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9 - THE CLASSIFICATION AND ATTRIBUTE ANALYSIS SYSTEM APPLIED TO THE SIUREN I LITHIC ASSEMBLAGES

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Introduction

The choice of a classification system for the analysis of Paleolithic stone artifacts should not be abstract and *ad hoc*, but rather highly related to the key techno-typological traits of lithics which need to be classified and then discussed analytically. Therefore, we first note here the industrial attributions of the flint artifact assemblages recovered during the 1990s excavations at Siuren I. Even during excavation, it became clear that the Siuren I assemblages relate to the following three Paleolithic industrial technocomplexes:

1) Most flint artifacts from Units H-G and all lithics from Units F, E and C can be attributed to the *Aurignacian of Krems-Dufour type*. Moreover, purely numerically, these Aurignacian finds comprise more than 90% of all lithics from the 1990s excavations at Siuren I.
2) Stratigraphically lower Units H and G also contain a series of *Middle Paleolithic* tools and distinctive retouch flakes/chips from secondary treatment processes.
3) Stratigraphically upper Units D and A, as well as some out of context finds from humus deposits, can be attributed to *non-Aurignacian, Gravettian and Epigravettian* industries. Consideraing that this artifact group contain less than a dozen cores and tools, they are excluded from classification, but will be simply described using typological definitions and attribute analysis.

Thus, our classification and attribute analysis system for the Siuren I lithic assemblages is a kind of "symbiosis" of both Middle and Upper Paleolithic techno-typological data. The most appropriate method for constructing this system is as follows.

We start with typological classification. The presence of morphologically prominent Middle Paleolithic tool types and their retouch by-products, typologically comparable to other assemblages of Crimean Micoquian tradition, leads us to use our classification system (Chabai & Demidenko 1998), recently developed and applied to the description and analysis of variability in Crimean Middle Paleolithic industries (e.g. Marks & Chabai 1998; Chabai et al. 2004). Crimean Micoquian Tradition types pieces from both Siuren I and other Crimean Middle Paleolithic/Micoquian sites will thus be described using the same system, facilitating typological comparisons. Description of much more common Upper Paleolithic assemblages, particularly the Aurignacian cores and tools, constitutes another a second part of the typological classification. Here, we apply the Upper Paleolithic type-lists typically used for artifact analyses of European and Near Eastern Aurignacian complexes (e.g. Sonneville-Bordes & Perrot 1954-1956; Hours 1974; Besancon et al. 1975-1977). Indeed, using these type-lists as a basis, and also typological improvements relating to Aurignacian tool classification (e.g. Kozlowski 1965; Kozlowski & Kozlowski 1975; Movius *et al*. 1968; Movius & Brooks 1971; Hahn 1977; Demars 1982, 1990; Demars & Laurent 1989; Marks 1976a) would seem to be sufficient for description and analysis of the Siuren I Aurignacian lithics using a traditional approach. Howver, for a complete analysis, technological classification should be done as well (see, for example, Bergman 1987 for the on Aurignacian at Ksar Akil). Principally, if we had techno-typologically homogeneous Aurignacian industries at Siuren I, we would probably limit our analysis to traditional typological description of tools, unretouched artifacts and cores, with quantitative subdivision of some categories, such as the core data, indicating the number of striking platforms and inferred blanks produced (flakes, blades, bladelets), and the main by-products. But the Siuren I Aurignacian assemblages cannot "boast" such industrial homogeneity, showing instead many techno-typological differences between the assemblages from Units H-G and the Unit F assemblage, although these are in the range of European Aurignacian of Krems-Dufour type, recognized during the 1996 excavations (Demidenko et al. 1998). In this case, traditional typological descriptions alone would simply "hide" many of these differences. In such a situation, it is crucial to complement typological identifications with technological data. Before presenting this, application of technological and typological classifications for Upper Paleolithic assemblages is briefly summarized.

A complicating factor lies in the fact that it is not yet standard practice for Upper Paleolithic studies in Europe to carry out very detailed technological and/or morphological analysis for core-like and debitage pieces, including tool blanks. This is particularly true for Upper Paleolithic research in Western Europe where most work focuses on typological analyses with almost no data documented for core-like and debitage pieces (e.g. Brooks 1995 on the Aurignacian from Abri Pataud). A good example of the situation can be well illustrated by F. Harrold's attempts to technologically compare the French Early Aurignacian and Chatelperronian industries. One of his most demonstrative conclusions on the matter is as follows:

"*In terms of blank production technology, both industries are broadly characterized by blades; however, more detailed information on lithic reduction practices is nearly nonexistent. Even laminal indices (the percentages of blades among all tools or all blanks) of early Aurignacian assemblages, are surprisingly difficult to obtain in the literature. More subtle issues, such as whether the two industries are characterized by any systematic differences in techniques of blank production and modification, cannot yet be resolved*" (Harrold 1988:162).

Although new approaches to technological analyses of the Early Upper Paleolithic have been developed (see Pelegrin 1990, 1995; Bicho 1992), detailed technological analysis of core-like and debitage pieces for the Western European Upper Paleolithic is not yet common and sometimes only used to examine specific kinds of artifacts (e.g. Lucas 1997; Bordes & Lenoble 2002 for Dufour bladelets and; Hays & Lucas 2000 for carinated pieces).

On the other hand, technological studies of Upper Paleolithic assemblages were and still are common for Central European archaeologists, where initially many workshop sites, usually with only a few tools and many pre-cores, cores, reduction products and waste, have been analyzed (e.g. Krukowski 1939-1948; Schild 1969, 1980; Ginter 1974; Ginter & Kozlowski 1990; Svoboda 1980; Sobczyk 1993); this approach was later expanded to analyze "regular" or non-workshop sites (e.g. Svoboda 1987; Hromada & Kozlowski 1995; Drobniewicz *et al.* 1992).

Regarding Upper Paleolithic studies in the former Soviet Union on East European materials, we also note that the main focus was on typological analyses (very similar to recent Western European approaches) with usually, if at all, only very general technological information (e.g. Rogachev & Anikovich 1984; Anikovich 1992, 2001-2002).

Apart from European approaches to description and analysis Upper Paleolithic assemblages, beginning in the mid-1970s, Upper Paleolithic research on Near Eastern materials began to concentrate on technological analyses. A retrospective look at the reasoning behind the application of detailed morphological classification and attribute analysis systems for the Upper Paleolithic shows that this was principally caused by the need to have detailed and real comparisons to identify the subdivisions of Middle and Upper Paleolithic industries. Here we note the technological approaches of A.E. Marks and his associates (e.g. Marks 1976a, 1976b; Marks & Ferring 1976; Marks & Kaufman 1983; Marks & Volkman 1983; Ferring 1980, 1988). Significantly, the technological data (Marks 1981; Marks & Ferring 1988) did much to strengthen the twofold industrial subdivision of the Near Eastern Early Upper Paleolithic into the Ahmarian and Aurignacian traditions, initially proposed on the basis of mainly typological criteria (Gilead 1981). These technological approaches were then intensified by K. Ohnuma and C. Bergman for studies of different Initial and Early Upper Paleolithic assemblages, including Aurignacian, from Ksar Akil (Lebanon) (Ohnuma 1988; Bergman 1987; Ohnuma & Bergman 1990). These studies were highly useful for understanding the different Ksar Akil assemblages from levels XXV-VI and their more minute subdivision into different industrial phases.

We can thus conclude that when technological analyses are done, Upper Paleolithic assemblages can be understood in much more detail. The question here is how to carry out such analyses for the Siuren I assemblages. All successfully conducted Upper Paleolithic technological studies in Central Europe and the Near East were based primarily upon the identification of many morphological attributes for core-like pieces, core maintenance products and debitage pieces/blanks. The only exception is refitting studies (e.g. Volkman 1983, 1989; Usik 1989), but a large-scale refitting project is not always possible, which is the case for the assemblages recovered from the 12 sq. m. zone excavated in the 1990s. This leaves using an attribute analysis system for technological study of the Siuren I assemblages. Such a system can be constructed using the attribute analysis used for Crimean Middle Paleolithic artifact classification as a basis (Chabai & Demidenko 1998:47-51). Using Middle Paleolithic attribute analysis for the mainly Aurignacian Siuren I lithics is not at all a strange choice because most of these attributes are universal to lithic artifacts for the entire Paleolithic, although some more specific Upper Paleolithic attributes have been added, taken from the listed publications.

In sum, then, using the Crimean Middle Paleolithic classification and attribute analysis system supplemented with techno-typological additions proper to the Upper Paleolithic/Aurignacian will help us "to kill two hares with one bullet": to have described Crimean Middle Paleolithic industries and both Middle and Upper Paleolithic components from Siuren I using the same range of methodological principles and, accordingly, to have a good basis for understanding similarities and differences between industries in the context of the Middle-Upper Paleolithic transition in the Crimea.

General assemblage structure by artifact classes

The major artifact classes, based on morphological features, are the following: core-like pieces, core maintenance products, debitage, tools, waste from production and rejuvenation of tools and debris. Each of these major classes has different technological and typological significance. They result from different processes of reduction and use and variability in their frequencies is critical for understanding these processes. Each of these classes are is subdivided into several sub-categories, making clear their internal structure.

Classification system employed

Core-like pieces

These are subdivided into three sub-categories: pre-cores, cores and core fragments.

Pre-Cores

First defined by S. Krukowski (1939-1948) on Polish materials, pre-cores became a standard sub-category of core-like pieces in descriptions of Paleolithic industries by Central and Eastern European archaeologists, reflecting the initial stages of primary reduction processes and clarifying different technological practices for initial preparation of primary reduction objects for subsequent intentional reduction/blank production (e.g. Schild 1969, 1980; Gladilin 1976; Svoboda 1980, 1987; Gladilin & Demidenko 1989; Usik 1989; Ginter & Kozlowski 1990; Sobczyk 1993; Girya 1997).

For Siuren I, we define as pre-cores the three following types. The *first type* is simply initially tested flint plaquettes or nodules/chunks with no prepared striking platform and with just one or two unsuccessful heavily hinged removal scars that make these pieces unsuitable for further preparation or real systematic reduction. The *second type* differs from the first by the presence of prepared striking platform(s) but again with only one or two unsuccessful removals, either heavily hinged or too short, leading to spoiling of the flaking surface(s). The *third type* is rare, noted only for a single example from level Fa3 and identified by us as a single-platform narrow flaked bladelet pre-core/"carinated burin". This type is morphologically intermediate between "carinated" bladelet cores and carinated burins, which will be discussed in more detail below, and has been defined as a pre-core due to hinge fracture terminations of the bladelet removal scars from a wider platform/edge than for carinated burins. Thus, the three pre-core types evidence different "on-site" stages, ways of preparing "possible future cores" and attempts at real reduction. It is also worth noting that all pre-cores lack the platform abrasion found systematicly on Siuren I cores: an additional piece of evidence of their preparatory technological function.

Cores

This sub-category of core-like pieces is, of course, defined through traditional definitions such as Tixier's: "*block of raw material from which flakes, blades, or bladelets are detached*" (1974:14), although some unique specifications are also pointed out here. First, cores, as the main object of primary flaking processes, are characterized by the serial production of blanks destined for use as tools, which is not at all the case for pre-cores. Morphologically, cores also have prepared striking platform(s) with abrasion and clear planar morphology, and several removal scars on the flaking surface(s).

Core classification is done here through both traditional and non-traditional (Gladilin 1976) approaches. By traditional, we mean basic core identification based on the kind of blank produced and the number of striking platforms. Most colleagues identify Upper Paleolithic cores in this way and we are also sure that some specific debitage types (especially bladelets *sensu lato*) are strongly connected to the respective core types; the number of striking platforms is important for more detailed understanding of core reduction processes. These are the two characteristics used for basic core descriptions, if subdivision by shape (prismatic, pyramidal, globular, etc.) is not taken into account. In Gladilin's hierarchical classification, additional stress is placed on the analysis of combinations for number, arrangement and correlation of striking platform(s) and flaking surface(s) for cores. Other colleagues also carry out similar analyses (e.g. Drobniewicz *et al.* 1992; Sobczyk 1993; Hromada & Kozlowski 1995), but Gladilin's principle considers all the morphological features of cores together in hierarchical order. Thus, the following core types are defined among the 1990s Siuren I assemblages, starting with the Aurignacian complexes from Units H, G and F.

At the *first classification level*, *blade, blade/bladelet, bladelet, flake/blade, flake/bladelet* and *flake* cores are defined. Most of the *blade, blade/bladelet* and *bladelet* cores have clearly observable systematic reduction that easily enables their further typological subdivision. However, cores defined as *flake/blade, flake/bladelet* and *flake* have mostly non-systematic/amorphous multiplatform characteristics indicating that these objects of primary reduction have gone through multiple reduction processes. Accordingly, it is often impossible to determine actual flaking processes.

At the *second classification level, single-platform*, *double-platform*, *triple-platform* and *multiplatform* cores are defined. *Triple-platform* cores are represented by a single *flake/bladelet* example from level Fb1-Fb2, on which final reduction techniques on one flaking surface can be identified, although it is certainly quite exhausted, very close morphologically to multiplatform non-systematic/amorphous cores.

At the *third classification level*, single- and double-platform cores are subdivided based on the interrelationship of striking platform(s) and flaking surface(s). All *single-platform* cores have unidirectional removal scars on a single flaking surface. *Double-platform* cores are characteristized by more complex reduction processes, although all are defined as leaving bidirectional and orthogonal removal scars. These are subdivided into *true* bidirectional cores with two opposed striking platforms and one flaking surface where removal scars from two striking platforms "meet" each other and *complex* bidirectional and orthogonal cores with two striking platforms and two flaking surfaces. The former are termed bidirectional, while the latter are named depending on the disposition of the two flaking surfaces. Principally, these *complex* bidirectional and orthogonal cores are in fact different variations of two single-platform unidirectional independent reduction processes on a single core. The following variants are present for the Siuren I Upper Paleolithic and Aurignacian complexes:

Bidirectional-Adjacent. Two opposed striking platforms where two flaking surfaces are adjacent.
Bidirectional-Alternate. Two opposed striking platforms, but on two opposite flaking surfaces.
Bidirectional-Perpendicular. Two opposed striking platforms and two flaking surfaces connected by distal terminations of removal scars perpendicular in general profile in relation to the position of the flaking surfaces.
Orthogonal-Adjacent. Very similar to common orthogonal cores with two striking platforms on a core's adjacent edges about 90° one to another, but also with two adjacent flaking surfaces.

The importance of the typological subdivision of double-platform cores is explained by the fact that only a single core (from level Fb1-Fb2) out of all double-platform cores for Units H, G, F and E is a *true* bidirectional core, while all the other double-platform cores from these mainly Aurignacian units can be classified as one of the more complex variants; these actually reflect two single-platform unidirectional independent reductions on each core. However, both cores from Gravettian Unit D are double-platform *true* bidirectional cores. Thus, through this more detailed classification of double-platform cores, we have much more objective characteristics for reduction processes on these cores, furthermore supporting our observation of the overall dominance of single-platform unidirectional reduction for Aurignacian industries and the much more important role of double-platform *true* bidirectional reduction for Gravettian and Epi-Gravettian industries in Europe.

At the *fourth classification level*, cores are subdivided by shape of flaking surface: (1) *non-volumetric* (flattened) flaking surface (ovoid, rectangular, narrow flaked) and (2) *volumetric* flaking surface (sub-cylindrical, cylindrical, sub-pyramidal, pyramidal).

The undersurface features of Siuren I cores are not defined because, apart for one core from Unit A with a unilateral crested ridge on its back, no other cores show any evidence of specific undersurface preparation; they are instead simply naturally flat and convex.

Some Siuren I cores were additionally described as *"exhausted"* and others defined simply as *"unidentifiable"*. The term *exhausted* was used for cores with unsuccessfully removed thick core tablets that made their striking platforms' too concave and unsuitable for further reduction. *Unidentifiable* cores are those for which a final heavily overpassed removal took off almost all of the flaking surface, leaving just a single wide and very concave scar. This circumstance clearly caused abandonment of these cores for further reduction and made it impossible to determine the reduction technique used prior to the last removal. Purely formally, these still complete cores should be classified as flake cores, but this would not reflect their real reduction.

Finally, we note that all bladelet cores have also been subdivided into "regular" and "carinated" cores. In our opinion, this is a very important typological approach for Aurignacian complexes and will be further discussed below in the analysis of the Siuren I "carinated pieces" and discussion of their internal typological structure in the view of recognizing several distinct types.

Core Fragments

These are heavily fragmented cores, usually small, for which objective identification of the reduction techniques used and morphological features is impossible.

Core Maintenance Products

Artifacts in this class are directly connected to initial preparation and renewal processes before and during the reduction of core-like pieces and are thus discussed immediately after them. The internal subdivision and description of the Siuren I core maintenance products proposed here are based on elaborations on this matter by associates and followers of J.K. Kozlowski and A.E. Marks (Sobczyk 1993; Ferring 1980, 1988; Bergman 1987; Ohnuma 1988; Bicho 1992).

All core maintenance products are subdivided into three subcategories: crested pieces, core tablets and core trimming elements. Each of these sub-categories are of different technological importance.

Crested pieces (flakes, blades, bladelets, microblades)

These are products of the *"lame à crête technique"* applied, first, for initial preparation of the flaking surface of a pre-core/core forming a wholly crested ridge and, second, for subsequent re-preparation (re-cresting) of a core's flaking surface after systematic reduction forming a partially crested ridge (e.g. Demidenko & Usik 1993b). Taking into consideration such application of the *"lame à crête technique"* during the Upper Paleolithic, the following types of crested pieces are defined.

Primary crested pieces are products on initially prepared crested ridges removed from the flaking surfaces of pre-cores/cores. They generally show wholly crested preparation, but sometimes partially crested bilateral or unilateral preparation. With a unilateral crested ridge, the other side of the dorsal surface for this crested piece is either dorsal-plain or cortical showing the absence of systematic reduction prior to removal of the crested piece.

Secondary crested pieces are products on additional removals when a primary crested piece did not strike off the entire length of a crested ridge on a the core's surface; for the start of systematic parallel reduction, the remainder of such a crested ridge should be removed first. Secondary crested pieces are assumed to have been removed directly after such unsuccessfully removed primary crested pieces. They are morphologically distinguished by evidence of partially unilateral/bilateral crested preparation only at the medial or distal sections, with just one removal scar at the proximal section and not a series of scars as traces of previous systematic reduction.

Truly secondary crested pieces are products of the initial systematic parallel reduction of cores immediately after primary and secondary crested pieces, which have already completely removed the top of a crested ridge on a core's flaking surface, have been struck. They are morphologically defined by the lack of tops of crested ridges on their dorsal surfaces but, at the same time, show traces of these crested ridges by distal parts of small removal scars that formed these crested ridges. Dorsal surfaces of truly secondary crested pieces can already be identified by a series of removal scars from systematic core reduction expressed, for instance, by intensive unidirectional or bidirectional scar patterns, typical of Upper Paleolithic primary flaking processes.

Re-crested pieces are products resulting from the preparation (re-cresting) of the flaking surfaces of cores after a phase of systematic parallel reduction, in the aim of "repairing" these flaking surfaces, for example, to remove hinge fractures and creation of new convexities for further reduction. During such re-preparation processes, a new crested ridge is often partially formed on the flaking surfaces. In other cases, this can sometimes reflect wholly crested preparation when this was applied along the length of a core's ridge on its flaking surface. In both cases, however, parts of dorsal surfaces with no crested treatment for re-crested pieces have many removal scars from systematic cores flaking prior to re-cresting processes; this is the main morphologically distinctive feature of these pieces.

Identification and description of these four different types of crested pieces (flakes, blades, bladelets, microblades) can provide many details of both "on-site" pre-core and core preparation and re-preparation processes and, on the whole, technological data for the analysis of Upper Paleolithic primary reduction techniques.

While it is fairly easy to identify crested flakes and blades, it is more difficult to identify crested bladelets and microblades. When an Upper Paleolithic assemblage includes both intensive primary bladelet reduction and burin manufacture and rejuvenation through the detachment of many burin spalls, it is quite hard to morphologically separate crested bladelets and microblades from primary burin spalls with some cresting. For the Siuren I Aurignacian artifacts from Units H, G, and especially F, the following morphological distinctions for these pieces, which also seem to be suitable for other Upper Paleolithic industries, were applied. First, all bladelets and microblades with bilateral crested preparation are considered only as crested pieces. This is explained by the fact that primary burin spalls are usually struck from the lateral edge of a burin blank (a debitage piece) and one of its sides will have a dorsal-plain scar pattern: part of the blank's ventral surface. So, only items with lateral crested preparation actually constitute a problem. We propose to differentiate these pieces according to characteristics of the preparation/retouching of the lateral crested ridges. Crested bladelets and microblades are characteristized by "rough" scalar or stepped lateral retouch, while primary burin spalls on bladelets and microblades usually have either fine marginal lateral retouch or, much more rarely, very regular retouch indicating the transformation of a tool's retouched edge into a burin. These preparation/retouch characteristics play a decisive role in the morphological distinction between primary unilateral crested bladelets and microblades at Siuren I, and primary burin spalls with a unilateral cresting/retouch.

Core tablets

This is a well-known sub-category of core maintenance products. They are obtained by the radical rejuvenation of striking platforms on cores, when these platforms are exhausted, by a perpendicular blow slightly below the intersection of the core's flaking surface and striking platform to remove the top of the platform.

We distinguish two types of core tablets-*primary* and *secondary*. *Primary core tablets* are the most common which are produced as described above. *Secondary core tablets* differ from primary ones by the absence of the very top of a core's striking platform with clear percussion points from removals. Such secondary core tablets are removed immediately after a primary tablet when the first tablet was insufficient to create an adequate new striking platform, and it was clear to an Upper Paleolithic knapper that the core could no longer be reduced.

Core tablets usually occur on flakes. This is quite understandable when we are dealing with rejuvenation of flake and blade cores with mainly ovoid and quadrangular striking platforms. A different situation, however, occurs when applying the *"core tablet rejuvenation technique"* to bladelet cores which often have narrow and rather long striking platforms; this leads to removal of core tablets that resemble blades or even bladelets (see, for instance, data on this subject for a Gravettian industry from Kostienki-21, lower layer [Middle Don region, Russia]-Ivanova 1987). The core tablets on blades and on a sole bladelet discussed are also noted for the Siuren I Aurignacian complexes from Units H, G, and especially F, and should thus be specifically defined here in order to retain this technological trait due to the rejuvenation of bladelet core striking platforms. Core tablets on flakes, blades and bladelets will thus be defined.

The presence of only a few cores with flaking occurring around their entire striking platform edge (cylindrical and pyramidal cores in overall shape) leads to the virtual absence of so-called "true complete core tablets" with an entire circle of scars on the flaked surface. It was thus decided to additionally subdivide core tablets based on the location of remnants of the cores' striking platform: on the butt, on one lateral edge, on the butt and one lateral edge, on the butt and two lateral edges. The analysis of such morphological features may help to specify some technological processes for the rejuvenation of core striking platforms.

Core trimming elements

It is a common practice that "*all artifacts which exhibit evidence of previous core preparation, except for core tablets*" are defined as crested pieces (Marks 1976a:375). This is basically true, but there are always items among core maintenance products in Upper Paleolithic industries which occupy an intermediate morphological position between core tablets and crested pieces. Such pieces at Siuren I have a transversal location of crested ridges on their dorsal surfaces in relation to the axis of removal direction of these pieces. These "transversal crested pieces" generally reflect a unilateral partially crested preparation, although bilateral and entirely crested preparation are also attested. Their technological meaning seems to be related to both the initial formation of pre-cores and to the rather radical re-preparation of cores during reduction processes when changing from one striking platform and flaking surface to another and some crested ridges on the core's body needed to be removed, although, for instance, K. Sobczyk (1993:25 and Pl. XVI, 5-6, 8-9) prefers to consider morphologically similar pieces as "*flakes removing prepared pre-striking platform*". We propose to term such "transversal crested pieces" as *core trimming elements*. Among Siuren I artifacts, they occur only on flakes and their morphological description is limited to the unilateral/bilateral and partial/entire crested preparation of crested ridges.

Concluding the description of the classification method for Siuren I core maintenance products, an additional characteristic morphological feature that once again emphasizes their function in core preparation and re-preparation and, at the same time, that these are not deliberately produced debitage/tool blanks, should be mentioned. None of the primary and secondary crested pieces, core tablets and core trimming elements show any evidence of butt abrasion; pieces which do are most often products of systematic serial primary core reduction. On the other hand, some re-crested pieces and many of the truly secondary crested pieces with no preserved crested ridges' tops show butt abrasion that additionally confirms their detachment during systematic primary flaking processes.

Debitage

General structure of debitage pieces and tool blanks of debitage nature

At Siuren I, this general artifact category is composed of *flakes*, *blades*, *bladelets* and *microblades*. Usually Upper Paleolithic pieces of debitage nature are subdivided into flakes, blades and bladelets, although unretouched bladelets are sometimes analyzed within blades with no particular separation, while, at the same time, special typological analysis of retouched bladelets is quite common (e.g., Drobniewicz *et al*. 1992; Hromada & Kozlowski 1995). In our view, it is very important to separately define and analyze bladelets in Upper Paleolithic industries with pronounced bladelet primary reduction and this has been done for Siuren I. Moreover, we go much further and have also decided to separately define microblades within bladelets as well. This is the result of a contrast between different characteristics for the bladelets from Siuren I Units H and G, on one hand, and those from Siuren I Unit F, on the other, consisting in a prevalence of "wide" bladelets in H and G and in a prevalence of "narrow" bladelets in F.

Flakes

These are artifacts (whole or broken with identifiable characteristics) with an "on-axis" length less than twice their maximum width and larger than 1.5 cm in any of their dimensions including diagonal measurement for these pieces. As an aside, two lower size limits for flakes of Upper Paleolithic complexes have been established-more than 1.5 cm (e.g., Marks 1976a; Kozlowski *et al*. 1982) and more than 2.5 cm (e.g., Olszewski & Dibble 1994; Kuhn & Stiner 1998). We prefer the former approach, taking into consideration the great number of small-sized debitage pieces-bladelets and microblades in Siuren I Units H, G and especially F, often used for tool manufacture ("non-geometric microliths"), where using a lower limit of 2.5 cm would certainly "mask" the technological roles of flakes in Upper Paleolithic industries with pronounced primary bladelet reduction.

Blades

These are all pieces (whole or broken with identifiable characteristics) with an "on-axis" length of more than twice their maximum width and with a width equal or more than 1.2 cm. Thus, we use the *sensu lato* definition of blades, leaving aside the *sensu stricto* "true blades" definition that accepts as blades only those pieces with blady metric proportions having a non-cortical dorsal surface with parallel removal scars and characteristic parallel lateral edges. The *sensu lato* blades definition is our standard for blade identification in Paleolithic industries (Chabai & Demidenko 1998), but is additionally demanded by the Siuren I assemblages where quite a few blades from Units H, G and especially F have some cortex and non-parallel edges and their possible exclusion from the blades category would make significantly lower their numerical importance and, accordingly, the technological role of blade production processes for these lithic assemblages. In addition, these non-"true blady characteristics" of some of the Siuren I blades are a common feature for blades in many European and Levantine Aurignacian complexes.

Bladelets and microblades

The well-known general definition for bladelets consists of the following two conditions-"*1st: length twice or more than twice the width; 2nd: width less than 1.2 cm*" (Tixier 1974:7), a definition also accepted here. However, the differences in width for bladelets from Siuren I Units H-G and Unit F forces us to additionally subdivide them into bladelets *sensu lato*, bladelets *sensu stricto* and microblades. As against the broad scientific acceptance of the Tixier's bladelets definition, there are actually few, if any, morphological and/or metric elaborations nor a clear definition for microblades in the archaeological literature, mainly because this has not been needed by most of our colleagues in their studies of unretouched debitage pieces from Paleolithic complexes where separation of bladelets alone is sufficient. Principally, we know of only Amirkhanov's microblade definition, used by him for description and analysis of Upper Paleolithic complexes from the Northern Caucasus in Russia (Amirkhanov 1986). He distinguished microblades as blady pieces with a width less than 0.7 cm, while Tixier's definition of bladelets was restricted to blady items with a width between 0.7 cm and less than 1.2 cm (Amirkhanov 1986: 7). Purely statistically, Amirkhanov's differentiation of width parameters for bladelets and microblades is correct in terms of absolutely equal ranges of 0.5 cm for each, not taking into account, of course, widths less than 0.2 cm since such narrow microblades do not really occur. After such statistical checking of Amirkhanov's "width border" of 0.7 cm for bladelets and microblades, we decided to accept this metric approach and apply it to separate the Siuren I bladelets *sensu stricto* and microblades. Their definitions can be represented as follows.

Bladelets are all pieces (whole or broken with identifiable characteristics) with an "on-axis" length of more than twice their maximum width where width is greater than or equal to 0.7 cm and less than 1.2 cm.

Microblades are all pieces (whole or broken with identifiable characteristics) with an "on-axis" length of more than twice their maximum width and with a width less than 0.7 cm.

It is worth noting that no length limits for bladelets or microblades are set.

Separating bladelets and microblades one from another does not, however, mean separate primary reduction sequences for each of these sub-categories, which are simply products of general primary bladelet flaking processes with different technological characteristics leading to a more important role of either bladelets or microblades in the Siuren I Aurignacian assemblages.

Tools

All lithic artifacts with any kind of retouch or burin facet are referred to as tools. Three major tool groups have been defined for the Siuren I tool-kits: *indicative tool types, retouched pieces* and *non-geometric microliths*, as well as two more tool groups of secondary typological importance: *unidentifiable tool fragments* and *non-flint tools*. The internal composition of each of these tool groups is discussed below.

Indicative tool types

These are all pieces with regular well-made continuous retouch or a burin facet on flakes, blades and even chunks, including broken pieces, but not on bladelets *sensu lato* (bladelets *sensu stricto* and microblades). Thus, no *retouched pieces* or *non-geometric microliths* are included in this tool group. At the same time, structurally, *indicative tool types* are also subdivided into three more groups: *indicative Upper Paleolithic tool types*, *neutral tool types* and *Middle Paleolithic tool types*. All of these tool types differ from one from another by the representation of specific types and secondary treatment characteristics, and are therefore analyzed separately.

Indicative Upper Paleolithic tool types

These are composed of end-scrapers, burins, composite tools, truncations, retouched blades, perforators and scaled tools. Before description in our classification system of *Indicative Upper Paleolithic Tool Types*, the definition of "*carinated pieces*" will be discussed and particular principles of their typological attribution to one or another core and tool type because such pieces are found among cores, end-scrapers, burins and composite tools.

"*Carinated pieces*". Their identification has a long history in Upper Paleolithic industries and they still pose typological problems for their attribution, as reflected in many publications, of which we would mention only the main ones (Sonneville-Bordes & Perrot 1954-1956; Pradel 1962; Ronen 1964; Movius & Brooks 1971; Perpère 1972; Hahn 1977; Demars 1982; Bergman 1987). Without presenting a detailed discussion of all of the differents points of view expressed on this typological problem, we instead propose our own typological system for their classification, which is mainly based on general concensus on the matter.

In the de Sonneville-Bordes and Perrot type-list (1954-1956), the following tool types are usually referred to as "*carinated tools*": carinated end-scrapers (N 11), carinated atypical end-scrapers (N 12), thick nosed end-scrapers (N 13), core-shaped end-scrapers (N 15), rabots (N 16) and carinated/busked burins (N 32). Namely, all discussions are set around these types. Moreover, aside from strictly tools, it is also common for some archaeologists to define "*carinated cores*" in the Upper Paleolithic, especially in Aurignacian complexes (e.g. Marks & Ferring 1976). We must admit here that the most convincing and successful use of the term "*carinated cores*" was by E. Sachse-Kozlowska (1978,1983) for classification of Polish Aurignacian complexes. At the same time, there are no clearly proposed typological criteria for the separation of "*carinated cores*" from "*carinated tools*" and their selection is mainly based on similarity to carinated end-scrapers, but with a more core-like overall shape and treatment. So, "*carinated cores and tools*" should be discussed and we offer the following criteria and definitions for their identification.

We starting with <u>*carinated end-scrapers*</u> as the most typical carinated form. In addition to its classical characteristics (Sonneville-Bordes & Perrot 1954:332; Movius & Brooks 1971:255), *a carinated end-scraper* should always have in its typical form a front-edge scraper width greater than the length of *lamellar* (bladelets *sensu lato*) retouch facets which created this front-edge.

<u>*A carinated core*</u> should, first of all, also have exclusively bladelet *sensu lato* removal scars at its flaking surface because this is the obligatory morphological feature for all typical *carinated pieces* and, respectively, no blade and blade/bladelet cores can be considered as *carinated cores* at all. Then, a bladelet "*carinated*" core, opposite to a *carinated end-scrapers*, should always have bladelet removal scars longer than the width of the core's striking platform from which the bladelet removals were struck off. The only allowable exception, when the length of bladelet removal scars from a bladelet "*carinated*" core is shorter than the striking platform's width, is when edges of the striking platform are clearly quite irregular and rough in a way that is not consistent with end-scraper morphology. But where is "a morphological border" between "regular" bladelet cores and "*carinated*" bladelet cores? It is important because the lack of such criteria can lead to either their mixing or to identification of only "*carinated*" bladelet cores in Aurignacian complexes. "*Carinated*" bladelet cores are morphologically distinguished from "regular" bladelet cores by the following features: (1) bladelet removal scars on "regular" cores are at least twice as long as the width of the core striking platform; (2) a flaking surface of "regular" cores is more or less flat/non-volumetric or, if convex/volumetric, has bladelet removal scars more than twice as long as the width of the core striking platform; (3) "*carinated*" cores tend to have only volumetric convex or twisted flaking surfaces with the only exception being bladelet single-platform narrow flaked cores/"carinated burins" which will be described for the analysis of carinated burins; (4) "*carinated*" cores also tend to be characterized by a sub-cylindrical or a sub-pyramidal shape and only quite rarely by a wholly volumetric coring processes-a cylindrical or a pyramidal shape that we prefer to term "*advanced carinated*" bladelet cores.

<u>*Carinated burins*</u> are differentiated from *carinated end-scrapers* by the width of their working edge, which should not to exceed 1 cm, as proposed by F. Hours for Near Eastern assemblages (Bergman 1987:12). This does not apply to very specific narrow-nosed end-scrapers, well-defined by M. Oliva as a unique Lhotka type in some Moravian Epi-Aurignacian complexes (Oliva 1987: p. 78 and fig. 40, 7-10, 16-17 on p. 82; Oliva 1993: fig. 4, 13-15 on p. 42 and p. 49); these are not, however, represented at Siuren I at all. Differences between *carinated burins* and "regular" bladelet cores again consist in a narrow working edge (less than 1 cm), and usually infrequent, well-developed bladelet removal scars on their surfaces for burins. Practical ap-

plication of the criteria for differentiation of *carinated burins* and "regular" bladelet cores for the Siuren I artifacts confirms their importance with one exception. There are several pieces in the Units F and E assemblages which correspond to our *carinated burins* definition, but the width of the working edges is between 1.0 and 2.0 cm. Thus, according to formal metric data of our own criteria, such pieces should be classified as single-platform non-volumetric narrow flaked bladelet cores and we did so. But additionally, we have also decided to apply the "*carinated burins*" definition to them as well, emphasizing their intermediate morphological and metric position between "true cores" and "true burins". Finally, we should also touch on a problem in the definition of *carinated burins* related to their frequent attribution as a busked *type*. Recalling the classical definition of a busked *bur*in (Sonneville-Bordes & Perrot 1956:410), we accept this particular burin type in a twofold way as being a dihedral asymmetric item with one multifaceted verge on which more than three bladelet *sensu lato* removal scars terminate either by a characteristic retouched notch (busked *type sensu stricto*) or the unretouched edge of a blank (*carinated type sensu stricto*). There are no very typical *busked burins* among Siuren I flints, although one composite tool (a simple end-scraper/carinated burin) of level Fb1-Fb2 and one double carinated burin of Unit C have weakly-developed but still retouched notches to terminate the *carinated burin*. Taking into account the presence of just two examples of busked *burins* in the 1990s finds at Siuren I, and the presence of only one in Bonch-Osmolowski's 1920s assemblages, we define them as carinated (buskoid) burins, methodically similar to what some of our colleagues did (e.g., Marks & Ferring 1976). Concluding the *carinated*/busked *burins* discussion, we must note that the rarity of busked *burins* at Siuren I is in accordance with their overall scarcity in Central and Eastern European Aurignacian complexes being instead mostly represented by a *carinated* type with no characteristic lateral notch (e.g. Hahn 1977). It could be said that there are two approaches in discussions of these dihedral asymmetric multifaceted burins. The first one consists in considering the busked *burin* type as a discrete burin type made intentionally and typical of only some very local Aurignacian complexes. Let us just cite here the opinions of two of the most well-known archaeologists for the Western European Paleolithic on this matter. "*Outside of France, I do not know of any true* busked *burins*" (Bordes 1968:369) and "*... there are no typical buskeds burins in this part of Europe* (Yu. D. – i.e., Central and Eastern Europe) *just as there are none in Spain and Belgium*" (Sonneville-Bordes 1968:384) where the latter authority proposed to call such burins with no notch as *"burins carénés"* (Sonneville-Bordes 1968:383). During the many years that have passed since these opinions were published, it is now known that busked *burins* are not restricted to just the French Aurignacian as, for instance, M. Otte (1983: Pl. V, 4, 7-9 on p. 74) has convincingly shown their presence in the Aurignacian of Belgium. The second approach, which we support, considers some morphological differences between busked and *carinated* burins as the result of different intensity in their manufacture and use where for more reduction, a notch was simply added to the busked type for better control and limitation of bladelets *sensu lato* removed.

After establishing the typological criteria for the main "*carinated pieces*" types (bladelet "carinated" cores, carinated end-scrapers, carinated burins), their traditionally defined types are discussed.

Carinated atypical end-scrapers are defined using the classical definition (Sonneville-Bordes & Perrot 1954:332; Movius & Brooks 1971:255) with an emphasis on *non-lamellar* removal scars for their still thick front-edges. *Non-lamellar* treatment characteristics are recognized by us for those cases when the length of removal scars is less than four times their maximum width, a metric criterion used by A. Leroi-Gourhan for blade identification (Leroi-Gourhan *et al.* 1966).

Thick nosed end-scrapers or "*grattoirs épais à museau*" (Sonneville-Bordes & Perrot 1954:332; Movius & Brooks 1971:255) are subdivided into thick shouldered and nosed end-scrapers (e.g. Movius & Brooks 1971; Marks & Ferring 1976; Bergman 1987). As known from the publications, thick shouldered/nosed end-scrapers are technologically very similar to typical forms of *carinated end-scrapers* due to *lamellar (*bladelet *sensu lato*) secondary treatment and thick blanks with the only morphological difference between them the presence of one or two side notches delimiting a supposed front-edge scraper.

Core-shaped end-scrapers and *rabots* (Sonneville-Bordes & Perrot 1954:332; Movius & Brooks 1971:255) are proposed to be eliminated from both the tools type-list and "*carinated pieces*" types, although they are sometimes still defined (e.g. Demars 1982; 1992). Our decision is in accordance with the following considerations of such specialists. F. Bordes has underlined that "*... either the piece is a core or a scraper, not both. I believe it is impossible to distinguish core-scrapers from cores and suggest we remove grattoir nucléiforme from the type-list*" (Bergman 1987:12). C.A. Bergman later emphasized that "*... there is no way to tell what is retouch and what is simply preparation of the edge of a platform on a core*" and further also suggested that "*... a carinated tool must always be made on a flake or blade and never on a "chunk" or block of raw material. The latter are always regarded as cores because it is impossible using morphological attributes to determine if they served as tools*" (Bergman 1987:12). Indeed, the abrasion treatment of core striking platforms is very often indistinguishable from slight scalar retouch and, therefore, instead of morphological criteria, we use metric criteria to differentiate "*carinated cores*" and "*carinated tools*".

So, Siuren I "*carinated pieces*" are subdivided into "*carinated cores*" ("carinated" single-and double-platform sub-cylindrical and sub-pyramidal bladelet cores, "advanced carinated" single-platform pyramidal bladelet cores and single-platform narrow flaked bladelet cores/"carinated burins") and "*carinated tool*" types (carinated end-scrapers, carinated atypical end-scrapers, thick shouldered/nosed end-scrapers and carinated, including buskoid, burins). It is worth noting here that we make no suggestions regarding actual functional use during the Paleolithic for "*carinated pieces*" at Siuren I and this is intentional. Like many of our colleagues (e.g. Rigaud 1993:183), we consider that "*carinated pieces*" are mainly different technological variations of bladelet cores, although many Aurignacian assemblages with "*carinated pieces*" lack retouched bladelets and microblades. This fact may indeed point out that at least some types of "*carinated pieces*" also served as tools. We therefore subdivide the Siuren I "*carinated pieces*" into the different types to show their morphological and metric variability that, in our opinion, may in fact help to typologically differentiate various Aurignacian complexes. Because of these reasons, we do not support the position of C.A. Bergman (1987) on this matter when he made no such subdivision for the Northern Levantine Aurignacian "*carinated pieces*" at the Ksar Akil rock-shelter (Lebanon), although he was inclined to agree on the separation of such unique Levantine Aurignacian carinated type as "*lateral carinated end-scrapers*" (Bergman 1987:12-13).

Now, after this rather long discussion of "carinated pieces", let us return to the internal structure of the indicative Upper Paleolithic tool types at Siuren I.

As is clear, all "carinated" bladelet cores are placed in the core-like pieces category and all "carinated tools" are distributed among end-scrapers, burins and composite tools of indicative Upper Paleolithic tool types. The following specific types are recognized.

End-scrapers are also composed of *simple*, *atypical*, *double on retouched pieces*, *ogival*, *simple on retouched pieces*, *unilateral/flake*, *circular* and *flat shouldered* types. All of these types are classified using the classical definitions (Sonneville-Bordes & Perrot 1954:328-332) which certainly do not need to be repeated here. We add only that flat shouldered end-scrapers in conjunction with all carinated end-scraper types create a group of Aurignacian end-scraper types within the Siuren I lithic assemblages. However, as proposed by Demars (1990), the general subdivision of all end-scrapers into "*grattoirs minces*" (our non-carinated types) and "*grattoirs épais*" (our carinated types) is also worth recalling to observe the possible interrelations between"flat"/"*mince*" and "carinated"/"*épais*" end-scrapers. Finally, *fragments of flat end-scrapers' fronts* were also defined as a separate group. With respect to additional attribute, we have also included important secondary treatment characteristics of the font edges of end-scrapers: *lamellar/non-lamellar* and *convergent/non-convergent* (see Movius & Brooks 1971:264-266; Brooks 1995:207-211).

Burins include *single and double dihedral symmetric* and *asymmetric*, *single* and *double angle*, *on different truncations*, *on lateral preparation* and *transversal on natural surface* types and only one piece of *double mixed type*: *on truncation + angle*. A group of "*broken burins*" was also defined, with missing terminations from which burin spalls were struck off and having only the lower parts of burin spall scars on their lateral edges. The "*burin plan*" type (see N 44 in the type-list of Sonneville-Bordes & Perrot 1956:412) is not defined for the Siuren I burins, although when a burin has a *plan facet*, it is noted as one of its characteristic attributes and not as the basis for identification of a specific type; a comparable approach was used by A.E. Marks (1976a:379) for classification of the Negev (Israel) Paleolithic materials. All burin types identified at Siuren I are also classified by their classical definitions (N 27-31 and 34-41 in Sonneville-Bordes and Perrot 1956:408-412; Movius *et al*. 1968:20-22; Hours 1974:4-6) and, of course, should to be structured into several type groups.

There are, however, some methodological differences in grouping burin types in Paleolithic archaeology. In the ex-Soviet Union, it is typical to represent proportional numbers and percentages of different kinds of dihedral, angle and on truncation burins and to use their varying frequencies to compare Upper Paleolithic industries. In Western Europe, since the proposal of typological indices by D. de Sonneville-Bordes and J. Perrot (1953:326-327), the internal subdivision of burins has been based on the calculation of dihedral burins (all dihedral and angle types) and burins on truncation (all variations on truncation) with an additional separate evaluation of busked burins if present. So, in the latter approach, there is a mixing of dihedral and angle burins under "a single typological umbrella" as the general dihedral type. Recently, Demars has convincingly pointed out that such an approach to the structural subdivision of burins does not correctly reflect their true typological features, instead uniting all burins into three groups: dihedral (all dihedral and all carinated/busked types), angle (all on break and on natural surface types) and on truncation (all on truncation variations) for Aurignacian tool-kits (Demars 1990); this enabled him to demonstrate certain typological differences within the Early Aurignacian in the Périgord (France) (Demars 1992). As seen, Demars' approach is very similar to that used in ex-Soviet Union Paleolithic archaeology and we certainly prefer it for our own descriptions and analyses of the Siuren I burins. This is explained by the following comments. We believe that carinated and busked burin types are strongly connected technologically to dihedral burins, being their more reduced and used variants in Aurignacian complexes; their separation from all other "non-dihedral" burins is one of the most indicative Aurignacian typological features. We add only burins on lateral preparation and transversal burins on natural surface to the burin types used for these calculations. So, in this case, we have the following general burin groups: dihedral (all dihedral ones), carinated (all carinated and buskoid), angle (all angle on break and natural surface ones + transversal on natural surface) and on truncation (all on truncation ones + on lateral preparation), taking into account burin terminations. All dihedral and carinated/buskoid types will be additionally calculated together to obtain the general total of all "dihedrally" treated burin types. For Siuren I in particular and for other Upper Paleolithic complexes with small tool-kits or simply burins, it appears useful to add each termination of one type double and mixed types double and multiple burins and composite tools to the four main burin groups for more detailed and complete analysis of all burins, similar to what Demars proposed (1992).

Composite tools are represented by the following tool categories and type combinations at Siuren I: a *simple end-scraper/dihedral asymmetric burin*, *simple end-scraper/carinated (buskoid) burin*, *end scraper on a retouched piece/broken burin*, *perforator/angle burin* and *scaled tool/burin on a concave truncation*. The latter combination is very unexpected, usually missing in traditional Upper Paleolithic type-lists and in known Upper Paleolithic assemblages, but is represented by a single example in level Gb1-Gb2 at Siuren I and will be specially noted during description of the Unit G lithic assemblages. The rest of the composite tools occur quite regularly in Upper Paleolithic industries and will be described according to the specific tool types identified for each of their terminations.

Truncations are analyzed through retouch characteristics and relationship of the angle of the truncated edge and shape to the axis of removal direction for a used blank: straight, oblique, convex or concave (e.g., N 60-64 in the type-list of Sonneville-Bordes & Perrot 1956:548-550), as well as the placement of truncated edge on blank surfaces: dorsal, ventral or alternate.

Retouched blades are only those blades which have continuous and regular non-backed retouch of any kind except marginal. They are also subdivided into two internal sub-groups: *retouched blades* and *blades with Aurignacian-like heavy* retouch, numbers 65-67 in the type-list of D. de Sonneville-Bordes & J. Perrot (1956:550-552). The only significant difference of *blades with Aurignacian-like heavy retouch* from other *retouched blades* consists in the presence of more invasive scalar and stepped, usually semi-steep retouch for the former. We use the Aurignacian-like definition instead of simply Aurignacian because of the presence of only one such tool among the Siuren I 1990s finds and another (a simple end-scraper on an Aurignacian blade) among the 1920s artifacts; this obvious rarity prevents us from using a "stronger typological tone" for this definition. The description system of all *Retouched blades* is based on identification of retouch position (dorsal and ventral), retouch type (scalar, sub-parallel, parallel and stepped), retouch angles (flat and semi-steep), and above all, the number of retouched edges (unilateral and bilateral). *Aurignacian "pointed blades"* and *"strangled blades"* are absent at Siuren I.

Scaled tools or more commonly as *pièces esquillées* (N 76 in the type-list of Sonneville-Bordes & Perrot 1956:552) occur only in level Gb1-Gb2 from the 1990s finds. As is usually done in traditional typological descriptions (e.g., Marks & Ferring 1976; Kozlowski *et al.* 1982), we describe *scaled tools* based on their bifacially scaled extremities/poles location and number for each piece.

Perforators are represented by only two items among the 1990s finds: a perforator from Unit A and one on a composite tool (perforator/angle burin) from level Gc1-Gc2. They are identified and described using the classical definitions (Sonneville-Bordes & Perrot 1955:76-79).

Neutral tool types

These are *denticulated* and *notched pieces* and their separation as "*neutral types*" is explained by both the "simple" secondary treatment of these tools and their occurrence throughout the entire Paleolithic span with no significant morphological changes.

Notched pieces are classified by the presence of clear notches formed by regular, well-made (non-marginal) retouch according to their number and placement on edges: lateral and distal, dorsal and ventral.

Denticulated pieces are represented among these "*neutral types*" by a single example of a simple lateral straight piece with alternate retouch in level Fb1-Fb2, while another denticulated piece from level Gb1-Gb2 has been included in *Middle Paleolithic tool types* based on its secondary treatment, as discussed below.

Middle Paleolithic tool types

These types are represented by unifacial and bifacial points and scrapers, and the denticulated pieces mentioned above number in total 20. Their description is based on Gladilin's (1976) classification principles used for the analyses of Crimean Middle Paleolithic assemblages (Chabai & Demidenko 1998). The Siuren I Middle Paleolithic tool types have strict typological similarities to tool-kits from the Crimean Micoquian Tradition complexes and here our classification choice is obvious. Along with this, however, each of these tools is also additionally identified according to Bordes' (1961) Middle Paleolithic tool type definitions to make clearer their attributions for our colleagues who are not familiar with Gladilin's classification or do not feel comfortable with it.

So, all these tools, which come only from the lower cultural bearing deposits (Units H and G), are first classified as unifacial and bifacial. They are then classified into points and scrapers, noting as well whether they are complete or broken. Description then includes overall shape (e.g. simple, leaf-shaped, sub-trapezoidal, triangular, etc.), retouch placement for unifacial tools (dorsal and ventral) and secondary treatment (biconvex and plano-convex) for bifacial tools, and, finally, additional secondary modifications for dorsal and ventral thinning of different tools.

The specially noted denticulated piece from level Gb1-Gb2 is transversal convex dorsal with basal dorsal and ventral thinning - a morphological feature which completely corresponds to secondary treatment characteristics of only Middle Paleolithic unifacial points and scrapers among all tools from the 1990s excavations at Siuren I.

The special separation of this tool type is due to very distinct techno-typological characteristics for these pieces, which are unquestionably different from Upper Paleolithic and other tool types in the Siuren I units, being not just "retouched flakes" that also occur in many Upper Paleolithic complexes, but real Middle Paleolithic types characteristic for the Crimean Middle Paleolithic as well.

Retouched pieces

These are blades, flakes and even a single chunk which have only discontinuous irregular retouch that does not create a clear working edge or marginal continuous/discontinuous retouch. Their classification is based primarily on blank type (blade, flake, chunk), retouch characteristics (marginal/irregular and continuous/discontinuous partial) and location on blank edges and surfaces (e.g. lateral dorsal, distal ventral, etc.). Such secondary treatment characteristics are not sufficient to classify them into definite tool categories (e.g. Upper Paleolithic retouched blades or Middle Paleolithic scrapers) and, therefore, should be considered separately from other "true tools".

Non-geometric microliths

The most abundant tool group in the 1990s assemblages includes about 350 retouched bladelets and microblades. The great importance of these "small-sized tools" is well-known because their different types and forms very often serve as the main typological basis for industrial/"cultural" attributions of Upper Paleolithic assemblages. These pieces have thus been separated into a special tool group. The absence of any geometric forms is the basis for calling them *non-geometric microliths*, commonly used in Upper Paleolithic studies (e.g. Hours 1974). Taking into consideration retouch types applied to these "small-sized tools", we have divided these pieces into two main groups: *items with fine marginal and/or semi-steep micro-scalar and micro-stepped retouch* and *items with abrupt lateral retouch*. The first group deserves detailed discussion because of its typological variability and numerical dominance - more than 90% of all "small-sized tools" from the 1990s excavations, while the latter group of *pieces with an abrupt lateral retouch* accounts for less than 5%, being typologically represented by only two sub-types throughout the entire sequence.

Strictly morphologically, *non-geometric microliths with fine marginal and/or semi-steep micro-scalar and micro-stepped retouch* are represented by the following forms made on bladelets and microblades: *items with alternate bilateral retouch*, *items with ventral lateral retouch*, *items with dorsal lateral retouch*, *items with dorsal bilateral retouch*, *pointed items with dorsal bilateral retouch*, *pointed items with alternate bilateral retouch*, *items with dorsal retouch at distal end*, *truncated items*, *bitruncated items*, *items with either dorsal or ventral lateral micronotch*, *items with dorsal microdenticulated lateral edge*. There are 11 forms in total. All of these forms can be structured into three typological sub-groups: *items with continuous lateral/bilateral retouch*; *pointed items* and *items differing from the first two sub-groups by retouch location and nature*. Again, these should be discussed separately.

Pieces with continuous lateral/bilateral, fine marginal and/or semi-steep micro-scalar and micro-stepped retouch, in a very broad typological definition, are usually referred to as "*Dufour bladelets*". We have examined the available published information on different approaches to identifying"*Dufour bladelets* and have come to such conclusions, although this typological subject definitely needs further study and a separate publication. Thus, since the first "*Dufour bladelets*" definition in Aurignacian complexes of the Périgord (e.g. Bouyssonie 1944; Sonneville-Bordes & Perrot 1956: 554-N 90 in the type-list), the most typical "*Dufour bladelets*" forms have either alternate bilateral or ventral lateral retouch, although bladelets *sensu lato* with dorsal lateral and dorsal bilateral retouch placement were also usually added to "*Dufour bladelets*" given the same retouch types for all these items. The first systematic typological subdivision of "*Dufour bladelets*" based on retouch placement data was proposed by J.K. Kozlowski (1965:37-38) who distinguished "*Dufour bladelets*" with alternate lateral retouch and "*pseudo-Dufour bladelets*" with dorsal lateral/bilateral retouch, used to differentiate the Central European Aurignacian (Kozlowski 1965). However, Kozlowski seems to have abandoned such criteria for the subdivision of "*Dufour bladelets*", using on retouch type and not retouch location for their identification, although it was notably applied by him to Gravettian complexes (e.g. Drobniewicz *et al*. 1992).

In sum, we also propose to differentiate *pieces with continuous lateral/bilateral, fine marginal and/or semi-steep micro-scalar and micro-stepped retouch* into two sub-types on the basis of retouch location: "*Dufour bladelets*" with alternate bilateral and ventral lateral retouch as the most typical for European Aurignacian complexes and "*pseudo-Dufour bladelets*" with dorsal lateral and dorsal bilateral retouch because of their much rarer occurrence in European Aurignacian complexes, instead being more characteristic for Epi-Aurignacian assemblages in Eastern Europe (Demidenko 1999).

Aside from the subdivision of "*Dufour bladelets*" based on retouch location, P.-Y. Demars has proposed differentiating "*Dufour bladelets*" on the basis of length and profile of the used blanks (bladelets *sensu lato*) into two sub-types: "*Dufour*" with an overall length between 3.0 and 4.5 cm and incurvate profile, and "*Roc de Combe*" with an overall length between 1.5 and 2.0 cm and twisted profile (Demars & Laurent 1989:102). We think that in general terms, this is a quite precise typological observation for additional subdivision of "*Dufour bladelets*", but it is also needed. First of all, there are few, if any, Aurignacian assemblages with enough whole "*Dufour bladelets*" to statistically determine average length, while broken items could in fact be from the longest examples of a particular assemblage. On the other hand, our own observations of "*Dufour bladelets*" morphological and metric parameters from Siuren I and other European Aurignacian and Epi-Aurignacian complexes, including Demars' data, have shown that Demars' "*Dufour bladelets sub-type*" is generally made on wide bladelets (bladelets *sensu stricto* in our terminology), with flat and incurvate profiles, bearing mostly semi-steep micro-scalar and micro-stepped alternate bilateral and ventral lateral retouch, while Demars' "*Roc de Combe bladelets sub-type*" are made on narrow bladelets (microblades in our terminology), with twisted profile, with in most cases fine marginal ventral lateral and dorsal lateral/bilateral retouch. These differences can be used to subdivide *"Dufour bladelets"* into "*Dufour bladelets*" and "*Roc de Combe bladelets*".

For Siuren I, taking into consideration our criteria on "*Dufour bladelets*" and "*pseudo-Dufour bladelets*", and our thoughts on the separation of "*Dufour bladelets* and *Roc de Combe*", we use the terms "*Dufour* and *pseudo-Dufour*" and separate them according to blank type (bladelets or microblades), retouch type (fine marginal or semi-steep micro-scalar and micro-stepped) and profile types (flat and incurvate or twisted). The main difference with Demars' sub-types added by our data consist in regarding bladelets *sensu lato* with ventral lateral retouch as a form of "*Dufour bladelets*" not "*pseudo-Dufour*" or "*Roc de Combe sub-type*". On the other hand, Demars' "*Dufour bladelets* and *Roc de Combe sub-types*" can be also used for general analysis of European Aurignacian and Epi-Aurignacian of Krems-Dufour type complexes, especially during analysis of such complexes known by the present author from published data and personal observation.

Pointed bladelets and microblades with noted retouch type characteristics were first distinguished on Aurignacian materials of the Périgord as "*Font-Yves points-Pointes de Font-Yves*" (Bardon & Bouyssonie 1920; Sonneville-Bordes & Perrot 1956:547-N 52 in the type-list) made on bladelets *sensu lato* with semi-steep dorsal bilateral retouch forming a pointed tip and often distributed along the entire length of the lateral edges. Unlike the universal term "*Dufour bladelets*", the *Font-Yves type point* definition became only one of several such special terms proposed through time for these basically Aurignacian bladelet points.

So, similarly retouched points made on bladelets *sensu lato* were defined in different regions of the Old World in mainly Aurignacian complexes, e.g. *El Wad points* in the Near East

(Bar-Yosef 1970:211; Hours 1974:6-8; Besançon *et al.* 1975-1977:32-35; Marks 1976a:381; Bergman 1987:13-14) and Gar Arjeneh points in the Zagros Baradostian/Aurignacian of the Middle East (Hole & Flannery 1967:156-158; Olszewski 1993:189; Olszewski & Dibble 1994:69). These non-European, mainly Aurignacian, bladelet points were considered to be typological equivalents of *Font-Yves points*, but have local names to underly industrial differences between the Asian and French Aurignacian complexes. Also, these bladelet points in Near Eastern and Middle Eastern, mainly Aurignacian, context were sometimes called as *Krems points* (e.g. Howell 1959:26; Hole & Flannery 1967:157) based on similarities to shorter points from the Krems-Hundssteig site (Austria) attributed to the Central European Aurignacian (Strobl & Obermaier 1909) in comparison to the French *Font-Yves type points*. Points from the Austrian site include, aside from points with dorsal bilateral retouch similar to the *Font-Yves type*, about 25% of pointed pieces with alternate bilateral retouch that has led to determination of the fourth name for these Aurignacian bladelet points-the *Krems type* (Schwabedissen 1954:5-6). Thus, for European Aurignacian complexes, it was generally established that *Font-Yves type points* are mainly made on elongated bladelets with dorsal bilateral retouch and *Krems type points* are usually made on shorter bladelets with alternate bilateral retouch (e.g. Kozlowski 1965:37-38; Kozlowski & Kozlowski 1975:162; Hahn 1977:59). Given these definitions, it seemed reasonable to also identify *Font-Yves points* in the Central European Upper Paleolithic, e.g. for the Banat Aurignacian (Romania) (Mogosanu 1983). But can we really accept such typological distinctions between *Font-Yves type points* and their Asian *El Wad* and *Gar Arjeneh* analogies with *Krems type points* on the basis of different retouch location? A review of published pieces from Aurignacian complexes in Western and Central Europe and Northern Levantine sites does not prove it, however. First of all, the type-site for the *Krems points* (Krems-Hundssteig site) is characterized by both types: points with dorsal bilateral retouch (*Font-Yves type*) and points with alternate bilateral retouch (*Krems type*) (see Broglio & Laplace 1966:77-85; Laplace 1970:250-252). Then, the Northern Levantine *El Wad type points* also include some items with, in addition to dorsal bilateral retouch, "... *small amounts of inverse retouch at the proximal end of the piece*" which were separately called "*El Wad variant points*" (Bergman 1987:14). Finally, statements on the only occurrence of points with dorsal bilateral retouch (*Font-Yves type*) in Western Europe does not reveal a typological truth because in such Aurignacian complexes of sites Dufour (Pradel 1968: fig. 4, 1, 4 on p. 474) and Bos-del-Ser (Pradel 1972: fig. 1, 11 on p. 430) in the Périgord (France) and Cueva Morin (Gonzalez Echegaray & Freeman 1971: fig. 85, 26 and fig. 93, 54) in Cantabria (Spain), points with alternate bilateral retouch (*Krems type*) are actually present, often along with points with dorsal bilateral retouch, but were typologically identified as *Dufour bladelets*. Such European pointed bladelets with alternate bilateral retouch were sometimes considered as a pointed variant of alternately retouched *Dufour bladelets* and called *Font-Yves bladelets* (e.g. Laplace 1958). Thus, both *Font-Yves* and *Krems* bladelet points with dorsal bilateral and alternate bilateral retouch placement are actually known throughout different Old World "Aurignacian regions" and their particular restriction to a few very local regions does not find actual support.

Both types of points on bladelets and microblades are found in the 1990s Units H and G and in the 1920s Lower layer assemblages at Siuren I, as is also characteristic of the Krems-Hundssteig site in Austria. We have decided to identify the Siuren I points as follows: pieces with dorsal bilateral retouch as *Krems points* and pieces with alternate bilateral retouch as *Krems points variant*. Elongated *Font-Yves type points* (see, for example, Demars & Laurent 1989:104-105 and especially length data for 16 such points from the Font-Yves type-site with an average length of 4.2 cm and length range between 2.6 and 7.9 cm, with only four items less than 3.0 cm long and 10 with length more than 3.5 cm; Pradel 1978) are absent at Siuren I, being represented by just two of the longest complete points, with lengths of 3.2 and 3.5 cm among 7 such pointed bladelets *sensu lato* from Units H and G.

Pieces differing from Dufour bladelets and pseudo-Dufour, Krems points type and its variant retouch location and nature are subdivided into several forms on the basis of very limited retouch/secondary treatment to create either micronotches and partially treated microdenticulated edges or semi-steeply retouched distal edges and truncated by almost steep retouch terminations of bladelets and microblades. Similar subdivision of these forms is often used in Upper Paleolithic type-lists (e.g. Hours 1974).

Non-geometric microliths with abrupt lateral retouch are represented by two sub-types of backed bladelets and microblades among the 1990s assemblages. The first sub-type includes *items with fine very thin continuous dorsal "micro-abrupt" retouch* identified in assemblages from Units G, F and A, totalling 7 pieces, The second sub-type is represented by 5 *items with thick pronouncely abrupt continuous dorsal retouch (true backed pieces) found* out of context during the 1990s excavations in the uppermost humus deposits at Siuren I. Moreover, of these 5 backed bladelets and microblades, 3 items have characteristic macro-traces of projectile damage. The industrial attribution of these two sub-types with abrupt lateral retouch will be made during detailed discussion of the assemblages in which these pieces were found or assumed to be associated.

Unidentifiable tool fragments

These are heavily broken pieces which in most cases are small fragments of retouched edges from indicative tool types; identification of tool categories and types for these pieces is impossible. They are therefore grouped in the category of *unidentifiable tool fragments*. In each of the Siuren I 1990s assemblages, *unidentifiable tool fragments* are counted, divided into pieces with or without primary cortex and types of raw material identified.

Non-flint tools

These include *retouchers, choppers, a battered piece* and *grinding tools* on different sorts of limestone pebbles, fragments and flakes. Each category is described individually for the respective levels of Units H, G and F.

Waste from production and rejuvenation of tools

This artifact category is composed of two general groups: (1) *burin spalls* and (2) *retouch flakes and chips, "a chamfer-like spall"*. Such division of these pieces is proposed because the first group will include only waste from burin manufacture and rejuvenation, while the second group will include waste from production and rejuvenation of all the other indicative tool types with no burin facets showing pattern, degree and variability of secondary treatment processes applied to Middle and Upper Paleolithic tool types.

Burin spalls are classified according to traditional descriptions (e.g. Tixier 1974:9-14; Kozlowski *et al.* 1982:139) for complete and broken *primary* and *secondary* items. *Primary* burin spalls are also divided into simple unretouched and retouched (unilateral and bilateral). All *primary* and *secondary* burin spalls are then described through their profiles, butt types and metrics. For plain butts, we assumed an origin from angle burins, subsequently confirmed by refitting of such a burin spall to a double angle burin in level Gc1-Gc2. Finely-faceted butts of burin spalls testify to their removal from burins on truncation and lateral preparation, while one or two distinct longitudinal facets on butts of secondary burin spalls tend to be considered as flaked during rejuvenation of dihedral burins.

Retouch flakes are assumed to be waste products from secondary treatment processes for Middle Paleolithic tool types. This is indeed so because all 22 such items with flake proportions are found in Units H and G where Middle Paleolithic tool types are only known for the entire archaeological sequence. Basic morphological principles to identify *retouch flakes* from the other flakes in these units are those already used for classification of lithic artifacts from Crimean Middle Paleolithic sites (Chabai & Demidenko 1998:40). Along with this, these *retouch flakes* have varying morphological features and thus five distinct types of *retouch flakes* were defined (see Demidenko 2003, 2004a:139-141, 2004b:54-60).

Here we note the main data for differentiation between waste products from Middle and Upper Paleolithic tool types. All *retouch flakes* (items more than 1.5 cm in maximum dimension) are considered to be detached from Middle Paleolithic bifacial and unifacial tools because such large flakes, in our opinion, cannot have come from retouching Upper Paleolithic end-scrapers or retouched blades which, on their working edges, do not show removal scars of this size. Accordingly, all but one *retouch chips* are considered to be waste products from secondary treatment processes of both Middle and Upper Paleolithic tool types as it is impossible to find "a morphological line of demarcation" between them, apart from a single very unique chip that will be discussed on its own.

All *retouch flakes* are composed of the following five types: *bifacial shaping flakes, bifacial thinning flakes, resharpening flakes for tips of bifacial convergent tools, resharpening flakes for tips of unifacial convergent tools* and *simple retouch flakes.*

Bifacial shaping flakes are represented by the sole item from Unit H and it is recognized through very characteristic crudely-faceted butt with lipped and abrasion features and acute angle, as well as a significant amount of distal cortex testifying with the butt's data on its detachment during an initial shaping treatment of a bifacial tool.

Bifacial thinning flakes (2 items in Unit H and level Gc1-Gc2) have been identified on the basis of finely-faceted butts with lipped and abrasion characteristics and acute angles with no dorsal cortex, interpreted in sum as resulting from thinning/rejuvenation of bifacial tools.

Resharpening flakes of bifacial convergent tools' tips are represented by a single piece from Unit H. It is properly a triangular non-cortical tip from a Middle Paleolithic bifacial rather symmetric tool with traces of multiple bifacial treatment that was detached by a side transversal blow during thinning/rejuvenation of the tool's distal tip.

Resharpening flakes of unifacial convergent tools' tips is noted for a single example from Unit H. This is a non-cortical flake with shortened, transversal proportions and a distinct triangular tip of a Middle Paleolithic type unifacial convergent tool on one of its lateral edges. Three similar pieces were also identified by the present author in the 1920s *Lower* layer assemblage. Such waste products are very characteristic for rejuvenation of unifacial points and scrapers in Middle Paleolithic/Crimean Micoquian Tradition complexes, being especially common in assemblages of the Kiik-Koba type industry.

Simple retouch flakes (17 items from Unit H and levels Gd, Gc1-Gc2 and Gb1-Gb2) are characterized by plain or linear butts with mainly lipped and abrasion characteristics, acute angles, and mostly non-cortical dorsal surfaces, interpreted as waste from general thinning/rejuvenation of Middle Paleolithic unifacial tool types (points and scrapers).

Retouch chips are pieces less than or equal to 1.5 cm in their maximum dimension. They are identified by the presence of plain, linear and puctiform butts (lipped, abrasion, acute angles) and non-cortical dorsal surfaces - waste products of both Middle and Upper Paleolithic indicative tool types in Units H and G, and of only Upper Paleolithic indicative tool types in Unit F where Middle Paleolithic tool types are completely absent.

The one *unusual retouch chip* (level Gd) is a waste chip from basal ventral thinning of a Middle Paleolithic tool type. It is a non-cortical ovoid chip with a dorsal-plain scar pattern on its dorsal surface that is actually part of a tool's blank ventral surface. So, it is a kind of "Janus/Kombewa" chip. Moreover, the dorsal-plain surface of this chip has a small part of a faceted butt (most likely, a flake) that was basally ventrally thinned by this chip. Thus, aside from the 22 retouch flakes, this *retouch chip* can be added to the waste products produced during secondary treatment processes of Middle Paleolithic tool types.

A "*chamfer-like spall*" is noted for level Fb1-Fb2 only. This is a spall with the remains of a rather steep simple end-scraper's working edge tip removed by a side transversal blow during rejuvenation of the front-edge. Such a method of rejuvenation of the fronts of simple end-scrapers is well-known for some Initial Upper Paleolithic complexes in Northern Levant and especially was described in great detail for Ksar Akil finds in levels 25-21 (Newcomer 1970), although it was also sometimes noted in chronologically later European Upper Paleolithic industries, e.g. in the Central European Gravettian complexes of Dolni Vestonice and Pavlov (Otte 1979:153).

Debris

This very general artifact category includes *chips, uncharacteristic debitage pieces, chunks* and *heavily burnt pieces.* Their morphological features and definitions are summarized as follows.

Chips

These are tiny debitage and retouch pieces and their fragments with flake proportions and less than or equal to 1.5 cm in maximum dimension.

Uncharacteristic debitage pieces

These are heavily fragmented debitage pieces with maximum dimension greater than 1.5 cm which cannot be identified either as flakes, blades or bladelets.

Chunks

Here we repeat and directly cite the chunks definition used for the classification of Crimean Middle Paleolithic artifacts. "*These are distinguished as variably sized pieces of raw material without recognizable dorsal or ventral surfaces, striking platforms, or dorsal scar patterns*" (Chabai & Demidenko 1998:40).

Heavily burnt pieces

These are cracked fragments of flint artifacts of any size which have become completely unidentifiable due to burning. Most often, such flints are included in the chunks category (e.g. Chabai & Demidenko 1998:40), but for the Siuren I 1990s materials we have decided to separate them as their frequency in each archaeological level will additionally provide evidence for fire use.

For these debris sub-categories, *heavily burnt pieces* are simply counted, while for *chips, uncharacteristic debitage pieces* and *chunks* presence/absence of cortex and raw material types are also described.

Attribute analysis adopted here

A number of attributes, important for technological studies, are not reflected in typological classification and are therefore discussed here. Many of these attributes are either well-known or already listed and described for analysis of Crimean Middle Paleolithic flints (Chabai & Demidenko 1998:47-51); here they will be simply listed. On the other hand, some more specific Upper Paleolithic attributes, lacking in the Crimean Middle Paleolithic attribute analysis system, will be discussed in more detail.

Cores

Platform types: cortical, plain, dihedral, crudely-faceted.

Platform angles: right, semi-acute, acute.

Platform abrasion: present/absent.

This is a very important core morphological feature that evidences the use of the "true Upper Paleolithic marginal soft hammer flaking mode" for intensive production of blades and bladelets *sensu lato*. The most convincing arguments for its technological significance were presented by K. Ohnuma and C.A. Bergman for Northern Levantine Ksar Akil materials (Bergman 1987; Ohnuma 1988; Ohnuma & Bergman 1990) and by Russian archaeologists E.Yu. Girya and P.E. Nekhoroshev (Girya 1997; Girya & Nekhoroshev 1993; Nekhoroshev 1999) in general technological studies of Middle and Upper Paleolithic industries.

Platform morphology in plane and removal scars on flaking surfaces.

Platform morphology in plane can be straight, semicircular or offset.

Removal scars on flaking surfaces can be twisted or non-twisted. These two morphological attributes are considered together because they are technologically strongly interrelated as platform shapes of straight and semicircular cores in plane are usually associated with non-twisted removal scars on the flaking surfaces, while platform morphology of offset cores in plane is mostly correlated with twisted removal scars on flaking surfaces. These technological specificites of cores were well-established for the Ksar Akil material from levels 13-6 (Bergman 1987:13) and actually served as one of the basis for demonstration of technological variability of these Upper Paleolithic/Northern Levantine Aurignacian complexes. Moreover, the presence of many bladelets and microblades with twisted profile and "off-axis" removal direction in Unit F, in contrast to the dominance of bladelets and microblades with incurvate and flat profiles and "on-axis" removal direction in Units H and G, requires some technological explanations; the attributes under discussion are of particular relevance and are in accordance with the following observation for the Ksar Akil Aurignacian bladelet cores, having "... *the removal of a large flake from the side of the platform in order to narrow the platform and flaking face. It is essential to maintain a relatively narrow platform and flaking face during the manufacture of twisted bladelets*" (Ohnuma & Bergman 1990:117). This "narrowing process" for core platforms corresponds to the offset morphology for bladelet core platforms and also for thick shouldered/nosed end-scrapers and some carinated and buskoid burins from which twisted bladelets and especially microblades could also be systematically detached.

Condition of flaking surface: regular, overpassed, hinged.

Reasons for core abandonment: a heavily hinged flaking surface, a heavily overpassed flaking surface, a crushed striking platform, too radical striking platform rejuvenation, general poor knapping quality of a used flint blank for core-like reduction, too small and thin exhausting a core's overall size, striking platform or flaking surface.

The latter two attributes are rarely used for technological analysis of core-like pieces, although their significance was clearly demonstrated by specialists from whom these attributes were borrowed (Bicho 1992:114; Sobczyk 1993:33-34).

Core-like pieces are also characterized by the following metric parameters: *overall size (length, width, thickness), platform width* and *thickness, scar maximum length off platform*.

Debitage pieces (flakes, blades, bladelets, microblades) and tool blanks of debitage character

The same range of attributes has been used for the description of flakes, blades, bladelets and microblades with or without secondary treatment, although not all attributes occur in equal representation for these debitage pieces/blanks already of technological importance.

Condition: complete and broken; proximal, medial, distal fragments, and longitudinally fragmented.

Dorsal scar pattern types: cortical, dorsal-plain, lateral, unidirectional, unidirectional-crossed, bidirectional, 3-directional, centripetal.

Most of these types were previously described by V.P. Chabai and Yu.E. Demidenko (1998:48) and only the following notions can be added. The *dorsal-plain scar pattern* is characterized by the completely flat surface of a previous removal from a core and lack of dorsal scars (Gladilin 1976:49). Technologically, pieces with a dorsal-plain scar pattern are associated with re-preparation processes of core flaking surfaces. The *unidirectional-crossed scar pattern* is also known as *orthogonal*, while the *3-directional scar pattern* is a simplified definition of the *bidirectional-crossed scar pattern*. The *cortical scar pattern* is only for pieces which have more than 75% dorsal cortex.

Surface cortex area and **location**. These attributes are used for all partially cortical pieces: less than 75% dorsal cortex, excluding wholly cortical and non-cortical items. On the basis of *overall cortex area,* all partially cortical pieces are divided into *items with a significant amount of cortex (*26-75% dorsal cortex) and *items with a non-significant amount of cortex* (less than 26% dorsal cortex). All partially cortical items are also described by *surface cortex location* on different areas of their dorsal surfaces: *proximal, distal, lateral, central* and all possible combinations, e.g. distal + lateral, etc.

The interrelationship of each dorsal scar pattern type with surface cortex area and location for partially cortical debitage pieces/blanks is important for the evaluation of the technological roles of flakes, blades, bladelets and microblades in decortification processes and regular reduction of core-like pieces.

Shape: parallel, converging, expanding, ovoid, irregular.

Parallel, converging and **expanding** shaped are also often called *rectangular, triangular and trapezoidal,* respectively. Strict evaluation of each shape for each debitage sub-category is of great importance for establishing their technological role and significance in general Upper Paleolithic parallel primary reduction processes.

Axis: "on-axis" and "off-axis" removal directions.

General profiles: flat, incurvate medial, incurvate distal, convex, twisted.

The interrelationship of *axis* and *general profile types,* as already noted for Siuren I bladelets *sensu lato*, is one of the most indicative ways for technological analysis of the value of each debitage sub-category in core processes and determining technological variability within the Upper Paleolithic as a whole or even within a single Upper Paleolithic technocomplex in a single selected region, e.g. Northern Levantine Aurignacian (Bergman 1987; Ohnuma & Bergman 1990). For Siuren I, with its Aurignacian of Krems-Dufour type industry complexes, this is one of the main technological keys for understanding the different morphological features and primary reduction methods characteristic for bladelet and microblade production in Units H-G and F.

Profiles at distal end: feathering, hinged, overpassed, blunt.

Feathering and *blunt types* are considered as indicating regular and successful reduction of debitage pieces, while *hinged* and *overpassed types* are most likely evidence of technological mistakes and unsuccessfully detached debitage pieces. In general, *profiles at distal end* are also called *distal terminations*.

Profiles at midpoint: flat, triangular, trapezoidal, multifaceted, lateral steep, crescent, irregular.

Among these seven profiles at midpoint, *trapezoidal* and *multifaceted* ones are the main indicators of intensive Upper Paleolithic parallel primary reduction and their indices will be calculated together.

Butt types: cortical, plain, punctiform, linear, dihedral, crudely-faceted, finely-faceted, crushed.

There are some difficulties in exact identification of *plain, punctiform* and *linear* butts because, generally speaking, they all are variants of the *plain* butt type but with different dimensions that leads either to their common identification as *plain* butts (e.g. Ohnuma & Bergman 1990) or sometimes to misunderstandings of the criteria for their separation. It is proposed here to use the following metric dimensions for identification of these three butt types. *Punctiform butts* are those for which butt width and height (thickness) is no more than 1 mm each. *Linear butts* have a butt height (thickness) no more than 1 mm and butt width more than 1 mm with no definite length limits, although this almost never exceeds 1.0 cm. *Plain butts* are all plain butt variants with a butt width and height (thickness) of at least 2 mm each and typically more, such that their dimensions exclude punctiform or linear butt classification. At the same time, the "*plain-punctiform-linear*" butt types group is also calculated for their common statistical value, an important indicator of general application of the "true Upper Paleolithic marginal soft hammer flaking mode" for each of the debitage pieces/blanks sub-categories, although some interesting proportional differences for the occurrence of each of these butt types are shown for flakes, blades, bladelets and microblades. *Cortical butts* are usually associated with wholly cortical and partially cortical pieces, while all *faceted* (including *dihedral* type) butts are also separately counted.

Lipping: lipped, semi-lipped, not lipped.

Butt angles: right, semi-acute, acute.

Butt abrasion: present and absent.

These three attributes seem to be the most important ones for evaluation of "true Upper Paleolithic marginal soft hammer flaking mode" and for identification of retouch flakes and chips from secondary treatment processes for Middle and Upper Paleolithic indicative tool types as well. Association of mostly semi-lipped butts with semi-acute angle and abrasion is most typical for this Upper Paleolithic flaking mode, while retouch flakes and chips usually have lipped butts with acute angle and abrasion. Unlipped butts with right angle and no abrasion are mainly characteristic of debitage pieces/blanks detached during core preparation and re-preparation processes. Thus, such strict morphological subdivision of all debitage pieces/blanks butts is of the great technological importance.

Some specialists (e.g. Ohnuma 1988; Ohnuma & Bergman 1990) add a special attribute, or, more appropriately, indicator: "*flaking mode- hard or soft*", but as it seems that strict objective morphological criteria have not yet been determined for such identification for debitage pieces/blanks (see Girya 1997:70), we therefore consider that butt lipping, angle and abrasion data is generally enough for a basic understanding of hard/soft hammer flaking modes used in each Paleolithic complex. The *presence/absence of percussion point on a butt's edge* (Drobniewicz *et al.* 1992:394-396) may also help for such studies, but was not used for artifact analysis at Siuren I.

Debitage piece/blank measurements. Identification of *overall size* (*length, width, thickness*) and *butt width* and *height* (*thickness*) through the measurement principles used by V.P. Chabai & Yu.E. Demidenko (1998:50) for analyses of Crimean Middle Paleolithic artifacts.

Raw material types

Most lithic artifacts from the 1990s excavations, as well as the late 19th century and the 1920s excavations, were made on different kinds of flint, with only a small number of other lithic artifacts made on different kinds of limestone.

The following *flint types* are distinguished there: *black, gray, color* and *brown* ones.

The source of *black flints* is known in the immediate vicinity of the site, about 1 km to the east in the small and narrow Zmeinaya ("Snake") Valley (Vekilova 1957:259 and personal observations during the 1990s investigations). A large number of small nodules of this coarse-grained, speckled black flint occurs in limestone deposits. This black flint should be considered as local for the Paleolithic inhabitants of Siuren I, although because of its definitely poor knapping quality, its use during each human occupation of the site was quite limited. It is worth noting that such small poor-quality black flint nodules were only rarely used by Crimean Paleolithic human groups. For example, its presence for debitage and tools from levels 1 and 3 at Starosele, another Western Crimean, but exclusively Middle Paleolithic site, was only between 2.7 and 7.7% (Marks & Monigal 1998:125) and here these nodules were not even a hundred meters away from the site.

Gray flints varying from light to dark shades are fine-grained with good knapping quality. Fresh, unweathered cortex on most of these gray flints show that they were either actually quarried from some deposits or, more likely, were collected in front of actively eroding sources. On the other hand, some of these gray flints have a weathered, smooth cortex indicative of a gravel/alluvial sources. E.A. Vekilova (1957:259) suggested that the most probable sources of these gray flints are in "*Kacha valley near the road from Bashtanovka village*" further to the east, about 7-10 km from Siuren I as the crow flies. At the same time, it should be kept in mind that there were no flint sources were found in Kacha Valley during survey in the 1980s (V.P. Chabai, pers. comm.). Again it is useful to refer to Starosele, as these gray flints are the main ones for lithic artifacts there and their original outcrops unknown (Marks & Monigal 1998:125), and, at the same time, the location of this Middle Paleolithic site is only ca. 13 km from Siuren I. Taking all of this into consideration, as well as the dominance of artifacts made on gray flints in each archaeological level at Siuren I, we would assume that the source(s) of the gray flints sources are not very far from the site and that these gray flints were easily available for the rockshelter's Paleolithic inhabitants.

Colored flints are a translucent rose-ochre shade, fine-grained with fresh, unweathered cortex. Knapping quality of these colored flints is considered the best among all the range of flint types at the site, but their provenance is still unknown despite surveys undertaken for their identification in the 1950s (Vekilova 1957:259). These colored flints are thus considered to be meso-local for the Siuren I Paleolithic inhabitants. These colored flints were used quite often in flint treatment processes in the 1990s Units H and G and the 1920s excavations *Lower* layer, but very rarely occur in the 1990s Unit F and the 1920s excavations *Middle* layer, and, finally, they are entirely absent in the site's Upper cultural bearing deposits. Interestingly, these colored flints is also that they have never been identified in any Crimean Paleolithic sites except for Siuren I and are thus a kind of "enigmatic flint" for the Crimean Paleolithic.

Brown flints are of fine-grained type with dark shades and fresh, unweathered cortex. This is a new flint type defined after the 1990s excavations; however, there are very few artifacts and its source is also unknown.

The varying occurrence of these four flint types through the Siuren I archaeological sequence will be discussed in detail for the 1990s excavations, for artifact categories, sub-categories, groups and types in each level and unit.

Various *limestones* are almost exclusively characteristic for the site's *non-flint tools*. Most limestone pebbles were highly likely collected from gravels/alluvial deposits in the nearby Belbek River.

Concluding remarks

The classification and attribute analysis system applied to the Siuren I lithic artifacts is evidently very detailed, for which its application allows us to make an overall techno-typological description and to understand the industries. On the other hand, many European Upper Paleolithic complexes compared to the Siuren I Upper Paleolithic assemblages have not been classified in such detail, but many of their techno-typological features could be recognized and used for such comparisons. We are not afraid of very detailed descriptions for Upper Paleolithic complexes and through time, we hope that more information will be necessary for understanding of Upper Paleolithic artifacts, the basis of which is their description.