middle Paleolithic type tools, such as bifacial scrapers, points, and convergent and simple scrapers. Although it has been assumed that Aurignacian people were responsible for such archaic tool types (e.g., Kozlowski 2000a:99), detailed analysis of the Siuren I material indicates that Micoquian and Aurignacian groups visited the shelter at different times (Demidenko 2000).

Mid Don

The Aurignacian assemblage at Kostenki 1 layer III has a microblade technology (Rogachev 1957; Hahn 1977; Rogachev et al. 1982). About half of all cores are true microblade cores. The most common tool types are Dufour (Figure 25-16: *26-30*) and pseudo-Dufour (Figure 25-16: *31*) microblades, comprising about 50% of the toolkit. Krems points occur (Figure 25-16: *22-24*), endscrapers (ca. 20%) include carinated and shouldered examples (Figure 25-16: *32, 34*), and burins, including carinated forms, are relatively rare (Figure 25-16: *29, 36*). There are a few points on blades and a number of retouched flakes and blades, including one with "Aurignacian retouch" (Figure 25-16: *35*).

Bone and ivory tools consist of bone awls, points (Figure 25-16: *33*), and rods made on mammoth tusk fragments. Fragments of bone points are decorated with parallel scratches. Personal ornaments consist of perforated shells and fox teeth, as well as rods decorated with transverse parallel incisions (Hahn 1977; Rogachev et al. 1982).

Two other certain Aurignacian sites are known: Chulek I in the Lower Don Valley (Gvozdover 1964) and Kamennomostskaya Cave in the Northern Caucasus (Formozov 1971) (Figure 25-2). While Chulek I was found in redeposited sediments of a low river terrace, recent technological and typological studies indicate it is a valid, homogeneous assemblage of Krems-Dufour type (Demidenko 2000-2001: 149–153). The Kamennomostskaya Cave assemblage, on the other hand, clearly contains artifacts from a number of different periods, from Chalcolithic through Middle Paleolithic, although a Krems-Dufour Aurignacian component is visible (Demidenko 2000-2001:153–160).

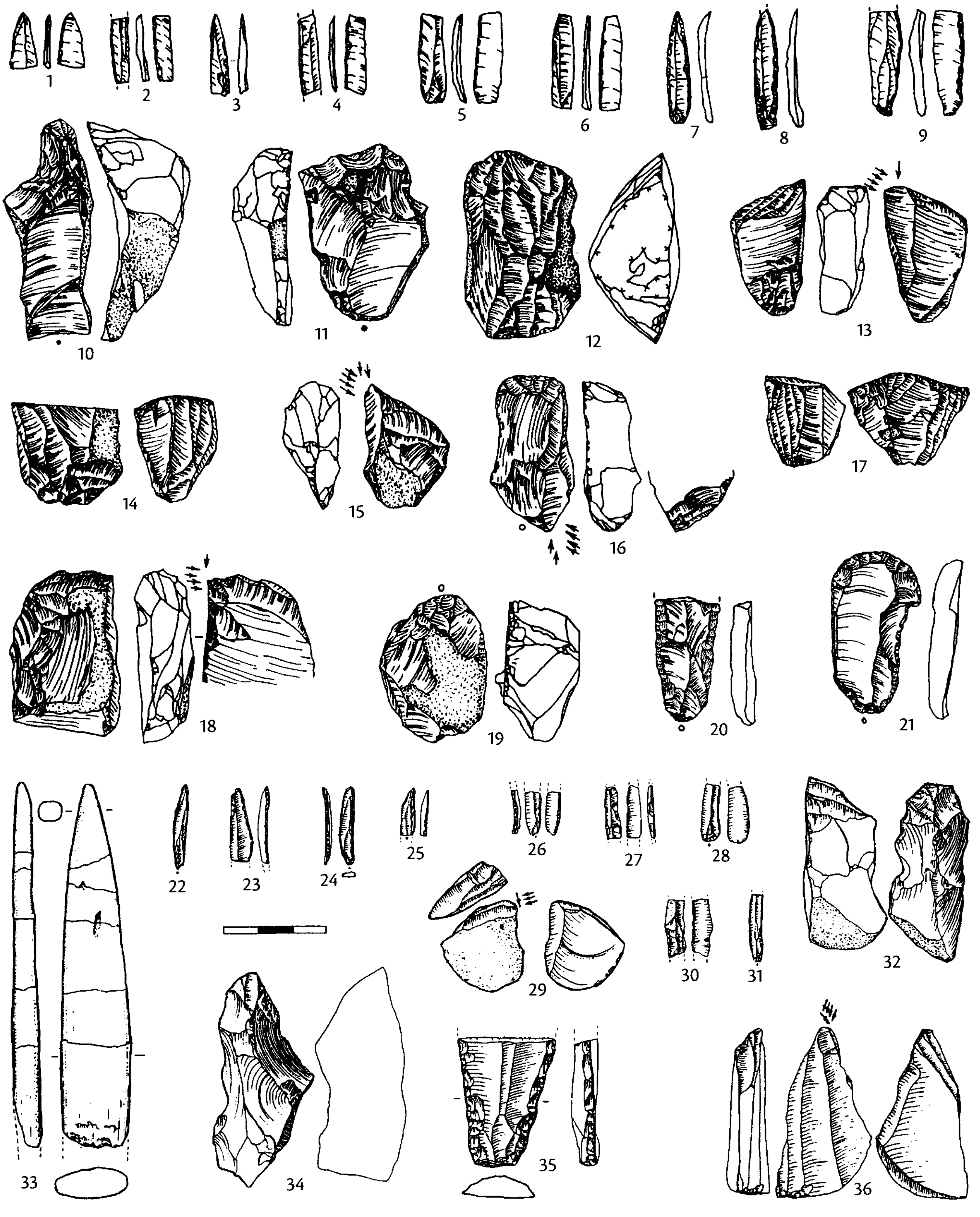


Figure 25-16—Aurignacian complex non-geometrical microliths: Krems points (*1, 3, 7, 8, 22–25*); Dufour microblades and bladelets (*2, 4, 5, 6, 9, 26, 27, 28, 30*); pseudo-Dufour microblade (*31*). Endscrapers: thick shouldered (*10, 11, 34*); carinated (*12, 19, 32*); on flake with bilateral retouch (*21*); carinated cores (*14, 17*); carinated burins (*13, 17, 18, 29, 36*); endscraper/carinated burin (*16*); blades with "Aurignacian-like retouch" (*20, 35*); point made on a mammoth tusk fragment (33). Siuren I levels H ( ), Gd ( ), Gc1-Gc2 ( ), Fb1-Fb2 ( ); Kostenki 1 layer III (22–36) (after Demidenko et al. 1998; Demidenko and Otte 2000–2001; Hahn 1977).

Prut-Dniester

In the Prut-Dniester region, Mitoc Malul Galben includes three Aurignacian occupations, all of which are basically similar in their technology, focusing on both blade and flake production. The presence of bladelet cores as well as carinated, nosed, and busked tool forms attest to the importance of bladelet production. Yet, there is a fairly high number of tools made on thick flakes (as well as cores), which might reflect the opportunistic use of waste from blank production. Blades are not very numerous, nor are bladelet tools, but given the evidence for true blade/bladelet technology (including crested blades and other core trimming elements), they were most likely taken away from the site (Otte et al. 1997).

The toolkit includes carinated endscrapers, carinated and busked burins, and simple burins on blades, as well as retouched, truncated, and pointed blades/bladelets. No Dufour bladelets have been found, although it has been suggested that they probably were made in at least one of the Aurignacian workshops and exported from the site (Otte et al. 1997:282). Denticulates, notches, and sidescrapers also occur in low numbers. A Mladeč point was recovered from the lowermost bone concentrations (Otte et al. 1997).

Aurignacian Variability

It appears that the Krems-Dufour type was the only Aurignacian in Eastern Europe, assuming that Mitoc Malul Galben was oriented toward Dufour production (Demidenko 2000–2001:161). The very few known Aurignacian sites in Eastern Europe, as a whole, their wide distribution throughout this huge area, without any known regional site clusters, and their relatively recent dates, certainly, mitigate against any model that postulates the Aurignacian as a source of "Upper Paleolithic" traits in Eastern Europe.

The Early Gravettian

The Early Gravettian occurs only in two regions: the Prut-Dniester Basins and in the Mid Don. If the Prut-Dniester assemblages are truly both chronologically and typologically Early Gravettian, the "Early Gravettian" of the Mid Don only reflects its chronological position.

Mid Don

The assemblage from Kostenki 8, layer II, was recognized as "Gravettoid" (Rogachev et al. 1982:102). The technology of this assemblage is based on blade and microblade production from unidirectional and bidirectional cores. A significant part of toolkit (900 of 2100 tools), is microliths, the most numerous type of which is a backed needle-like point with an obliquely retouched base. The sizes of microliths vary from 1 cm to 5 cm in length and from 0.1 cm to 0.5 cm in width (Rogachev et al. 1982:102). Burins, mostly angle, are also numerous: about 500 examples. Endscrapers are not numerous and tend to be simple on blade (about 50 pieces). Also, there are some points on blades, scrapers, perforators, denticulates, and notches (Rogachev et al. 1982:104). The worked bone assemblage contains points, rods, ornamented bones, and tusk fragments (Rogachev and Anikovich 1984:186).

Prut-Dniester

According to Borziac and Kulakovskaya (1998:59) the assemblages from Mitoc Malul Galben sedimentation cycles 7b–6a and Molodova V layers 8–10 belong to the 2nd stage of Gravettian evolution in Central and Eastern Europe. In these assemblages, blank production is based on bidirectional blade core reduction (Otte et al. 1997:280). Toolkits are characterized by points on blades with flat distal and proximal retouch, endscrapers on blades with bases pointed by retouch or by burin spalls, double endscrapers on blades, dihedral burins, burins on oblique truncation, and only rare backed bladelets. Given the rarity of microliths, these assemblages were called macro-Gravettian (Borziac and Kulakovskaya 1998: 59).

Early Gravettian Variability

The difference between the Early Gravettian of the Prut-Dniester region and the "Gravettoid" assemblage of Kostenki 8 layer II is obvious. According to the typological cluster analysis published by Amirkhanov (1998), the Kostenki 8 layer II assemblage is much closer to the Late Gravettian of the Eastern European Plain than to Early Gravettian of Molodova V.

Early Upper Paleolithic Variability

The earliest indication of an Upper Paleolithic in Eastern Europe, probably unassociated with the Middle Paleolithic, is at Buran-Kaya III Level E. This small assemblage (Marks and Monigal 2000a; Monigal, Chapter 4) has a consistent blade technology based mainly on unidirectional prismatic cores. Platforms are small but unfaceted, there is no evidence for striking edge regularization, and blades were seemingly detached by hard hammer. These patterns are vastly different from those seen in the late Crimean Levallois-Mousterian (WCM) but are similar to those used in the Blade Mousterian. The high incidence of truncated-faceted pieces in the Blade Mousterian and their absence in Buran-Kaya III Level E is striking, even with the small sample size. Given the dating of the Blade Mousterian to no later than the Early Glacial and Buran-Kaya III level E to Hengelo, it is most likely that the technological similarities are fortuitous, rather than parts of a single developmental sequence.

Another two assemblages, from Kostenki 14 levels IVa and IVb (Sinitsyn 2000), are also quite early in the Early Upper Paleolithic, with dates greater than 33,000 BP (Table 25-5). These small assemblages reflect a combined flake and blade technology, the tools include various burins on flakes, and a few bone tools were recovered. Without question, they are Upper Paleolithic in our understanding of that term, but there are insufficient samples to place them into an already-named Early Upper Paleolithic industry or to define a new one.

The Streletskaya, Spitsynskaya, Gorodtsovskaya, Aurignacian, and Gravettian Early Upper Paleolithic industries are all strikingly different, with diverse lithic and bone technologies and very specific toolkits. The paucity of Early Upper Paleolithic sites seems to indicate that human populations were quite low, and that they were also highly dispersed. Is the richness and diversity of the archeological cultures related to a new hominid form trying to adapt to new environments?

Middle Paleolithic and Early Upper Paleolithic Human Remains

Before turning to the question of what the variability in these Middle Paleolithic and Early Upper Paleolithic industries means and how it arose, it is necessary to review the skeletal evidence. The human fossil record from Eastern Europe is not nearly as rich as that of Western Europe and it has a number of gaps, as well. No human remains have been found in association with Levallois-Mousterian, Blade Mousterian, or Streletskaya assemblages.

Micoquian Human Remains

The Micoquian is the only Eastern European Middle Paleolithic complex having a clear stratigraphic association with human remains, all of which are Neandertal. While the number of discoveries of human fossils has greatly increased in the past decades, they are all limited to Crimea and the Northern Caucasus and all are chronologically late, dating to between 50,000–30,000 BP.

Parts of 10 different Neandertal skeletons were discovered in Crimea at Kiik-Koba upper and lower levels and at Zaskalnaya VI layers III and IIIa. Both Kiik-Koba Neandertals (adult and juvenile) were buried in pits (Bonch-Osmolowski 1940, 1941, 1954) but it is unclear from which level or levels the pits were dug (Bonch-Osmolowski 1940; Gladilin 1979; Smirnov 1987, 1991; Kolosov et al. 1993). Zaskalnaya VI layer IIIa produced three Neandertal child skeletons. They were found in a pit(s) with no clear borders (Kolosov 1986), but Smirnov (1991) has interpreted it as a "burial structure." Parts of five more child and subadult Neandertal skeletons were also found in layer III (Kolosov 1986; Kolosov et al. 1993). A few adult Neandertal bones were found at Zaskalnaya V layer II and Prolom II layer I produced a phalange (Danilova 1979a, 1979b; Kolosov 1986).

All Crimean human remains associated with the Micoquian were described as Neandertals (Yakimov and Kharitonov 1979), with the exception of the Starosele child (Formozov 1958), which was published as an anatomically modern child. Based upon another two nearby intrusive modern burials at Starosele, it is most likely that the Starosele child is a modern intrusive internment (Marks et al. 1997; Monigal et al. 1998) and certainly not Neandertal, as reported as late as 1996 (Gvozdover et al. 1996).

In the Northern Caucasus, in Barakaevskaya Cave, a mandible and isolated teeth of a young child were found in association with Micoquian deposits (Zubov et al. 1994). Other remains from Northern Caucasus Micoquian assemblages include an isolated tooth from Matuzka Cave layer 5b and isolated teeth and phalanges from Monasheskaya Cave layer 2 (Hoffecker 2002.)

Mezmaiskaya Cave, also in the Northern Caucasus, yielded a partial skeleton in layer 3 associated with a Micoquian assemblage dated to > 45,000 BP. The skeleton of layer 3 was that of an infant or foetus, with an age estimated between 7 months foetal development and 2 months neonate, and appeared to have Neandertal characteristics (Golovanova et al. 1999). No pit was observable around the skeleton (Golovanova et al. 1999), but the very good preservation of the post-cranial material might suggest some intentional (or very fortuitous) protection. A rib of this fœtus/child was later radiocarbon dated to 29,195 ± 965 BP (Ua-14512) and also had a DNA sample extracted from it (Ovchinnikov et al. 2000). Based on the recent *date* Ovchinnikov et al. (2000) suggested that the skeleton was intrusive from the Upper Paleolithic layer 1 (which overlay layer 3 in this portion of the cave). But, the *DNA sequence* left no room for doubt that the infant was much more similar to the Feldhofer Neandertal than to modern humans and concluded that it was, in fact, a Neandertal, and one of the latest-living of them (Ovchinnikov et al. 2000:490).

Spitsynskaya Human Remains

The only human remains associated with the Spitsynskaya is an isolated third molar from Kostenki 17 layer II, which is anatomically modern human (Boriskovski et al. 1982:186; Hoffecker 2002). Layer II is dated to about 26,000 BP (Table 25-6).

Gorodtsovskaya Human Remains

Two burials were found in association with Gorodtsovskaya assemblages: at Kostenki 15 and Kostenki 14. The burial in Kostenki 15 was a 6–7-year-old boy buried in a sitting position. This burial was in a dwelling area and contained some stone and bone tools, including a bone shovel (Rogachev and Sinitsyn 1982b:163). The burial at Kostenki 14 was found below layer III, but its association with that layer is not clear. The burial was of a 25-year-old male in a writhing position (probably tied) (Rogachev and Sinitsyn 1982a:157, 160). The nearly complete skeleton of a neonate was also found at Kostenki 12 layer I (Hoffecker 2002). All of these individuals are anatomically modern (Gerasimova 1982) and date to between 25,000 and 30,000 years ago (Table 25-6)

Aurignacian Human Remains

An isolated molar from an anatomically modern human was found at Siuren I layer 3 during the original excavations of the site (Bonch-Osmolowski 1934). Aurignacian occupations at the site date to ca. 28,000 BP (Figure 25-18). Anatomically modern tibiae, a pelvis, and a tooth have been reported from Kostenki I layer 3 and dated to 26,000 BP (Hoffecker 2002).

Gravettian Human Remains

A number of cranial fragments, probably modern, were found at Kostenki 8 layer 2 and dated to 27,7000 BP. The remains were near a hearth and were heavily burned on their interior surfaces (Rogachev et al. 1982: 108; Hoffecker 2002).

In sum, while the evidence is certainly not overwhelming, it does appear that Neandertals are associated with the Middle Paleolithic and anatomically modern humans with the Upper Paleolithic. On the other hand, the Micoquian lasted over 100,000 years, yet human remains are known only from the end of its span. It should also be stressed that for the most important period of time—from about 36,000 to 28,000 BP—when, at least in Crimea, Middle Paleolithic (Levallois-Mousterian at Kabazi II, Kiik-Koba at Buran-Kaya III) and Upper Paleolithic (Streletskaya at Buran-Kaya III, Aurignacian at Siuren I) peoples apparently co-existed, there are no associated human remains other than the tooth found at Siuren I during the 1930s.

While anatomically modern humans are known to have been in the Levant by 100,000 years ago, they apparently did not reach Eastern Europe until after 30,000 BP. Physically adapted to southerly tropical climates (Trinkaus 1981), these modern humans arrived during the later OIS 3 and dispersed into the periglacial loess steppes, then into the taiga before subsequently expanding throughout the Eastern Europe. It is widely assumed that these hominids first colonized "empty niches" that had been abandoned by Neandertals (Hoffecker 2002:188), but given that there is such a dearth of fossil remains and that we have no way of knowing who was responsible for many of the cultural remains during this period, such assumptions must be treated with caution.

The Evolution of Middle and Early Upper Paleolithic in Eastern Europe

In spite of the wide geographic distribution of the Micoquian in Eastern Europe, its relative stratigraphic position in the Middle Paleolithic is not uniform. In the Prut-Dniester Basins, the Micoquian always overlies the Levallois-Mousterian, as in Central Europe, where the Micoquian overlies Levallois and/or blade industries (Conard 1992; Tuffreau 1993; Kulakovskaya 1999). In Crimea and the Donbass-Azov regions, however, the Levallois-Mousterian and Blade Mousterian normally overlie Micoquian occupations, although contemporaneity of the two is chronologically demonstrable in Crimea (Figures 25-17 and 25-18).

In Central Europe, there is no Micoquian dated to the Last Interglacial or before (Richter 1997, 1999; Conard and Fischer 2000), while at least two Micoquian assemblages in Eastern Europe are firmly dated to the Last Interglacial. When it is considered that Crimea was probably an island during the Last Interglacial, the Crimean Last Interglacial Micoquian must have been present before the Black Sea transgression (Figures 25-3 and 25-17). Thus, the idea that Central Europe was the core region for Micoquian expansion to the east (Gladilin 1976, 1985) can no longer be supported. At the same time, there is no specific evidence to postulate a western expansion from Eastern Europe beyond the vagaries of present archeological knowledge. Given the presence of the diagnostic Micoquian plano-convex tool production in association with a paucity of blade production, and a common use of ventral thinning in several Western European sites dated to the Middle Pleistocene (e.g., Marks et al. 2002), it is certain that both the meaning of what we call Micoquian and its origin(s) still elude us (Ronen and Weinstein-Evron 2000). The present knowledge of Eastern European Middle Pleistocene industries (Kolosov et al. 1993; Golovanova 1994; Liubine 1998; Sytnyk and Boguckyj 1998; Sytnyk 2000) is far too tentative to suggest a reliable local

kyr BP	*OIS*	*Chronostratigraphy*		*Micoquian* Prut-Dniester	Crimea	Northern Caucasus	Donbass	Lower Volga	*Levallois-Mousterian* Prut-Dniester	Crimea	*Blade Mousterian* Donets-Don
40		Hengelo	2nd Period	Ripiceni-Izvor, V	Starosele, 1, 2					Kabazi II, II8-IIA/1	
50	3	stadial		Ripiceni-Izvor, IV	Zaskalnaya V, III Zaskalnaya V, IV Kabazi II, IIA/2-3 Chokurcha I, IV	Monasheskaya, 2-4 Barakaevskaya Mezmaiskaya, 2B-1,2 Mezmaiskaya, 2B-3; 3				Kabazi II,IIA/2	
60		Moershoofd	1st Period		Kabazi V, II/3-II/4A Kabazi II, IIA/3-IIA/4B				Ripiceni-Izvor, III Molodova V, 11a		
70	4	stadial			Kabazi V, III/1-III/3 Kabazi II, III/1A-III/1						Shlyakh, 8C Belokuzminovka, 3 Zvanovka
80	5a	Odderade?			Starosele, 4 Kabazi II, III/2	Ilskaya I			Ripiceni-Izvor, II		
90	5b								Molodova I, 4 Molodova V, 11		Kurdumovka
100	5c	Brörup?			Zaskalnaya V, V				Molodova V, 12 Ripiceni-Izvor, I		
110	5d	Amersfoort?		Yezupil, II Kolodiev, 12.5–12.9	Kabazi II, III/2A-III/7		Nosovo I Antonovka II Antonovka I	Sukhaya Mechetka	Proniatin Igrovitsa I, II Bugliv V, II		Belokuzminovka, 2
120	5e	Eem			Kabazi II, V/3-VI/17		Belokuzminovka, 1	Cheluskinets ?	Yezupil, III		

Figure 25-17—The chronological position of assemblages belonging to the 1st (Early) and 2nd (Middle) Periods of the Eastern European Middle Paleolithic.

ancestor for the Micoquian complex, if such ever existed in Eastern Europe. From wherever and out of whatever it developed, present evidence from Eastern Europe, at least, indicates it was made by Neandertals. Yet, all associations come from Micoquian sites in Crimea and the Northern Caucasus that post-date 50,000 BP.

Unlike the Micoquian, the Last Interglacial Levallois-Mousterian of the Prut-Dniester Basins might have originated in Central Europe, since, on the other side of the Carpathian Mountains at Korolevo, there are numerous Rissian-age Levallois-Mousterian assemblages (Gladilin and Sitlivy 1990). There is no indication, at all, of a possible progenitor for the Blade Mousterian. Since there are no hominid fossils associated with either industry, their creators remain unknown.

From the Early Glacial to the Moershoofd Interstadial, Micoquians populated Crimea, while in the Azov-Donbass and Prut-Dniester resident Micoquians shared their areas with makers of the Blade Mousterian and Levallois-Mousterian, respectively (Figures 25-4 and 25-17). After the Moershoofd Interstadial, the Levallois-Mousterian sequence in Prut-Dniester region ends and comparable assemblages are found in Crimea (Figures 25-5 and 25-17). Is this evidence of migration? Perhaps. If so, this population movement might have been caused by harsh climatic conditions in the Prut-Dniester region that are seen after Moershoofd in the Molodova V sequence and also, throughout Poland during OIS 4 and 3 (Madeyska 1996). According to J. Kozlowski (2000b:90), there are two "hiatuses" in the human occupation of southern Poland, corresponding to the Early Pleniglacial and the first stadial of the Middle Pleniglacial. Unlike southern Poland, where Micoquian disappeared before the maximum of the Early Pleniglacial (OIS 4) (Kozlowski 2000b:77), the Micoquian in the Prut-Dniester region replaced Levallois-Mousterian at the beginning of OIS 3. Also, after the Moershoofd began, the first well documented appearance of the Micoquian in the Northern Caucasus is found and both Micoquian and Levallois-Mousterian occur in Crimea (Figures 25-5 and 25-17). Thus, the climatic deterioration during the Early Pleniglacial (OIS 4) may have caused population movements toward balmier southern climes. Seemingly, the onset of OIS 3, the Middle Pleniglacial, was a time of changes in Eastern Europe, as everywhere in Europe (Gamble and Roebroeks 1999).

While the Micoquian and the Levallois-Mousterian were both in Crimea at the same general time, the

Levallois-Mousterian seemed to have had a quite different settlement strategy than that of the already established Micoquians (Marks and Chabai 2001). Most striking is the apparent ephemeral nature of virtually all Levallois-Mousterian (Western Crimean Mousterian) occupations, which might argue for a highly mobile settlement system consistent with long distance movements. While comparably ephemeral and short-term Micoquian occupations existed (Chabai 1998d; Yevtushenko et al., Chapter 15), many Micoquian sites indicate a certain degree of occupational stability, with a wide range of economic and social activities (Chabai et al. 1999), including secondary butchering (Burke 1999a, 1999b), purposeful on-site burials, buried artifact caches, fireplace structures, etc. (Marks and Chabai 2001). In spite of this difference, both the Micoquian and the Levallois-Mousterian populations mainly exploited the same range of steppe megafauna, regardless of the availability of forest species during interstadials (Burke, Chapter 16; Patou-Mathis, Chapter 22). Thus, while present evidence now clearly places the Levallois-Mousterian (Western Crimean Mousterian) in both western and eastern Crimea (Yevtushenko, Chapter 20), they apparently utilized quite different settlement systems to exploit the same range of animals as those exploited by the contemporary Micoquian.

Since Crimea is quite small, the apparent contemporaneity of the Levallois-Mousterian with, at least, the post-50,000 year old Micoquian, raises the issue of possible contact and interactions between them. At least one site, Zaskalnaya V (Chabai 2000a), provides some evidence for possible interstratification of Levallois-Mousterian and Micoquian occupations. Comparable absolute dates and such interstratification do not and cannot demonstrate any actual contacts. After all, the time involved is in the order of 20,000 years and even at a recurrently occupied and reoccupied site, such as Zaskalnaya V, the probability of anyone being there on any given day in that 20,000 year period must have been exceedingly small. Evidence *against* meaningful contact—contact that resulted in some archeologically visible modification of an existing behavioral pattern—can be found in the homogeneity and marked continuity of the Micoquian technological and typological proclivities from the Last Interglacial until post-30,000 BP. In addition, whatever contact might have occurred between the Levallois-Mousterian populations and the Micoquian populations led to no archeologically visible changes in Levallois-Mousterian patterns. The settlement system did not change and, while technological change did take place, it did not reflect an adoption of Micoquian technological patterns. If anything, the technological changes within the Levallois-Mousterian were totally foreign to Micoquian technology.

The appearance of Early Upper Paleolithic assemblages in the western (Prut-Dniester) and central (Mid Don) regions of Eastern Europe during the stadial preceding the Denekamp (Arcy) Interstadial was a major event (Figures 25-6 and 25-18). They appeared while Middle Paleolithic peoples still inhabited Crimea and the Northern Caucasus and, seemingly, their presence had little initial effect on the Micoquian residents. This may relate to Early Upper Paleolithic choice of settlement locations. The Mid Don Early Upper Paleolithic Spitsynskaya from Kostenki 17 layer II was associated with humid forests of northern taiga type (Malyasova and Spiridonova 1982:237). There is no reason to believe that Streletskaya occupations of about the same time and same area existed in different environments: they both appear to have been limited to the taiga forest. The Micoquian, on the other hand, at this time were distributed mainly in the forest-steppe environments of Crimea and the Northern Caucasus. Later, at the end of the same stadial and then after Denekamp (Arcy), the Streletskaya appears to have spread into the steppe environment of Crimea and the Lower Don, as well as during some unknown time into the northern latitudes of the Northern Urals (Guslitzer and Pavlov 1993).

The Streletskaya adaptation to open steppe landscapes coincides with changes in arrowhead typology. The heavy bifacial triangular arrowheads useful in the forested landscapes of the taiga were augmented by light, bifacially retouched micro-points and trapezoids. The connection between the Mid Don and Crimea was geographically determined by the Black Sea basin regression, which caused the disappearance of Azov Sea. In such situations, the eastern Crimean rivers (tributaries of Salgir, etc.) became the tributaries of the Don River.

After 30,000 BP (during Lower Humic Bed deposition), the Mid Don region was visited by another taiga adapted group—the Gorodtsovskaya (Figures 25-7 and 25-18). At least two Gorodtsovskaya assemblages, from Kostenki 14 layers II and III, are associated with forested landscapes, which were not as humid or cold as at Kostenki 17 layer II, but still of taiga type (Malyasova and Spiridonova 1982: 244). The Gorodtsovskaya has a relatively "primitive" lithic technology, but shows an incredibly developed and variable bone industry, adornments, burial customs, and dwelling structures for that period.

The first appearance of the Aurignacian in Eastern Europe is documented at the end of the preceding stadial and beginning of the Denekamp (Arcy) Interstadial in the Prut Valley. There is also evidence for the Aurignacian during the Denekamp (Arcy) in Crimea and, at the end or after the Denekamp (Arcy), in the Mid Don (Figures 25-6, 25-7, 25-18). Thus, the Aurignacian was not contemporaneous with the other non-Aurignacian Early Upper Paleolithic, but

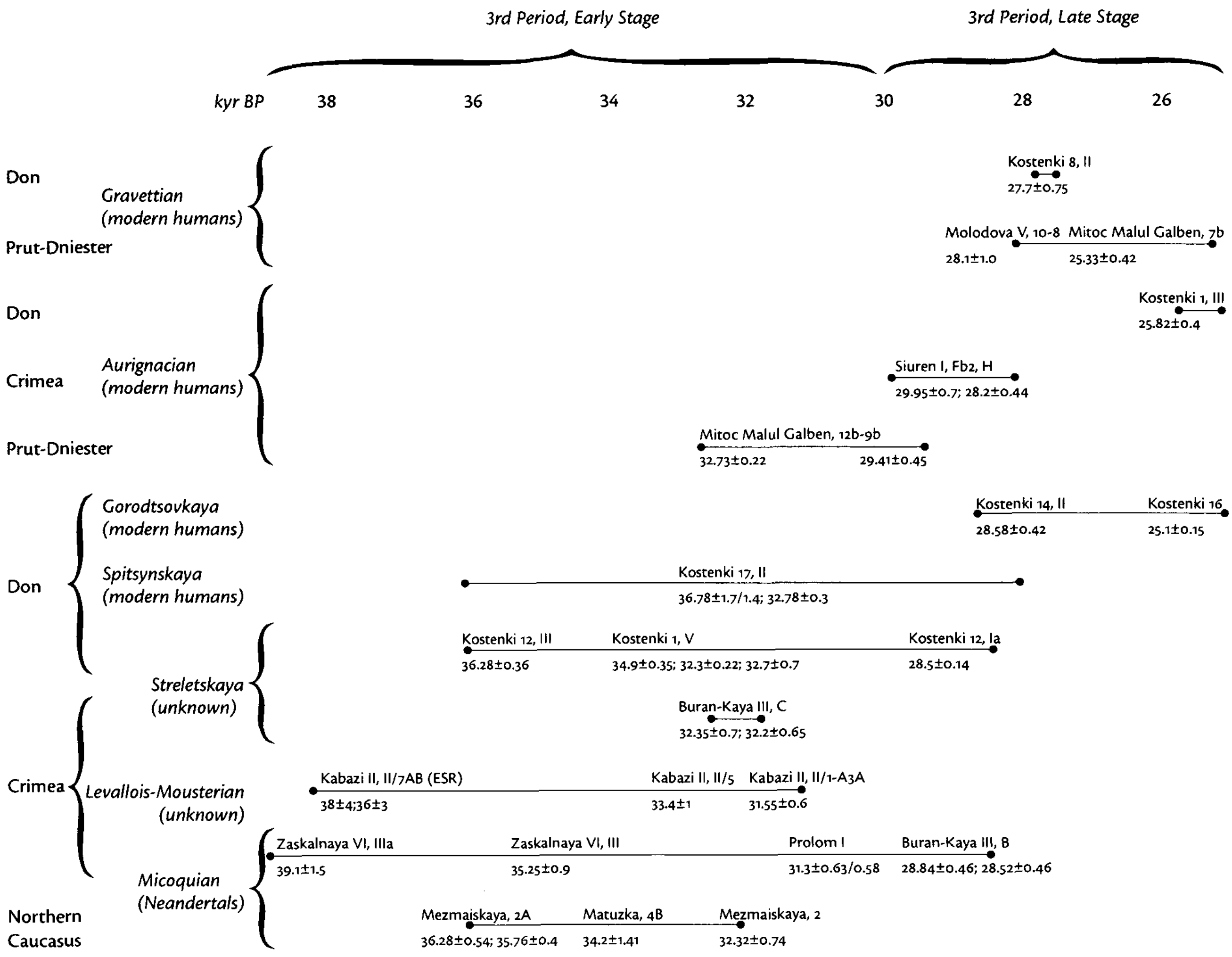


Figure 25-18—The chronological position of assemblages belonging to the 3rd (Transitional) Period of the Eastern European Paleolithic.

it co-existed with the Crimean Micoquian. The first documented Aurignacian "visit" to Crimea and the Mid Don was after the Streletskaya, Spitsynskaya and, at least, after the first manifestation of the Gorodtsovskaya. The appearance of the Aurignacian in the Mid Don was connected to environmental changes that took place after the deposition of the Upper Humic Bed. The pollen samples from loess deposited above the Upper Humic Bed show open forest-steppe/steppe-desert landscapes in the Mid Don area. Therefore, the Eastern European Aurignacian is only associated with open landscapes; the same kind of landscapes exploited by the Middle Paleolithic population. The Aurignacian exploitation of the "Don Passage" between the Kostenki-Borshchevo area and Crimea is documented by Black Sea shells found in Kostenki 1 layer III (Hahn 1977: 144).

The appearance of the Gravettian in the Prut River basin and "Gravettoid" industries in the Mid Don around 28–27,000 BP (Figures 25-7 and 25-18) marks the beginning of the end of incredible environmental, technological, typological, and adaptive variability in Eastern Europe. There is no documented evidence for Middle Paleolithic or Spitsynskaya assemblages after 28,000 BP and none for the Gorodtsovskaya after the Denekamp (Arcy). Only the Streletskaya survives to the end of the Denekamp (Arcy) Interstadial at Birioutchaya Balka 2 layer 3.

A number of Middle Paleolithic and Early Upper Paleolithic complexes, such as Levallois-Mousterian, Micoquian, Aurignacian, and Gravettian, demonstrate environmental and technological affinities with the same or similar complexes of Central Europe. On the other hand, the environmental context, and the stone and bone technologies of the Spitsynskaya, Streletskaya, and Gorodtsovskaya have nothing common with Central European or local Middle Paleolithic predecessors or contemporaries (Gladilin and Demidenko 1989). At the same time, at least two of them are associated with anatomically modern humans (Figure 25-18). It is most likely that during the 3rd Period, the Eastern European Plain was populated by modern humans in two environmentally different regions: the East European belt of taiga forests and the forest-steppe zone of eastern Central Europe. The Central European modern human "invaders" seemingly exploited the same environment as did the local Neandertals.

The coexistence of Aurignacian and Micoquian in Crimea resulted in no archeologically or anthropologically visible interactions. In addition, there is no evidence for influence on the local Middle Paleolithic of the contemporaneous taiga people. In fact, they may never have come into contact with one another, since they chose to live in different environments.

Thus, there are two core regions for modern human dispersal in Eastern Europe: the Central European belt of forest-steppe/steppe and the taiga forest belt of Eastern Europe and/or Asia. The Eastern European model of a "Transitional Period" is based on a two-step scenario. First, between the Hengelo and Arcy, modern humans adapted to the taiga belt mainly populated the northern part of the Eastern European Plain. During that time, Middle Paleolithic and Early Upper Paleolithic populations coexisted in environmentally different regions. Second, during the Denekamp (Arcy) Interstadial, modern humans from Central Europe followed the steppe expansion, replacing the local Middle and Early Upper Paleolithic peoples. After the Denekamp (Arcy), the Eastern European Plain became Gravettian, while in Crimea, an archeological hiatus occurs until Epi-Gravettian industries appeared around 18–17,000 BP.

The primary reason for composing syntheses of this nature is to place a localized, yet very detailed, Paleolithic sequence (in this case, Crimea) into its larger geographical context (in this case, Eastern Europe). In doing so, one is necessarily confronted with the maddeningly patchy database for paleoenvironments, absolute and relative dating, and lithic assemblages. With the desire of comparing a single, tiny region to continent-wide adaptations to ever-changing environments, and the variations in lithic, landscape, resource, and time use, one is invariably forced to gloss over the gaps in data or the details of, for example, typological variation. Obviously, to attempt to discuss continuity or replacement of the rich lithic industries associated with Neandertals and anatomically modern humans on such a massive, almost continent-wide scale is simplistic and not at all testable. Yet, to not do so would be to marginalize an area like Crimea—an area that was continuously inhabited throughout the Late Pleistocene due to its southerly location, easy accessibility from the west, north, and east during most of this time, and was a highly desirable, refugia-like environment—for flora, fauna, and humans—when most of Eastern Europe was cold, harsh, and shelterless.

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