Préhistoire d'Anatolie, Genèse de deux mondes, Liège, ERAUL 85, 1998, pp. 579-598.

MIDDLE PLEISTOCENE HOMINIDS AND BEARS AT YARIMBURGAZ CAVE (THRACE, TURKEY)

Steven L. Kuhn, Mary C. Stiner, and F. Clark Howell

INTRODUCTION

Yarımburgaz Cave is located in Thrace (western or European Turkey), a short distance west of the modern city Istanbul. A joint Turkish-American project, directed by Prof. Güven Arsebük (Istanbul University) and Prof. F.C. Howell (University of California, Berkeley), conducted extensive investigations of *in situ* Middle Pleistocene deposits within the cave, producing large samples of Paleolithic artifacts and animal bones from a stratified context. Their probable Middle Pleistocene age places these faunal and lithic assemblages among the oldest documented archaeological remains from Turkey.

GEOLOGICAL AND ARCHAEOLOGICAL BACKGROUND

Yarımburgaz Cave is situated near the northern shore of the Marmara sea, not far from the Istanbul airport (Fig. 1). The cave is cut into a limestone ridge forming one edge of the Sazlıdere valley, which empties into a small lagoon and eventually into the Marmara. For most of its length the cave is a narrow, debris-choked gallery, but at its southern end it widens into two broad, vaulted alcoves up to 14 m high (Fig. 2), which were the primary loci of hominid (and animal) activities. The archaeological potential of Yarımburgaz has been known for decades, and excavations have been carried out in the more recent (Chalcolithic and historic) layers since the 1950s (Kansu 1972; Özdoğan 1985). Between 1988 and 1990, Arsebük and Howell conducted three seasons of excavations in the western or "lower" chamber (Arsebük *et al.* 1991; Howell *et al.* 1990). A total of nine trenches or blocks, amounting to just over 130 square meters, were excavated. The eastern or "upper" chamber at Yarımburgaz also contains Paleolithic deposits, but these have been extensively reworked by post-Pleistocene inhabitants of the cave. In contrast, recent activities have had much less destructive impact on deposits in the lower chamber. The majority of the lower chamber sequence -- which extends to a depth of 5 m or more -- appears to date to the Middle Pleistocene. Fig. 2 is a map of excavations within in the lower chamber.

Based on findings from the 1988-1990 excavations, sediments in the lower chamber at Yarımburgaz Cave have been divided into three main sedimentary cycles (Fig. 3) (Farrand 1994; Farrand and McMahon 1997). **Cycle 1** (layers R and S) consists of stratified sands, gravels, and

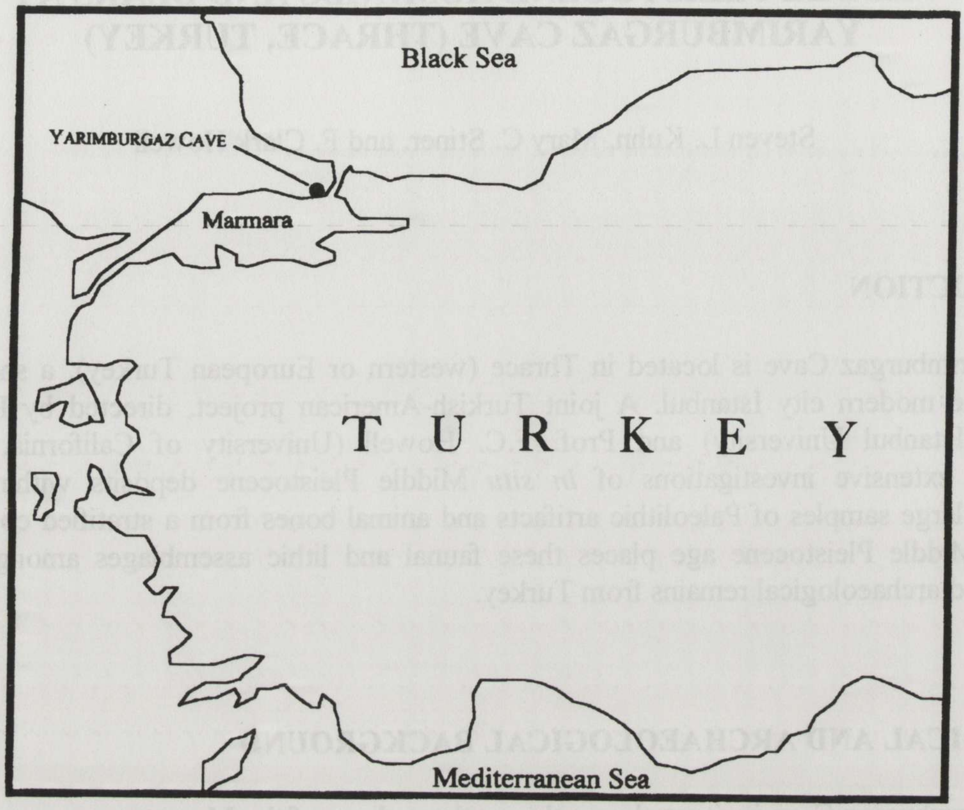

Fig. 1. location of Yarımburgaz Cave.

pebbles probably deposited by a stream flowing outward towards the present cave mouth. Flint, quartz and quartzite pebbles occur naturally within these layers. Sediments grade to silt near top of the cycle, suggesting that the rate of water flow had decreased significantly by the end of this interval. **Cycle 2** (consisting of layers T, U, and V) sits atop an erosional unconformity with Cycle 1. The deposits making up Cycle 2 consist primarily of dark clay loams also containing occasional flint, quartz and quartzite pebbles. The uppermost sediment (layer V), a dark reddish brown loam, is vertically fissured, suggesting a marked drying out of the cave: layer V also contains many large bones and some artifacts. **Cycle 3** (layers W, X and Y) differs radically from underlying sediments. The layers making up Cycle 3 contain quantities of angular limestone with relatively little fine-grained sediment between the large stones. These materials were not deposited by water, which had long since ceased flowing through the cave. Instead, the large blocks spalled off the cave roof, possibly as a result of seismic activity. The densest concentrations of Pleistocene fauna and Paleolithic artifacts occur in layers W and X within this third sedimentary cycle. Stratum Z, at the top of Cycle 3, contains the more recent Pleistocene and Holocene deposits.

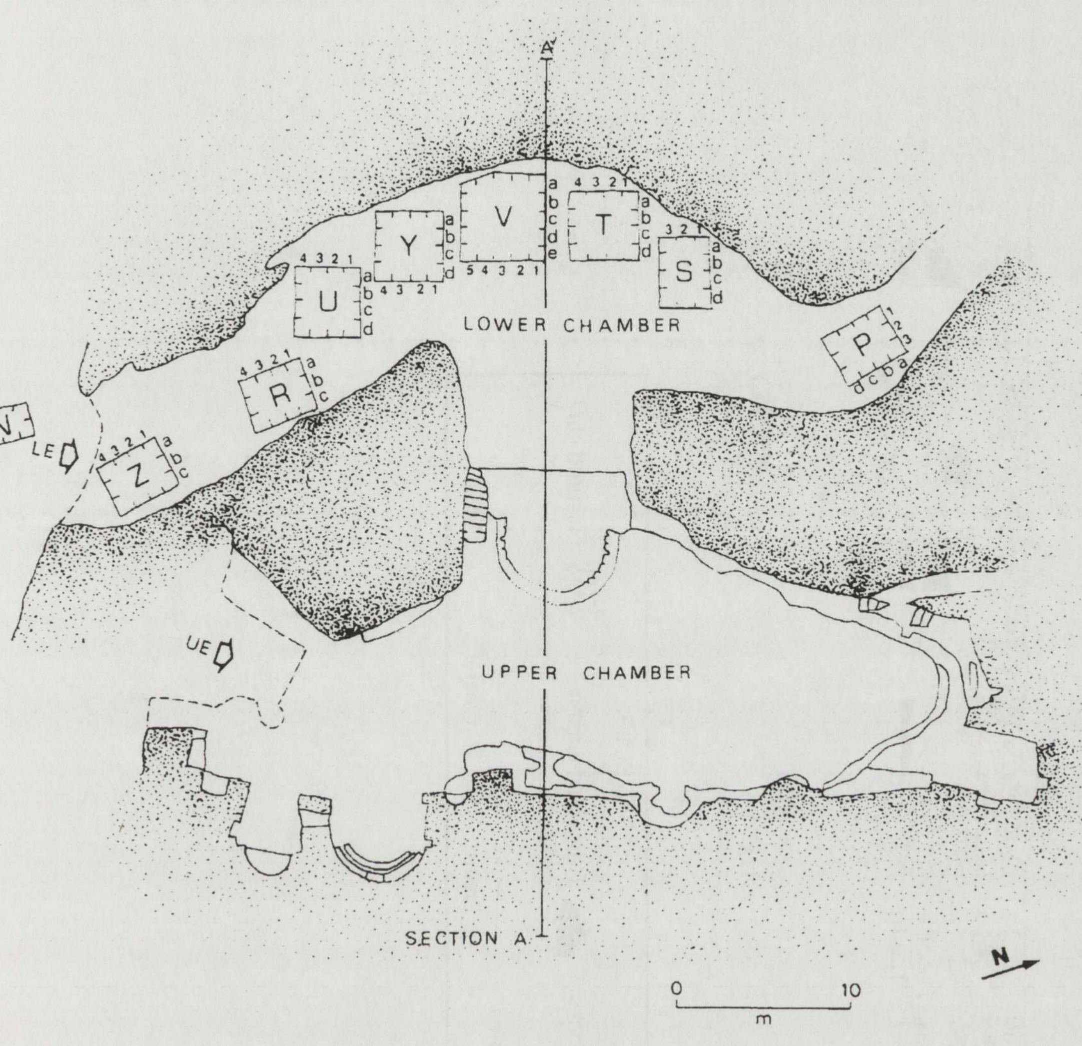

Fig. 2. Map of Yarımburgaz Cave, showing location of excavation trenches.

Establishing absolute dates for the Pleistocene archaeological levels in Yarımburgaz cave has proven difficult. A series of ESR (Electron Spin Resonance) dates on bear teeth range from Oxygen Isotope stage 6 back through stage 9 (Blackwell *et al.* 1990). However, cave bear teeth do not posses the convoluted enamel surfaces best suited for ESR dating, and these dates must be considered with caution. Paleontological assessments of cave bears are consistent with some of the ESR dates, in that they suggest that the site should be assigned to the latter half of the Middle Pleistocene (Stiner *et al.* 1998).

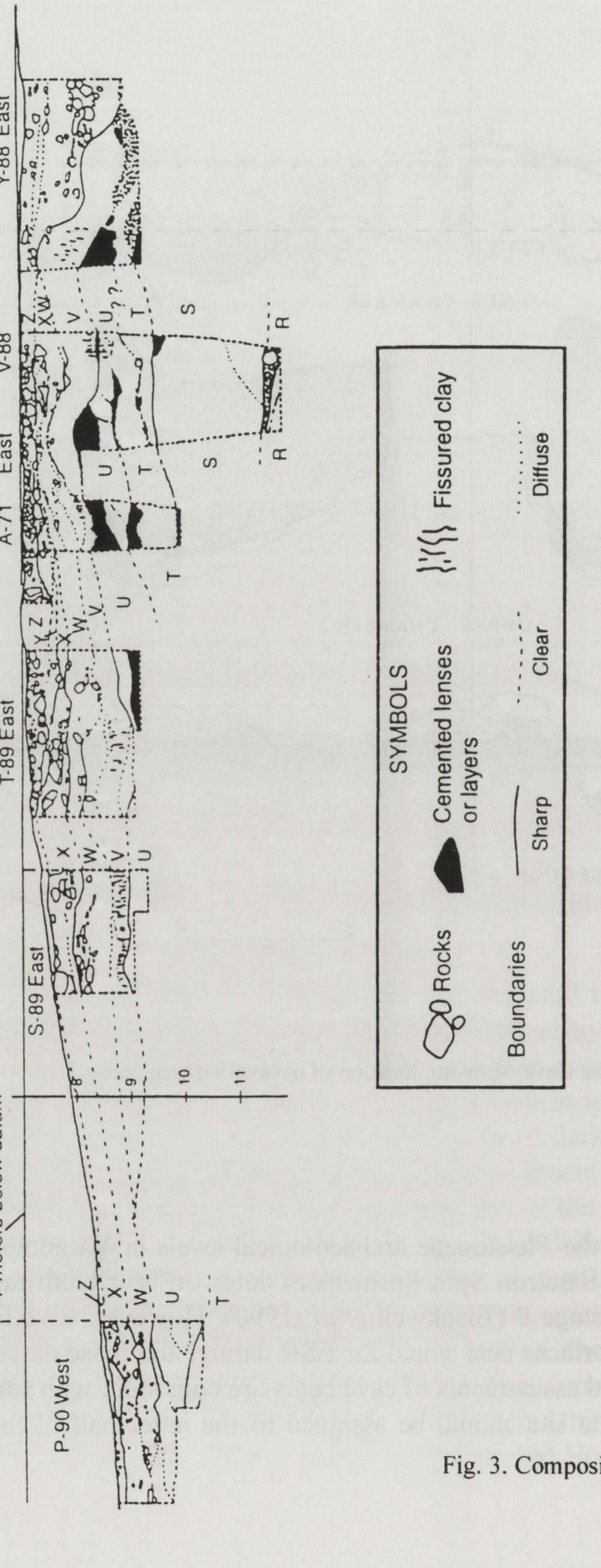

Fig. 3. Composite stratigraphic profile.

Taxon	bone NISP	tooth NISP	total NISP
indet. small mammal [a]	9	---	9
indet. medium mammal [b]	5	---	5
indet. large mammal [c]	548	---	548
Equus	8	1	9
Capreolus	9	4	13
Dama	4	9	13
Cervus	23	6	29
Megaloceros	2	---	2
indet. cervid	23	13	36
Bos/Bison	3	2	5
Sus	3	1	4
Capra	1	4	5
indet. small ungulate	2	---	2
indet. medium ungulate	3	---	3
indet. large ungulate	17	---	17
Hippopotamus	---	2	2
indet. megfauna	6	---	6
Crocuta	---	2	2
Felis	10	3	13
Canis/Cuon	17	8	25
Vulpes	3	7	10
Panthera	26	4	30
Ursus	2611	761	3372
Mustella	1	3	4
indet. carnivore	6	3	9

[a] mostly other carnivores.
[b] mostly ungulates.
[c] mostly bears.

Table 1. Frequencies of bone and tooth elements, by taxonomic group.

from the cave. Choppers and chopping tools comprise only 10.6% of the modified tools. Neither Levallois flakes nor typical biface-thinning flakes are present in the Yarımburgaz assemblage.

Consistent with the high frequency of retouched artifacts, many flake tools have been extensively modified. Edges tend to be quite steep, and the mean angle of retouch is approximately 70° for all types of flake tool and raw materials. Retouch scars are often invasive. Flake tools with multiple retouched edges are also relatively common, accounting for nearly 24% of all modified pieces. Many retouched edges appear to have been resharpened or reshaped at least once.

Denticulate tools, and irregular or denticulate edges in general, are somewhat more common than sidescrapers with regular retouched edges. The bec/perçoir group (Fig. 4: 3) -- artifacts with pointed edges formed either by the intersection of two retouched margins, or by the intersection of a retouched margin with a fracture or steep natural flake margin -- are considerably less abundant than denticulates and scrapers (Table 4). Even these very simple typological distinctions seem somewhat arbitrary when applied to the Yarımburgaz materials. The differences between "scraper" and "denticulate" edges are not always clear, as there seems to be a continuous range of variation in edge profiles from deeply notched or serrated to regular and evenly retouched (e.g., Fig. 4: 1,2,4,11,13). Denticulates, notches and becs/perçoirs also seem to grade into one another. A tool with a single retouched concavity may be classed as a notch if the modified area is located near the center of a flake margin, but may resemble a bec/perçoir if the notch is adjacent to a fracture or steep natural edge. Similarly an artifact with two or more adjacent notches might be called a notch, denticulate, or bec/perçoir, depending on the breadth, depth, and location of the concavities.

	Flint	**Quartz**	**Quartzite**	**Other**	**Total**
Cores	60	41	35	3	139
Core tools	10	5	48	1	64
Flake tools	398	94	40	6	538
Whole flakes	147	22	32	12	213
Broken flakes	111	16	20	6	153
Debris	373	119	62	14	568
Total	1099	297	237	42	1675

Table 3. Basic assemblage composition.

	Flint	Quartz	Quartzite	Other	N	Percent
Sidescraper	83	30	7	1	121	22.5%
Denticulate	162	17	11	4	194	36.1%
Notch	38	6	6	0	50	9.3%
Bec/Perçoir	26	15	1	0	42	7.8%
Burin	2	1	0	0	3	0.6%
Combination	25	5	2	0	32	6.0%
Rabot	2	1	4	0	7	1.3%
Partially ret'd	60	19	9	1	89	16.5%
Total retouched	398	94	40	6	538	100.1%

Table 4. Artifact Type Frequencies, retouched flake tools.

A wide variety of core forms were recovered at Yarımburgaz (Table 5, Fig. 5). The largest single category is that of "tested pebbles", natural cobbles with between one and three removals. The most abundant formal cores are centripetally-worked or discoid specimens (Fig. 5: 3-5). The discoid cores tend to have relatively flat faces of detachment, and the majority have been worked on one face only. Platforms may be either plain or cortical. Few of the cores preserves any traces of platform faceting. Other, less abundant forms include globular cores (Fig. 5: 6,7), informal cores with one or two platforms, bipolar (splintered) cores, and amorphous pieces. Some of the cores are generally polyhedral in form (e.g., Fig. 5: 6), but there are no typical spheroids in the Yarımburgaz assemblage.

THE FAUNAL EVIDENCE

The Pleistocene layers at Yarımburgaz have yielded a large and diverse fauna, for the most part in an excellent state of preservation. At least 18 genera of large terrestrial vertebrates are represented, including both typical European and Asian taxa (Table 1). Despite its diversity, the fauna is dominated by the remains of a single species, the early cave bear, *Ursus deningeri*, which accounts for about 93% of the identified specimens. Bones of other large carnivores comprise about 3% of the sample, and remains of ungulates make up the remaining 4%. By and large, the faunal remains are in an excellent state of preservation. A nearly full range of anatomical parts is represented but not for other species. There are no traces of hominid-caused damage on the bear bones, and fewer than 1% of ungulate bones have possible cut marks on them. On the other hand, many of the bones are gnawed, especially the remains of ungulates and large carnivores other than bears (Table 2) (Stiner *et al.* 1996).

The fauna of Yarımburgaz has a complex taphonomic history. The cave appears to have served as a hibernation site for generations of cave bears. The age structure, skeletal representation and damage patterns of the remains of *Ursus deningeri* are entirely consistent with natural *in situ* mortality during hibernation (Stiner 1998; Stiner *et al.* 1996, 1998). Gnaw marks on bear bones show that wolves and/or hyaenas, and sometimes other bears fed on some carcasses, probably discovered after hibernation-related deaths. The non-ursid carnivores also appear to have sometimes denned in the cave, and in the process they accumulated (and gnawed) small quantities of ungulate bone. The role of hominids in producing the Yarımburgaz fauna is less clear. Hominids were probably responsible for accumulating and processing of some of the ungulate remains. However, the scarcity of cut marks and other hominid-caused damage in comparison with the frequency of carnivore damage indicate that humans had relatively little to do with collecting these bones overall.

	Ungulates	Bears	Other carnivores
Total bone NISP	117	3129	67
Gnawed by carnivores	23%	10%	18%
Gnawed by rodents	6%	11%	1%

Table 2. Frequency of gnawing damage on bones.

STONE TOOL TYPOLOGY AND TECHNOLOGY

The majority of lithic artifacts from the lower chamber are from layers W, X, and to a lesser extent Y. In some trenches, stone tools were also recovered from the upper part of sedimentary cycle 2 (layer V). It is possible that the materials recovered from layer V represent an earlier phase of human occupation. For the most part, however, lithic assemblages from the various layers are statistically identical with respect to typology, technology and raw material. At present, it seems most likely that artifacts were introduced into strata V and Y through reworking of the sediments by digging bears or as a result of falling into fissures in drying sediments. As a consequence, the entire lithic assemblage from the lower chamber is treated as a single entity in the following discussions.

Three principal raw materials were used in the manufacture of artifacts at Yarımburgaz. In order of abundance, these are flint, quartz, and quartzite. A few artifacts of jasper, silicified wood, and unidentified metamorphic rocks are also present. The flint appears to be of high quality, with variable grain size and texture: many specimens are fossiliferous. It is possible that more than one type of flint is present, but more precise assessment of macroscopic properties is impossible due to the heavy, opaque white patination. The quartz used by Yarımburgaz toolmakers is a semi-translucent, milky-white crystalline variety. It shows a marked tendency towards angular cleavage rather than conchoidal fracture. The most common variety of quartzite is relatively coarse grained, but it is also well indurated and quite homogeneous. It appears that quartzite pebbles were larger on average than pebbles of the other two common raw materials. All raw materials appear to have been derived from heavily rolled stream cobbles. Unworked quartz, quartzite, and chert or flint pebbles are found in the deposits underlying the archaeological strata within the cave (sedimentary Cycles 1 and 2), and it is likely that all raw materials present could have been obtained within a few kilometers of the site.

The lithic artifacts from Yarımburgaz appear comparatively fresh. Tool edges are sharp and show no evidence of either water transport or *in situ* abrasion by water-borne sediments. Although there has been little mechanical modification of the lithics, many flint specimens have been chemically altered. More than 95% of the flint artifacts are heavily patinated, and a great many are almost completely desilicified.

Assemblage composition and typology

Retouched flake tools are the dominant elements in the lithic assemblage from the lower chamber of Yarımburgaz Cave. A notable feature of the assemblage is the high frequency of intentionally modified or utilized pieces. Modified flake tools far outnumber unbroken, unretouched flakes, and modified tools of all sorts comprise about one-third of the total assemblage (Table 3). Even though all sediments were sieved, quantities of small flaking debris are relatively limited, possibly indicating that much primary stone flaking was done outside of or away

Core Form	Flint	Quartz	Quartzite	Other	Total
Tested (1-3 scars)	4	7	32	3	46
Centripetal	37	3	3	0	43
1-2 Platforms	5	7	0	0	12
Globular	6	5	0	0	11
Bipolar	0	8	0	1	9
Amorphous	7	11	0	0	18
Total	59	41	35	4	139

Table 5. Core Forms.

Technology and raw material

One of the most striking aspects of the Yarımburgaz assemblage is the differential treatment of the three main raw materials. Prehistoric toolmakers at Yarımburgaz cave employed a variety of methods to manufacture flakes and tool blanks, and distinct if overlapping ranges of technological procedures were applied to flint, quartz, and quartzite. The technological features of the assemblage have been described in detail elsewhere (Kuhn *et al.* 1996), and will only be summarized here.

Overall, **quartzite** appears to have been the least commonly used and least intensively exploited raw material. The working of quartzite often resulted in the production of cores or "core tools" that would be classified as unifacial choppers. Fully 75% of the "core tools" from the site are made of quartzite, even though this material only accounts for about 14% of the total lithic assemblage (Table 3). Most quartzite flakes also have forms typical of byproducts from chopper manufacture --cortical platforms, few dorsal scars, much dorsal cortex. The quartzite choppers from Yarımburgaz have quite regular, fairly sharp edges, and would have worked well as heavy-duty cutting tools. On the other hand, they obviously served as sources of flake tools as well. Flakes of quartzite were not retouched as often as those made of either flint or quartz (Table 3), but if unretouched flakes showing macroscopic use-damage are considered, flakes of all three materials appear to have been *utilized* with about the same frequency.

Quartz was most frequently employed for the manufacture of flake tools: quartz flakes show evidence of retouch nearly as frequently as do flakes of flint. The forms of quartz cores and flakes are highly varied. However, a large proportion of quartz flakes and blanks seem to have been derived from bipolar, hammer-and-anvil percussion. The broad range of core forms and flake morphologies seen in the quartz artifacts from Yarımburgaz cave probably reflect the unpredictable fracture patterns of the raw material itself, the outcome of a series of decisions made by tool makers in response to unexpected fractures during reduction. Bipolar, hammer-and-anvil percussion has been a favored technique for working quartz pebbles in a variety of cultural contexts and time periods, including at Yarımburgaz. This technique may be especially appropriate for working quartz because it is less likely to be disrupted by the material's natural tendency to break along flat planes.

Like quartz, **flint** was frequently used for the manufacture of retouched flake tools (Table 3). The production of flint flakes and tool blanks was often achieved by means of a distinctive method of core preparation and flake detachment. Although flint cores exhibit a variety of forms, the majority (62.7%) show evidence of centripetal or multi-directional patterns of flake detachment. These centripetal cores seldom preserve evidence for platform preparation and the faces of detachment are either flat or only slightly convex (e.g., Fig. 5: 3,4). They are quite distinct from both discoid cores and the classic centripetal Levallois cores. In general form, many of the Yarımburgaz centripetal cores resemble what have been termed "unifacial discoids" (e.g., see Schick and Toth 1993:130). In keeping with the nature of the cores, flint flakes often exhibit an unusual combination of attributes combining cortical platforms with centripetal dorsal scar patterns (Fig 4:5-9). Basically, it appears that flakes were struck centripetally or obliquely from the cortical surfaces of large flint pebbles that had been split in half. Platforms were seldom prepared with even a single flake removal, except perhaps near the end of the reduction process (Kuhn *et al.* 1996: Fig. 10).

DISCUSSION

Due to the predominance of heavily retouched flake tools with steep, irregular, denticulate edges, the presence of well-made choppers and chopping tools, and the absence of both true bifaces and Levallois technology, the industry from Yarımburgaz cave most closely resembles the "Tayacian" and related assemblages from southern Europe (Rolland 1985; de Lumley 1976a, 1976b), or the chopper and small tool industries of eastern and central Europe (e.g., Svoboda 1987, 1989). Similar Middle Pleistocene industries composed mainly of flake tools and choppers have also been found in central Asia (Davis *et al.* 1980; Ranov *et al.* 1995). Thus, the closest affiliations of the Yarımburgaz assemblage would seem to be with eastern Europe and/or central Asia, rather than with south-central Anatolia or the Levant, where more classic Acheulean assemblages predominate (Bar-Yosef 1990; Bostancı 1961; Minzoni-Deroche and Sanlaville 1988; Yalçınkaya 1981). It is interesting that Karain Cave on the southwest Anatolian coast, the only other recently-excavated Lower Paleolithic cave site in western Turkey, also contains a Tayacian-or Clactonian-like Lower Paleolithic industry (Otte *et al.* 1995;Yalçınkaya *et al.* 1993). However, it would be premature to draw any definitive conclusions about the regional distribution of biface and non-biface industries in Turkey based on these two sites. The presence of flake tool assemblages and the scarcity of bifaces could be tied in part to the fact that both Yarımburgaz and Karain are deep caves, a type of locality which does not commonly yield abundant Acheulean materials.

We should also be cautious in interpreting the apparent similarities between the assemblage from Yarımburgaz cave and other Middle Pleistocene core and flake tool industries. Prehistorians' perceptions of the uniformity of the chopper and flake tool industries may reflect very limited exploration of variation within this group. Such assemblages are more often described in terms of what they lack -- bifaces and Levallois -- than in terms of their own distinctive features (Rolland 1985:144; Villa 1983:237-238). Extensive comparisons of flake production technologies or *chaînes opératoires* may reveal more profound contrasts among some assemblages, as well as closer similarities between others, than have been described to date. For example, the distinctive mode of flake production employed at Yarımburgaz cave to work flint cobbles finds parallels elsewhere. A similar method is represented at a number of Middle or late Lower Paleolithic localities in France, including sites on the terraces of the Tarn and Garonne rivers (Jaubert and Farizy 1995; Tavoso 1978). An apparently related technique, known as the Lahuti technique, has also been described for Middle Pleistocene sites in central Asia (Ranov *et al.* 1995).

The presence of such a large number of cave bear remains in close geological association with a substantial sample of stone artifacts naturally raises questions about potential interactions between *Ursus* and *Homo*, a topic that has excited much speculation in the past (summarized in Kurten 1976). At Yarımburgaz cave, the close association between artifacts and bear bones seems to represent a situation in which hominids had little direct behavioral and ecological interaction with bears. Yet the presence of both of these species of omnivore together in the same deposits may hold some clues as to the human use of the cave.

	bear remains	**other carnivores**	**ungulate remains**	**stone artifacts**
bear remains	---			
other carnivores	0.750	---		
ungulate remains	0.722	0.754	---	
stone artifacts	0.627	0.625	0.264*	---

Table 6. Pearson's correlation coefficients, major material classes across horizontal and vertical provenience units. All results statistically significant except starred values (df=15). Only units containing both artifacts and bear remains are included.

There is no compelling evidence that humans and bears occupied different parts of Yarımburgaz cave. Preliminary analyses reveal no major spatial separation between bear bones, stone artifacts, and other archaeological and paleontological finds. Densities of all classes of materials are highly correlated both horizontally and vertically (stratigraphically) (Table 6). Yet at the same time, there is virtually no evidence for human modification of bear bones at Yarımburgaz. Thus, while humans and bears seem to have utilized the same parts of the cave during approximately the same prolonged intervals of geological time, one cannot easily argue that humans either preyed upon bears or scavenged their carcasses. The procurement and processing of herbivores was apparently also not a major component of the hominid occupation of Yarımburgaz cave. Herbivore remains are scarce overall, and only a handful preserve traces of cutmarks or percussion damage: many more were gnawed by non-human carnivores. Moreover, herbivore remains show a very weak spatial association with stone tools (Table 6). In combination with the high frequency of gnaw damage, these observations suggest that the most of the remains of herbivores in Yarımburgaz should probably attributed to predators other than humans (several potential culprits are represented in the faunal assemblage).

The association between a large assemblage of stone tools and the remains of a large number of bears may at least provide clues as to the scale of human occupation at Yarımburgaz. Modern bears are also quite selective about denning locations, and they tend to shy away from places where there are obvious traces of other predatory species (see Stiner 1994:80; Stiner *et al.* 1996 and references therein). Since hibernating bears are unlikely to remain in or return to a location heavily frequented by humans, it is reasonable to infer that hominids used the cave when bears would not have been present. Since rotting food may attract other carnivores dangerous to hibernating bears, they prefer relatively clean, debris-free dens with no evidence of recent disturbance. Thus, not only must hominids have been present when bears were not hibernating, but their activities in the site must not have resulted in the presence of large quantities of food debris and other organic waste, at least when bears were using the cave. It is noteworthy that neither hearths nor constructed features were identified during the excavation, and that few if any artifacts show evidence of burning. The absence of evidence of fire and the scarcity remains of bones of likely prey are consistent with the idea that visits by Middle Pleistocene humans to the cave were relatively brief or ephemeral. Whether hominids and bears used the cave in different seasons, or whether there were brief, alternating periods of frequentation by one species or the other remains unclear. While hominids and bears did occupy the cave during the same interval of geologic time, the archaeological record does not provide resolution at the scale of a few years, much less a single season. However, archaeological patterns do suggest rather different patterns of coexistence between humans and other carnivores than is typical of later time periods (see also Brugal and Jaubert 1991; Gamble 1986; Stiner 1993).

Despite the fact that hominids may not have used Yarımburgaz cave intensively or for prolonged periods, the lithic assemblage is substantial. It also contains a high proportion of retouched and/or utilized pieces made from local raw materials, showing that there were at least some episodes of intensive manufacture and use of stone tools. Moreover, many artifacts appear to have been employed in tasks that required robust edges and that probably entailed some resharpening. Whatever these tasks were, they did not entail the accumulation of large quantities of animal bone. It is possible that the stone tools were used to process some other type of subsistence resource, but the artifacts present-- mostly flake tools with steep, irregular edges -- are more likely to have been used in the modification of other raw materials such as wood.

Based on a combination of negative and positive evidence, we can infer that the Middle Pleistocene hominid "occupation" consisted of a series of short, even ephemeral stays, possibly during the warm seasons of the year when hibernating bears would not have been present. Neither hunting nor scavenging of medium to large sized ungulates were major components of the activities pursued by hominids within Yarımburgaz. To the extent that they occurred at all, subsistence activities may have been focused on resources such as vegetable foods and perhaps resources from the nearby littoral zone (although no shell or fish bone was recovered from the cave). The stone tools could have been used to process these resources directly, but it is more likely that they were used in activities only indirectly related to subsistence pursuits. As incomplete as it is, the perspective on Middle Pleistocene adaptations provided by Yarımburgaz cave is an unusual one. The kinds of activities implied by the particular configuration of archaeological evidence at this site are likely to be hidden "beneath" more obvious evidence of predation at sites where bones of ungulate prey are more abundant. This case also highlights the importance of detailed taphonomic analyses of the faunal remains found with artifacts, since an interpretation based simply on spatial association would have resulted in a very different picture of past human activities.

ACKNOWLEDGMENTS

Prof. Guven Arsebuk (University of Istanbul) was the major driving force behind the excavations at Yarımburgaz cave, and the research reported here would not have been possible without his efforts. We are also grateful to Mihriban Özbaşaran for her enormous contributions to the excavation and study of Yarımburgaz. Prof. M. Özdoğan has always been generous in sharing his vast knowledge of the prehistoric archaeology of Turkey, and of Yarımburgaz in particular. Funds for the analysis of the stone tools were provided by a grant from the Wenner-Gren Foundation for Anthropological Research (to FCH). Our presence in Istanbul was greatly facilitated by the American Research Institute in Turkey (ARIT), and especially Dr. Anthony Greenwood (director). All illustrations of archaeological finds are the work of Ms. Judith Ogden.

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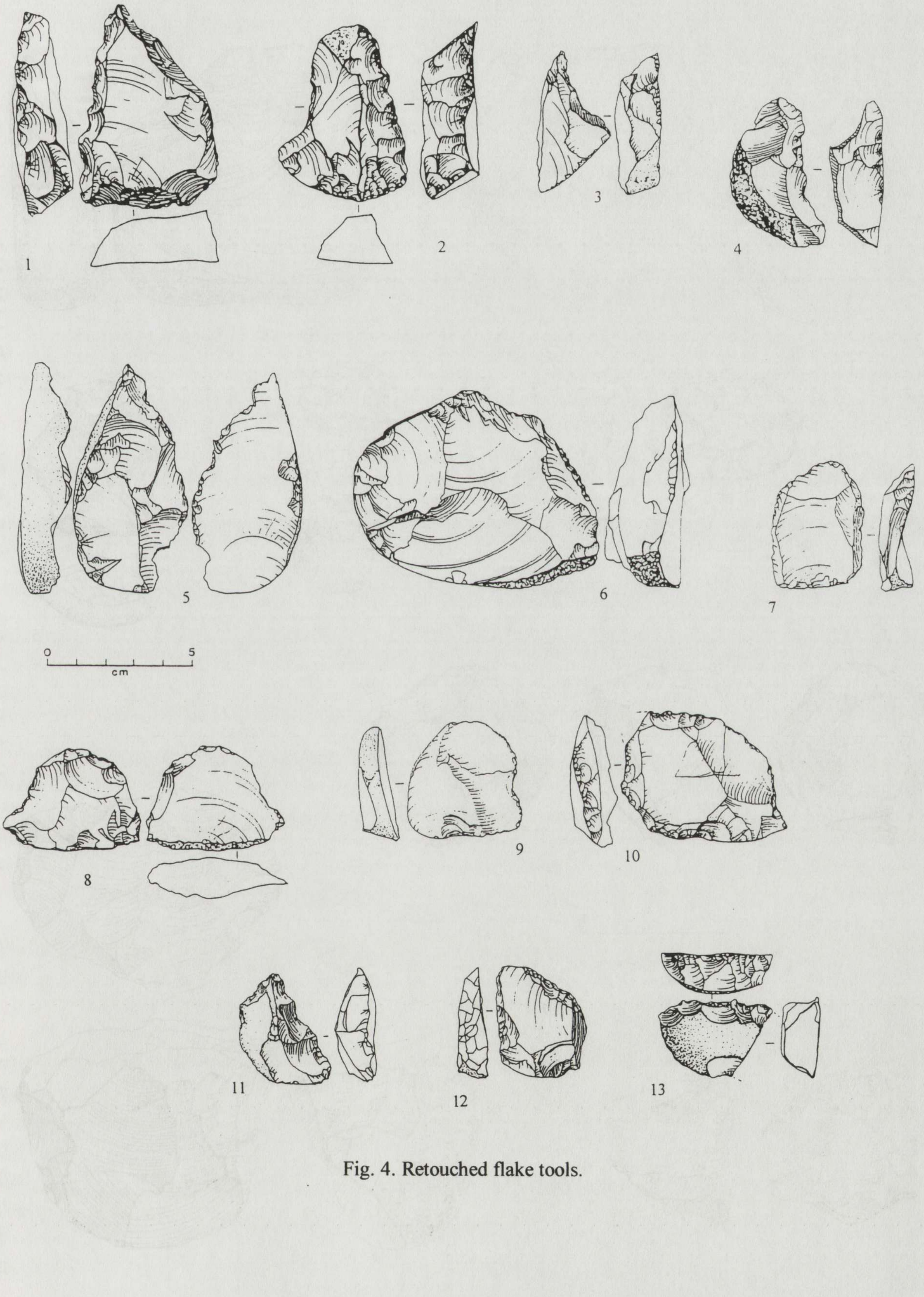

Fig. 4. Retouched flake tools.

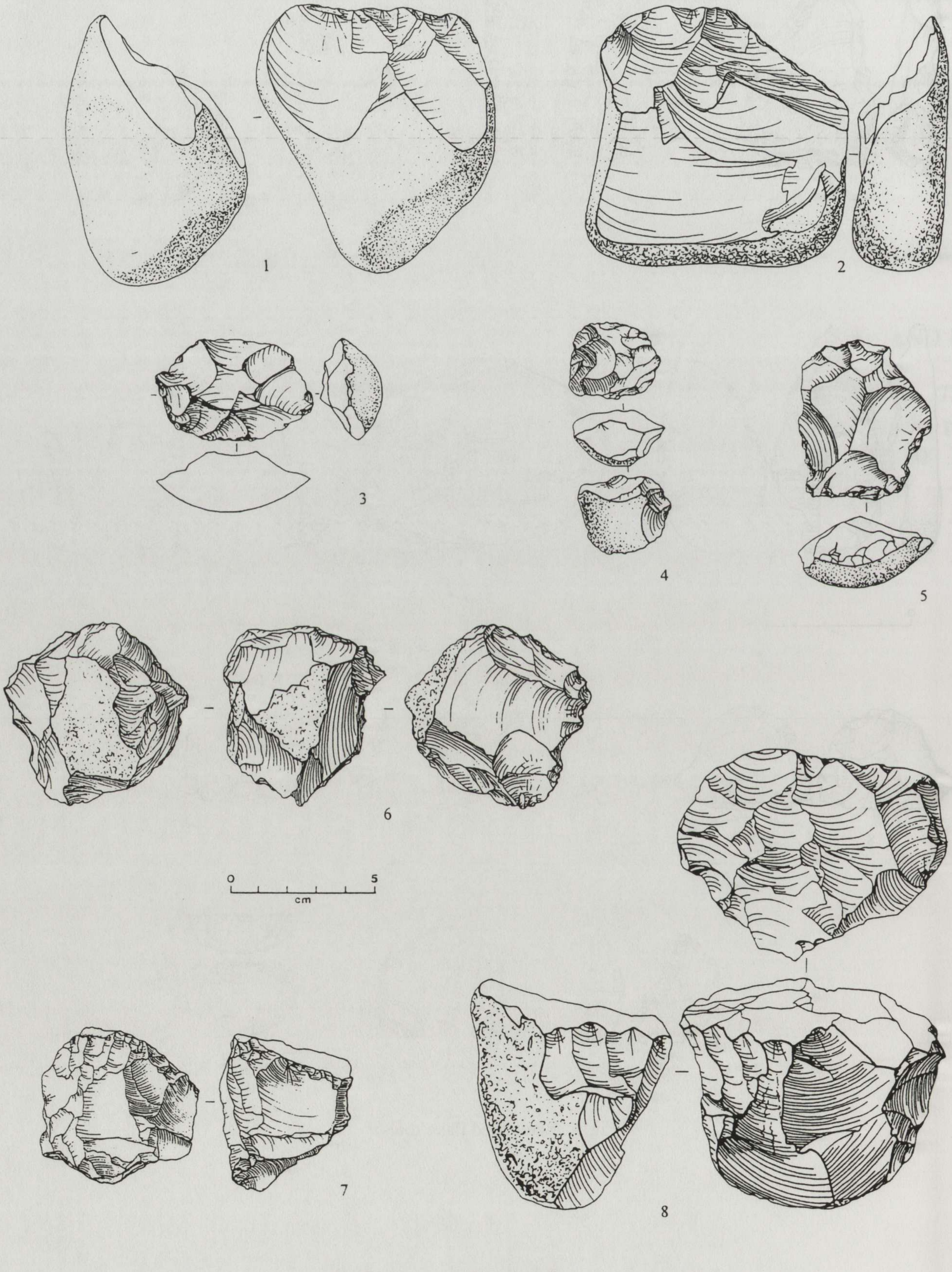

Fig. 5 Cores and core tools.