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INTERNATIONAL SYMPOSIUM "EARLY HUMAN HABITATION OF CENTRAL, NORTHERN, AND EASTERN ASIA: ARCHAEOLOGICAL AND PALEOECOLOGICAL ASPECTS"

The latest available archaeological, anthropological and genetic evidence suggests that Africa is the motherland of humankind. The most ancient human sites with stone tools of the Oldowan type dating from 2.6 to 2.0 Ma are located mostly in the area of the East African Rift. Around 2 Ma ago, early hominids crossed the boundaries of Africa and colonized a considerable portion of Eurasia. The earliest human populations of the first migration wave seem to have moved along two major routes: via the Near East to Southern Europe, including the Mediterranean Sea and the Caucasus Mountains, and via Western Asia toward the east. The eastern route is likely to have had two main branches: along the southern slopes of the Himalayas and Tibet across the Indian Subcontinent to Eastern and Southeastern Asia, and via the Middle Eastern plateaus to central and northern regions of Asia and the Far East.

Paleolithic studies in the areas situated in the border zones of large geographical regions are especially important for reconstructing migration routes of early hominids. The Altai Mountains are situated along the presumed northern migration route in the area bordering Central and Northern Asia. Archaeological teams of the Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of Sciences, have been carrying out research on all archaeological periods from the Lower Paleolithic to medieval times in the Altai for several decades already. One of the main foci of research is the initial peopling of the Altai and adjoining regions. During the last two decades, a large number of stratified cave and open-air sites have been discovered in the Altai, providing researchers with new data on relevant topics.

The most interesting results have been achieved over the course of archaeological research in the upper reaches of the Anui River in the Northwestern Altai. Several stratified sites, which contain human habitation horizons ranging in age from the Lower to the terminal Upper Paleolithic, have been investigated in this region. For instance, the Karama stratified site has yielded the earliest pre-Acheulian pebble tools in Northern Asia. These archaic tools have been recovered from red Lower Pleistocene sediments dated to 600 – 800 ka BP on the basis of geomorphological, litho-stratigraphic, paleobotanical, and other data.

The early Middle Paleolithic layers at Denisova Cave yielded remains of early *Homo sapiens* in association with numerous stone tools. The culture-bearing horizon of the initial Upper Paleolithic, dating to about 50 ka BP, has yielded a collection of personal adornments made of animal bones and teeth, ivory, ostrich egg shell, and stones. This collection comprises pendants, beads, ornamented cylinder beads, a chloritolite bracelet with traces of polishing and drilling, and miniature eyed needles and bone borers that are considered among the most ancient personal ornaments in the world. Archaeological materials have been recovered in clear stratigraphic context and are correlated with lithological and paleontological data and dated through physical and radiometric methods.

One of the largest stationary camps in Russia has been built close to the unique Denisova Cave site and provides logistical support for large-scale archaeological investigations. The Denisova camp is a well-equipped station with comfortable cabins, a conference hall, a dining hall, and premises for analytical and laboratory work. Paleolithic studies of the Altai sites are carried out in close collaboration with experts in various sciences. Multidisciplinary research proceeds along three principal trajectories: cultural, chronological, and geographic. The laboratory provides researchers with modern equipment for complex analyses of archaeological and natural materials, stratigraphic sequences of Pleistocene deposits and their relative and absolute geochronology. The complex approach to studies of stratified Paleolithic sites in the

Altai meets the requirements of modern archaeology in the best way. The integration of archaeological and environmental data will hopefully reveal ecological regularities in the evolution of Pleistocene human populations, reconstruct the impact of environmental changes on human migrations, and assess the role of biological and cultural factors in the early peopling of new territories.

To familiarize scholars with the recent results of multidisciplinary studies of the Altai Paleolithic, the Institute of Archaeology and Ethnography of the Siberian Branch, Russian Academy of Sciences, sponsors regular international meetings. In August 2005, an international symposium focusing on archaeological and paleoenvironmental aspects of the initial peopling of Central, Northern, and Eastern Asia was held at the Denisova research camp. About 60 scholars from Europe, Asia, and North America participated in this forum.

Several important topics of Quaternary history of continental Asia were discussed at the Symposium. Papers presented there addressed the following issues: Paleolithic geology and geochronology, the formation and evolution of Pleistocene faunal and floral complexes, the reconstruction of environmental conditions, correlations between regional climatic fluctuations and changes in the environment, the periodization and chronology of the Paleolithic record, the formation, dispersal and regional features of Paleolithic cultural traditions, and the physical anthropology of the Paleolithic inhabitants.

Participants of the Symposium visited the most important stratified Paleolithic sites in the Altai, where they examined the lithology and bio-stratigraphy of the Pleistocene deposits and studied the main artifact collections, including both the stone tools and the personal adornments.

Materials presented at the symposium have shown that the Altai Paleolithic is the best-studied part of the Quaternary history of Northern and Central Asia. Archaeological research in the Altai has yielded stratified sites allowing for the construction of chronological sequences covering the Lower, Middle, and Upper Pleistocene. This time span encompasses the development of human culture and environment from the Lower to the terminal Upper Paleolithic. Archaeological materials from the Altai sites suggest a continuous development of prehistoric cultural traditions throughout all the major stages of the Paleolithic.

In this issue, we begin the publication of papers from this Symposium.

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The red bed at Karama contains the earliest stone tools in Northern Asia.

Excursion to Denisova Cave.

Professors G.F. Baryshnikov, V.P. Liubin, M.V. Anikovich, E.V. Beliaeva,
and H.A. Amirkhanov (Russian Academy of Sciences) examine Paleolithic artifacts.

Professors H.A. Amirkhanov and A.P. Derevianko (Russia) show recently discovered Lower Paleolithic artifacts from Darvagchai (Dagestan) to Prof. A. Ronen (Israel).

Prof. N. Goren-Inbar (Israel), an expert in early prehistory.

Prof. O. Bar-Yosef (USA) presents his hypothesis about the Middle
to Upper Paleolithic transition.

Professors S. Mishra (Dekkan College, India), O. Bar-Yosef (Harvard, USA), J. Svoboda (Institute of Archaeology, Academy of Sciences of the Czech Republic), and V.P. Liubin (Institute for the History of Material Culture, Russian Academy of Sciences) before the discussion.

Participants of the Symposium. Altai, "Denisova Cave" camp, August 2005.

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TECHNO-MORPHOLOGICAL ASPECTS OF MICROLITHIC PROJECTILE IMPLEMENTS: EXAMPLES FROM THE LEVANTINE GEOMETRIC KEBARAN AND THE EAST EUROPEAN EPIGRAVETTIAN*

Introduction

Throughout human history, the use of stone tools underwent a number of essential changes, one of which is the transition to microlithic tools. These appeared in Africa, Europe, and Southwestern Asia during the final Pleistocene. By the Last Glacial Maximum, ca 20 ka BP, tool assemblages from prehistoric sites in these regions include a significant microlithic component. The observed variability in morphological, metric and technological attributes of microliths has long been employed in establishing chronological sequences and distinguishing between prehistoric cultural entities.

In the Southern Levant, microlithic production began during the Upper Paleolithic about 30,000 BP. Straight, pointed bladelets and twisted Dufuor bladelets with inverse or alternate fine or semi-abrupt retouch are characteristic of the Ahmarian and the Aurignacian, respectively. The transition from the Upper Paleolithic to the Epipaleolithic took place ca 20 ka BP and involved certain important changes in lithic technology which included significant increases in the proportion of microliths and the frequency of abrupt retouch. The techno-morphological characteristics of microliths form the foundation for the cultural divisions of this period (Bar-Yosef, 1970, 1998; Goring-Morris, 1998). Backed bladelets characterize the Kebaran (ca 20 – 14.5 BP); the Geometric Kebaran (ca 14.5 – 12.5 BP) is characterized by backed trapezes/rectangles while lunates with Helwan or abrupt retouch represent the Natufian (ca 13.0 – 10.2 ka BP). The Mushabian culture of the Negev and Sinai and roughly contemporary with the Geometric Kebaran, is represented by La Mouillah points. In addition to the chrono-cultural variability based on the morphology of the main microlith types, intra-cultural variability is also present. For example, the metric characteristics of the trapeze/rectangles comprise the base for the regional division in the Geometric Kebaran, when the Mediterranean core zone is characterized by narrow elongate pieces (Henry, 1989: 198; Gorring-Morris, 1987: 130). The chronological and regional variability in microlithic types and technology characterizing the Southern Levant is accompanied by extremely scarce direct evidence about the specific function of these tools (Bar-Yosef, 1987; Bocquentin, Bar-Yosef, 2004). At the same time, ethnographic evidence, archaeological findings, mostly from Europe, Africa and Eastern Asia, as well as studies based on analysis of damage marks diagnostic of projectile impact indicate that microliths functioned as different parts of projectile weapons, either tips or barbs (Clark, Phillips, Staley, 1974; Clark, 1975; Fisher et al., 1984; Odell, Cowan, 1986; Barton, Bergman, 1982; Bergman, Newcomer, 1983; Bergman et al, 1988; Nuzhnyi, 1990a, b; 1992, 2000; Caspar, De Bie, 1996; Pitulko, 1997; Dockall, 1997; Crombe et al., 2001; Shimelmitz, Barkai, Gopher, 2004).

This contribution attempts to explain microlithic variability in the Geometric Kebaran of the core

* This article is a part of the Ph.D thesis currently carried out under the supervision of Daniel Kaufman, Dmitri Nuzhnyi and Ofer Bar-Yosef.

Mediterranean zone in terms of projectile weapon manufacture. For the sites under consideration, Hefziba and Neve David, two kinds of analysis are applied to their microlithic assemblages. The first involves the identification of macro-fractures on microlithic tools diagnostic of projectile impact The classification of these fractures was accepted at an international congress of use-wear studies (Hayden, 1979) and later developed and supplemented (Fisher et al., 1984). The second kind of analysis concerns the techno-morphological characteristics of the assemblages. The combination of these analyses has the potential not only in determining the function of the Geometric Kebaran microliths as projectile insets, but also to reconstruct possible methods of their hafting, which should be reflected in the morphological, metrical and technological features of the implements.

Comparisons of projectile implements from different prehistoric cultures can reveal functionally required similarities in certain morphological characteristics, within the framework of varying technologies. For this purpose, techno-morphological characteristics of projectile implements representing the Epigravettian industry from the sites of Mezhirich and Semenivka III (Ukraine) are compared to the Geometric Kebaran trapeze/rectangles.

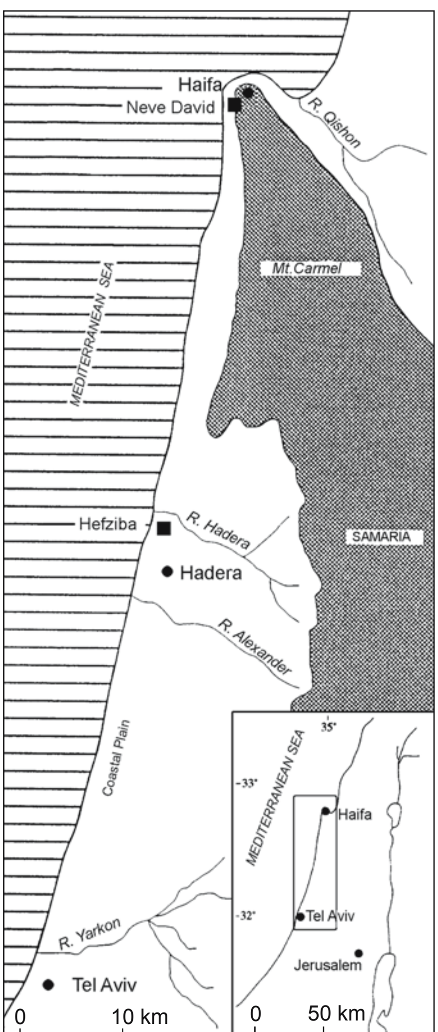

Fig. 1. Location of the sites Hefziba and Neve David.

Hefziba and Neve David

Both sites are located on the Mediterranean Coastal Plain of Israel, separated by approximately 50 km (Fig. 1). The

Fig. 2. Hefziba. General view, excavations of the west area, 1972.

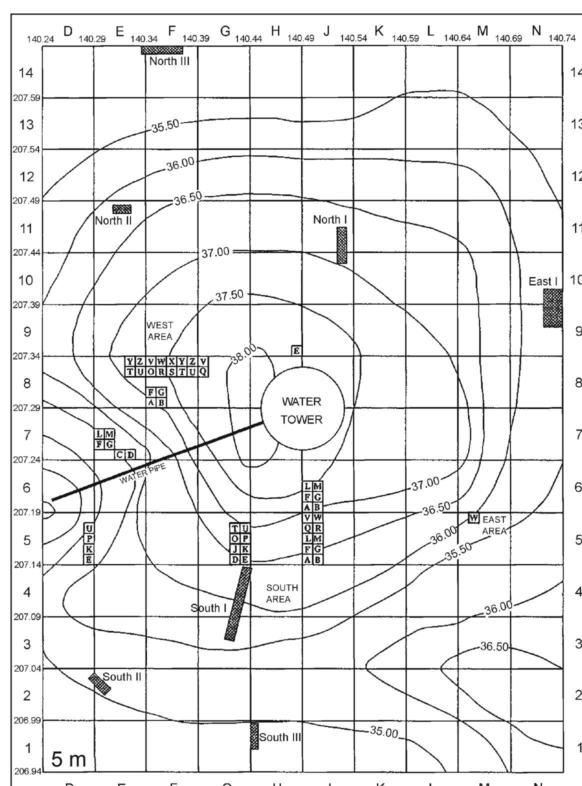

Fig. 3. Hefziba, plan of the excavation areas.

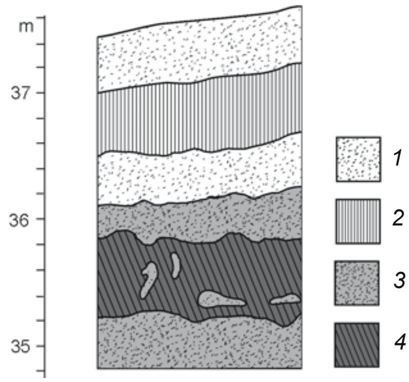

Fig. 4. Hefziba. Stratigraphic section at square F8 y, the west area of excavations (after (Kaufman, 1973)).
1 – sand; *2*– regosol; *3* – red loam (hamra); *4* – culture-bearing horizon.

Fig. 5. Neve David. General view, 1986.

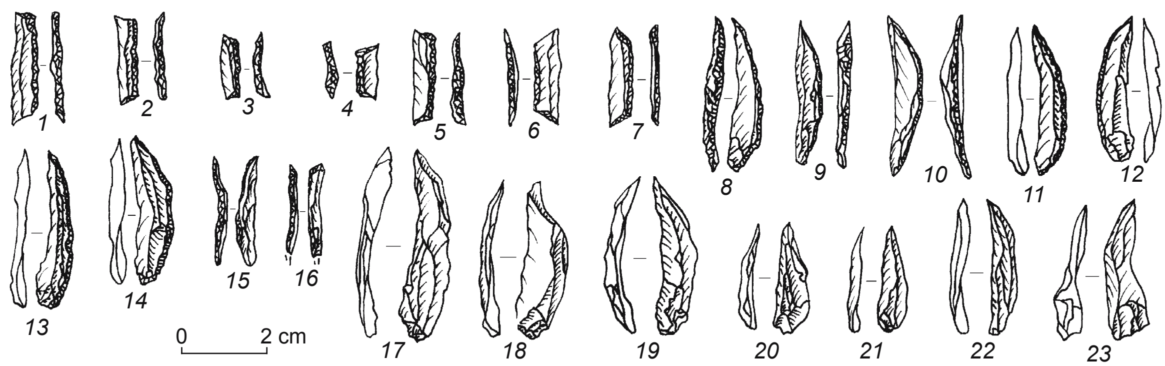

Fig. 6. Geometric Kebaran microlithic industry.
1 – 7– trapezes/rectangles (*1 – 3*: Hefziba, *4 – 7*: Neve David); *8 – 16* – non-geometric microliths (*8 – 14*: Hefziba; *15 – 16*: Neve David); *17 – 23* – unretouched bladelets (*17 – 19*: Hefziba; *21 – 23*: Neve David).

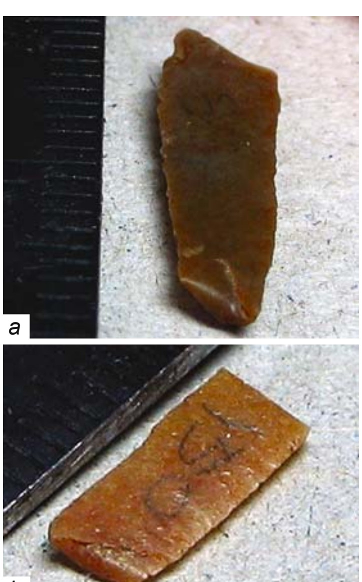

Fig. 7. Non-geometric microlith (*a*) and trapeze/rectangle with step terminating bending fracture on tip (*b*). Neve David.

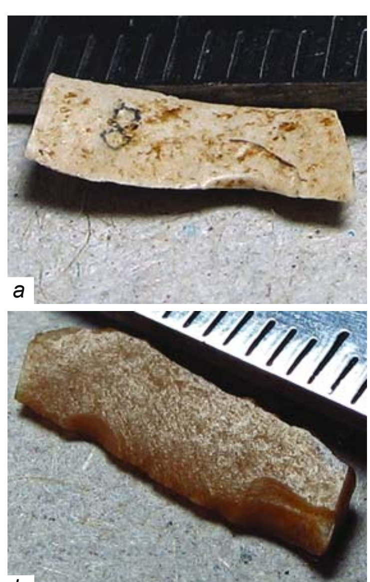

Fig. 8. Trapeze/rectangles with step terminating bending fracture on sharp edge. Hefziba (*a*) and Neve David (*b*).

site of Hefziba was initially excavated in 1972 – 1974 (Ronen et al., 1976) and more recently in 1996 – 1998 (Zakheim, Bar-Oz, 1998), (Fig. 2, 3). The stratigraphic column consists of four major geological units and indicates four cycles of sand accumulation and stabilization followed in three cases by weathering and soil formation (Fig. 4). Dense human occupation took place twice during the deposition of the red loam. The lithic assemblage is dominated by microliths, with endscrapers and burins also forming a major component. The faunal remains include *Gazella gazella*, *Bos primigenius*, *Capra*, *Dama mesopotamica*, and *Sus scrofa*, and indicate that, in addition to localized hunting, game was also sought at least 10 km to the east in the forested mountainous area (Bar-Oz, Dayan, 2003).

Neve David, located on the western piedmont of Mount Carmel (Fig. 5), was excavated from 1986 to 1990 (Kaufman, 1987). The Geometric Kebaran layer, 130 cm thick, is incorporated in a dark reddish-brown colluvium, overlaid by several units containing Chalcolithic, Bronze Age, and Byzantine findings. The faunal remains consist mostly of *Gazella gazella* and *Dama mesopotamica* (Bar-Oz et al., 1999). The site extends over an area of approximately 1000 m^2. According to dates (13,400 ± 180 and 12,610 ± 130) and some characteristics of the lithic assemblage, it belongs to the latter stages of the Geometric Kebaran (Kaufman, 1988).

Methodology

For the analysis of impact fractures, the microlithic tools were divided into three groups: trapezes/rectangles, non-geometric microliths, and "unidentifiable" (small medial) fragments. All three groups were examined for the occurrence of diagnostic projectile impact fractures (Fisher at al., 1984). The sample for Hefziba, drawn from sub-square F8y-3, in the western area of excavations, consisted of 561 pieces: 292 trapeze/rectangles, 100 non-geometric microliths, and 169 unidentifiable fragments. The sample from Neve David, drawn at random from different squares and elevations, consisted of 448 pieces: 316 trapeze/rectangles, 50 non-geometric microliths, and 82 unidentifiable fragments.

The recording of morphological and metric attributes was conducted on geometric and non-geometric microliths, as well as unretouched bladelets (Fig. 6). Only complete pieces were included in the samples. The sample from Hefziba was extended to squares F8 s, t, y, x and contains 743 pieces: 355 trapezes/rectangles, 134 non-geometric microliths, and 254 bladelets.

The sample from Neve David was selected at random and includes 325 pieces: 109 trapezes/rectangles, 24 non-geometric microliths, and 192 bladelets.

Morphological attributes included in the analysis were as follows:

– lateral profile – curved, twisted, and flat;

– form of lateral margins (applied only to bladelets and non-geometric microliths) – one curved edge, expanding edges, converging edges and parallel edges.

Metric attributes analyzed included length, width at mid-length, and thickness at mid-length.

Results

Projectile impact fractures

The two major types of fractures diagnostic of projectile function, the "spin-off fractures" and the "step terminating bending fractures,", were recognized on the microliths from both sites. The "step terminating bending fractures" start from large area and have straight or convex profile along its whole area of initiation. The fracture runs parallel to the surface and meets it at a right angle termination. The "spin-off fractures" initiate from bending fractures as point or small well defined area having a concave profile in the area of initiation (Nuzhnyi, 1990b). In Hefziba and Neve David, the first type is much more common and occurs on the tips and on the sharp edges of the microliths, both trapezes/rectangles and non geometrics (Fig. 7 – 9).

Morphological characteristics

Form of the lateral profile. For the trapeze/rectangles the number of pieces with twisted lateral profile is much lower than for the unretouched bladelets and the non-geometric microliths. The number of trapeze/rectangles with a flat lateral profile is higher than for the unretouched bladelets and for the non-geometric microliths. This pattern characterizes both sites (Fig. 10).

Form of lateral margins. Trapeze/rectangles have straight, for the most part abruptly retouched backs.

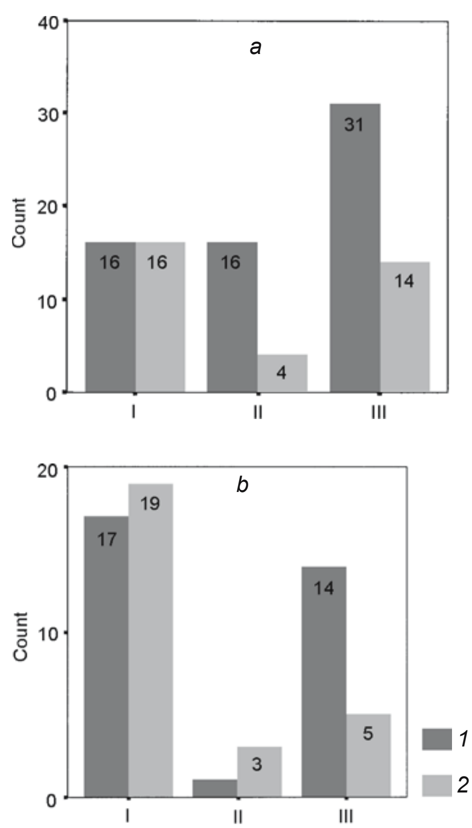

Fig. 9. Frequencies of step terminating bending fractures by location at Hefziba (*a*) and Neve David (*b*).
I – trapeze/rectangles; II – non-geometric microliths; III – indeterminable.
1 – on tip; *2* – on sharp edge.

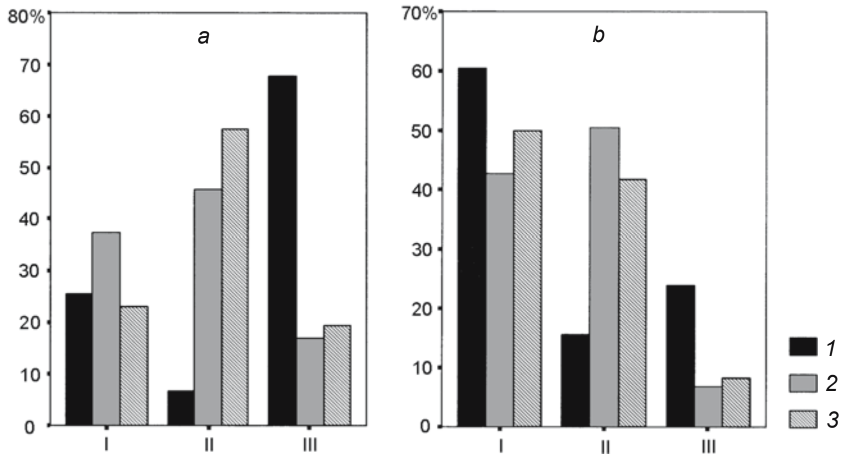

Fig. 10. Frequencies of lateral profile categories on trapezes/rectangles (*1*), non-geometric microliths (*2*), and bladelets (*3*) at Hefziba (*a*) and Neve David (*b*).
I – curved; II – twisted; III – flat.

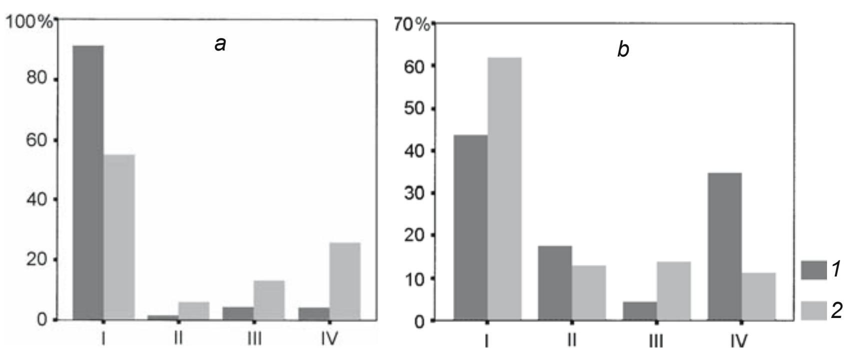

Fig. 11. Frequencies of lateral margin categories of non-geometric microliths (*1*) and bladelets (*2*) at Hefziba (*a*) and Neve David (*b*).
I – one curved edge; II – expanding edges; III – converging edges; IV – parallel edges.

The form of the lateral margins of the non-geometric microliths closely resembles the form of the original bladelets with both being characterized by one curved edge (Fig. 11).

Metric attributes

The distributions and means of the metric attributes of the trapezes/rectangles differ significantly from both unretouched bladelets and non-geometric microliths. Trapeze/rectangles are much smaller in all dimensions than blanks and non-geometric microliths. This pattern is seen at both Hefziba and Neve David (Table 1; Fig. 12 – 14). The coefficient of variation (CV), calculated by dividing the standard deviation by the mean, defines the relative degree of variability or dispersion for a given attribute. A more homogenous assemblage will have lower CV values, while a less homogenous assemblage will have higher CV values. The trapezes/rectangles from Hefziba are much more variable, particularly with regard to length and width, than those from Neve David. At Hefziba, length ranges from 24 to 8 mm and

Table 1. **Metric attributes, standard deviations, and coefficients of variation of trapezes/rectangles, non-geometric microliths, and bladelets**

Attribute		Trapezes/rectangles		Non-geometric microliths		Bladelets	
		Hefziba	Neve David	Hefziba	Neve David	Hefziba	Neve David
Number of specimens		355	109	134	24	254	192
Length	Mean	15.21	16.74	29.30	22.91	32.95	26.02
	Std. deviation	3.43	2.60	5.09	7.08	6.18	7.67
	CV	0.23	0.15	0.17	0.30	0.18	0.29
Mid-width	Mean	4.23	4.82	6.18	6.16	8.43	7.39
	Std. deviation	0.87	0.65	1.26	2.11	1.71	2.08
	CV	0.20	0.13	0.20	0.34	0.20	0.28
Mid-thickness	Mean	1.58	1.83	2.29	2.39	2.97	2.83
	Std. deviation	0.39	0.38	0.55	0.96	0.93	1.19
	CV	0.24	0.20	0.24	0.40	0.31	0.42

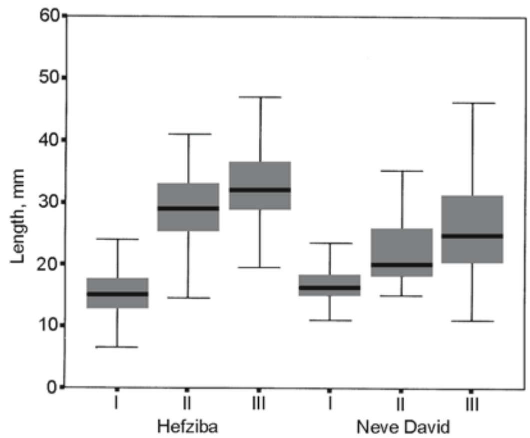

Fig. 12. Box-plots of length for trapezes/rectangles (I), non-geometric microliths (II), and bladelets (III).

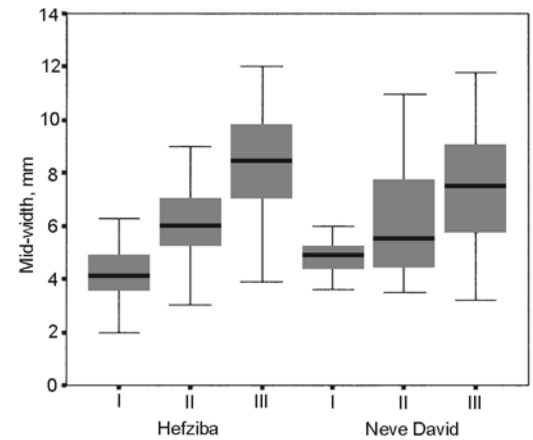

Fig. 13. Box-plots of width for trapezes/rectangles (I), non-geometric microliths (II), and bladelets (III).

width ranges from 6 to 2 mm. In contrast, the assemblage of the non-geometric microliths in Hefziba is much more homogenous than in Neve David.

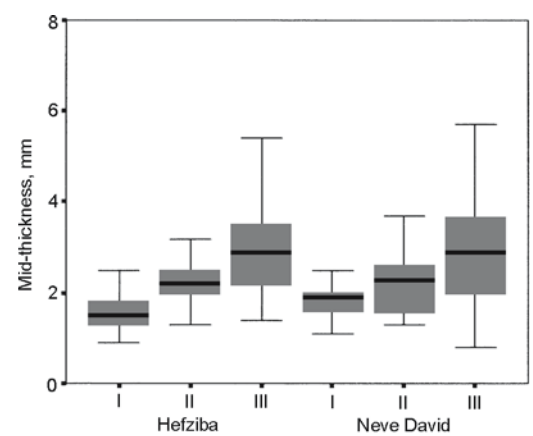

Fig. 14. Box-plots of thickness for trapezes/rectangles (I), non-geometric microliths (II), and bladelets (III).

Comparison with Epigravettian projectile implements

The Upper Paleolithic sites of Mezhirich and Semenivka III are located in the Dnieper Basin (Northern Ukraine), and both belong to the same entity of Epigravettian mammoth hunters. Two major types of microliths were used in projectiles, narrow microgravette points, and rectangles. Spear and dart ivory shafts with slots intended for insertion of microliths are found at both sites. According to diagnostic projectile impact patterns, the backed points served as leading points as well as lateral insets, whereas the rectangles were fitted into the lateral edges of the projectile (Nuzhnyi, 2002; Komar et al., 2003). The complete pieces are mostly rectangles (Fig. 15). In the following discussion, these will be compared to the Geometric Kebaran trapezes/rectangles with regard to lateral profiles and metric characteristics. Core reduction strategies characterizing both cultures will also be compared.

In terms of the frequencies of the forms of the lateral profiles, the Epigravettian rectangles are similar to the Geometric Kebaran trapeze/rectangles, with most being flat or slightly curved (Fig. 16).

The Epigravettian rectangles are longer (Fig. 17), wider (Fig. 18), and thicker (Fig. 19) than Geometric Kebaran trapezes/rectangles (Table 2). However, the similarity is seen in their ratios of length to width (Fig. 20) and width to thickness (Fig. 21).

The Geometric Kebaran is characterized mostly by pyramidal cores with single striking platforms (Kaufman, 1976; Shaul, 1999). The resulting blanks are mostly

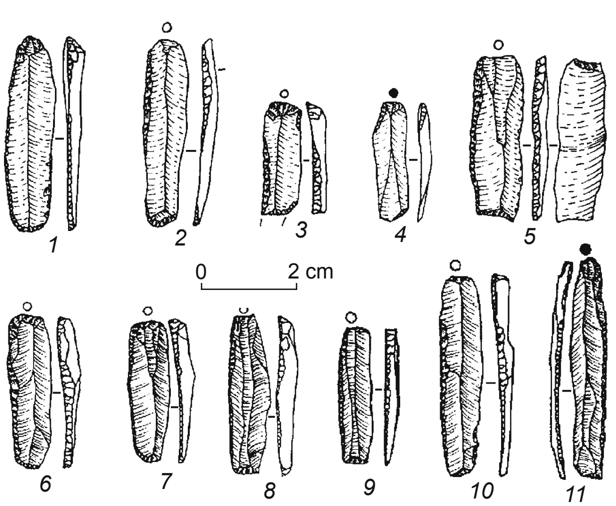

Fig. 15. Epigravettian lateral inserts for projectiles (after (Nuzhnyi, 2002; Komar et al., 2003)).
1 – 5 – Semenivka III; *6 – 11* – Mezhirich.

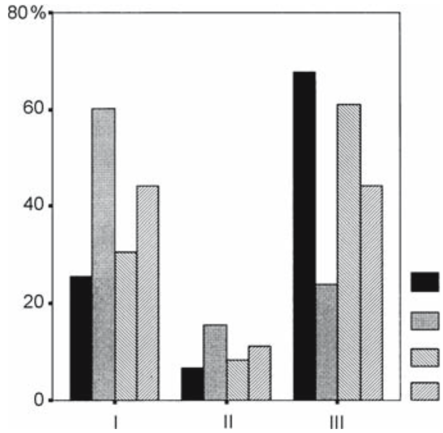

Fig. 16. Frequencies of lateral profile categories of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).
1 – Hefziba; *2* – Neve David, *3* – Semenivka III; *4* – Mezhirich.
I – curved; II – twisted; III – flat.

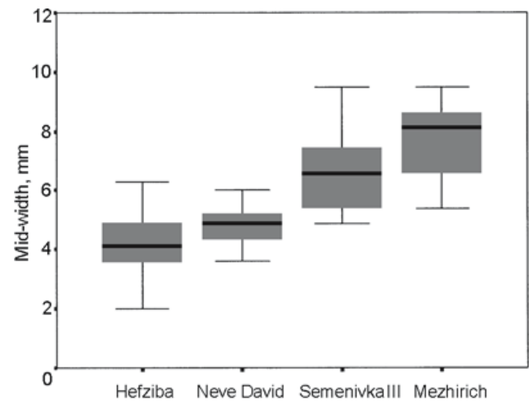

Fig. 18. Box-plots of width (in the middle) of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).

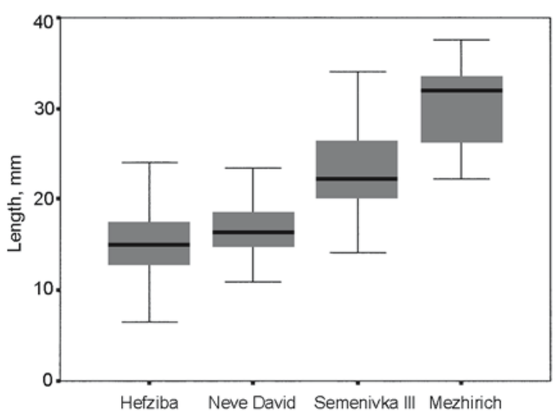

Fig. 17. Box-plots of length of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).

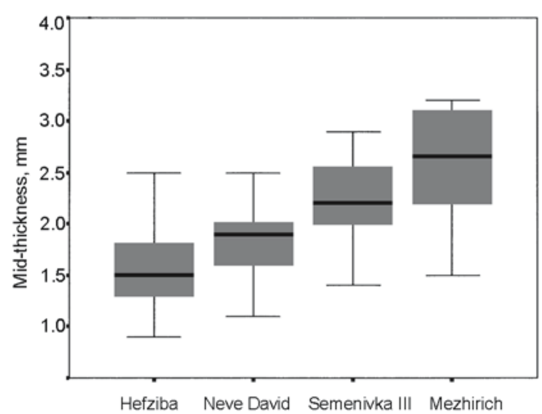

Fig. 19. Box-plots of thickness (in the middle) of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).

Table 2. **Metric characteristics of microliths, mm**

Site	Attribute	Length	Mid-width	Mid-thickness	Length/ mid-width	Mid-width/ mid-thickness
Hefziba (N=355)	Mean	15.21	4.23	1.58	3.65	2.78
	Std. deviation	3.43	0.87	0.39	0.77	0.70
Neve David (N=109)	Mean	16.75	4.86	1.83	3.51	2.76
	Std. deviation	2.61	0.72	0.38	0.72	0.65
Semenivka III (N=36)	Mean	23.51	6.56	2.32	3.61	2.95
	Std. deviation	5.19	1.14	0.53	0.62	0.74
Mezhirich (N=18)	Mean	30.51	7.70	2.53	4.04	3.12
	Std. deviation	5.24	1.25	0.57	0.93	0.54

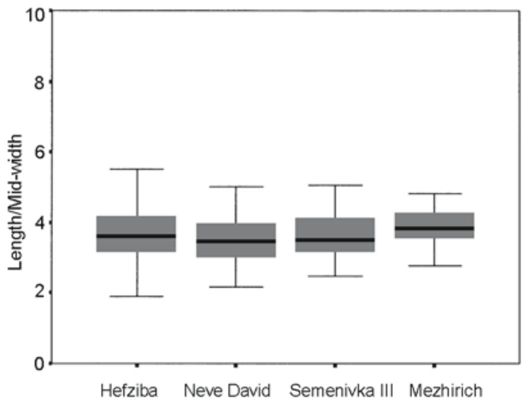

Fig. 20. Box-plots of length/width ratios of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).

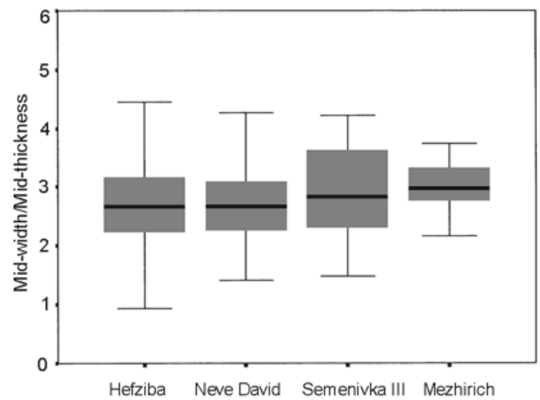

Fig. 21. Box-plots of width/thickness ratios of trapezes/rectangles (Geometric Kebaran) and rectangles (Epigravettian).

twisted or curved in profile and the main form of their margins is "one curved edge." In the Epigravettian, mostly prismatic cores with two opposed striking platforms were processed through pressure flaking (Nuzhnyi, 2002; Komar et al., 2003), a technology that allowed for the production of long, minimally curved blanks and almost parallel lateral edges.

Discussion and conclusions

Comparison between the microlithic industries of the two Geometric Kebaran sites revealed common features, as well as certain differences in technological behavior.

Both Hefziba and Neve David are characterized by different approaches in the production of trapezes/rectangles and non-geometric microliths with regard to blank processing. The differences in lateral profiles and all metric characteristics between bladelet blanks and trapezes/rectangles suggest that production of these tools involved selection of the thinnest blanks and their significant modification by truncations and steep lateral retouch in forming the backing. In other words, trapezes/rectangles were mostly made of medial parts of thin, minimally curved blanks.

The production of the non-geometric microliths required much less modification of the original bladelets. This is seen in the similarities in lateral edges, lateral profiles and metric characteristics of bladelet blanks and non-geometric microliths in both sites.

The occurrence of the diagnostic impact fractures on both tips and sharp edges of trapezes/rectangles and non-geometric microliths suggests that both could have been used as leading points and as barbs of projectiles.

Straight backs and minimally curved lateral profiles are characteristic of both Geometric Kebaran trapezes/rectangles and Epigravettian projectile implements, the latter of which were inserted into lateral slots or grooves on a projectile shaft. Notably, the similarities of morphological features were achieved through different technological approaches, starting from different core reduction strategies characterizing the two industries. The production of almost flat blanks in the Epigravettian required minimal modification of the original bladelets prior to insertion into grooves.

The practice of inserting microlithic implements into lateral grooves of projectile weapons has been documented for a variety of different cultures over a very long period from the Upper Paleolithic until the Bronze Age in Siberia (Pitulko, 1997). The standardized morphology and minimal curvature are seen as defining attributes of these inserts, as is the special core reduction strategy used for their production (Gir'ia, Pitulko, 1994).

In contrast, in the Geometric Kebaran the reduction of pyramidal cores with single striking platforms resulted mostly in twisted or curved bladelets, with one curved lateral margin. These blanks were utilized for the production of both non-geometrics and trapezes/rectangles, with each type requiring different selection of blanks and degrees of modification, as described above. In addition, the abruptly retouched backs of the trapeze/rectangles may have allowed for attaching the pieces directly to a shaft with the use of adhesives such as resin or bitumen, rather than within a groove.

There are several archaeological and ethnographical accounts showing various methods to haft microliths, particularly geometrics, as leading points (Clark, Phillips, Staley, 1974; Clark, 1975; Nuzhnyi, 1992). Trapezes can be mounted as both single and multiple piercing tips. Transversal arrowheads also must be taken into consideration as a possibility, since some of the projectile fractures on the sharp edges of the Hefziba and Neve David trapezes/rectangles are oriented perpendicularly to the longitudinal axis, a characteristic for such use.

The modularity, manifested in numerous possibilities of hafting, either as lateral barbs or leading points of projectiles, is the main advantage of microliths, particularly of the geometrics. This advantage seems to be the reason for the proliferation of trapeze/rectangles and other geometric forms in the transition from the Kebaran to the Geometric Kebaran in the Levant. The modularity of the implements may have allowed for greater efficiency in the manufacture of weapons. In addition, the increase in geometrics may also have had symbolic meaning as particular designs provided by the modularity of geometric forms may have been related to issues of group identity. In this regard, it is worth noting that a similar phase of"geometrization" in microlithic technology is a widespread phenomenon and characterizes the transition from the Upper Paleolithic to Mesolithic in Europe.

Certain differences are apparent when comparing the Hefziba and Neve David microlithic industries. Hefziba is characterized by a much more pronounced and standardized assemblage of non-geometric microliths than Neve David. At the same time, trapezes/rectangles from Hefziba exhibit considerably more variability in their metric attributes (as seen in the CV values). As there is some indication that Hefziba may be slightly older than Neve David, the difference could point to chronological change in projectile manufacture during the Geometric Kebaran in the Mediterranean zone. This change is toward greater uniformity of microlithic projectile implements, both in their form and metric characteristics. In addition to the chronological development, this difference can point to regional variability in hunting weapon manufacture during the Geometric Kebaran, since the wide trapezes and rectangles representing another faces of the culture also had have been used as projectile inserts (Shimelmitz, Barkai, Gopher, 2004).

Experimentally based research, including study of projectile impact damage in conjunction with techno-morphological features of different types of microliths has the potential to more precisely describe the methods of their hafting and, ultimately, the types of projectiles used in different cultures. This approach can provide insights into the chronological and regional variability that characterizes microlithic technologies in the Southern Levant.

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References

Bar-Oz G., Dayan T. 2003
Testing the use of multivariate inter-site taphonomic comparisons: The faunal analysis of Hefzibah in its Epipalaeolithic cultural context. *Journal of Archaeological Science*, vol. 30/7: 885 – 900.

Bar-Oz G., Dayan T., Kaufman D. 1999
The Epipaleolithic faunal sequence in Israel: A view from Neve David*. Journal of Archaeological Science*, vol. 26: 67 – 82.

Barton R.N.E., Bergman C.A. 1982
Hunters at Hengistbyry: Some experimental archaeology. *World Archaeology*, N 14: 236 – 248.

Bar-Yosef O. 1970
The Epi-Palaeolithic cultures of Palestine. Unpublished Ph.D. Thesis. Hebrew University, Jerusalem.

Bar-Yosef O. 1987
Direct and indirect evidence for hafting in the Epi-Palaeolithic and Neolithic Southern Levant. In *La main et l'outil. Manches et emmanchements préhistoriques. Travaux de la Maison de L'Orient*, vol. 15: 155 – 164.

Bar-Yosef O. 1998
Prehistoric chronological framework. In *T.E. Levy (ed.). The Archaeology of Society in the Holy Land*. London: Leicester Univ. Press: pp. XIV–XVII.

Bergman C.A, McEvaen E., Miller R. 1988
Experimental archery: Projectile velocities and comparison of bow performance. *Antiquity*, vol. 62: 658 – 670.

Bergman C.A., Newcomer M.H. 1983
Flint arrowhead breakage, examples from Ksar Akil. *Journal of Field Archaeology*, vol. 10: 238 – 243.

Bocquentin F., Bar-Yosef O. 2004
Early Natufian remains: Evidence for physical conflict from Mt. Carmel, Israel. *Journal of Human Evolution*, vol. 47/1: 19 – 23.

Caspar J.-P., De Bie M. 1996
Preparing for the hunt in the Late Palaeolithic Camp at Recem, Belgium. *Journal of Field Archaeology*, vol. 23: 437 – 460.

Clark J.D., Phillips J.L., Staley P.S. 1974
Interpretations of prehistoric technology from Ancient Egypt and other sources. Pt. 1: Ancient Egyptian bows and arrows and their relevance for African prehistory. *Paleorient*, vol. 2: 323 – 388.

Clark D. 1975
Interpretations of prehistoric technology from Ancient Egypt and other sources. Pt. 2: Prehistoric arrow forms in Africa as shown by surviving examples in traditional arrows of San Bushmen. *Paleorient*, vol. 3: 127 – 150.

Crombe P., Perdaen Y., Sergant J., Caspar J.-P. 2001
Wear analysis on Early Mesolithic microliths from the Verrebroek site, East Flanders Belgium. *Journal of Field Archaeology*, vol. 28: 253 – 269.

Dockall J.E. 1997
Wear traces and projectile impact: A review of experimental and archaeological evidence. *Journal of Field Archaeology*, vol. 24: 321 – 331.

Fisher A., Hansen P.V., Rassmussen P. 1984
Macro- and micro-wear traces on lithic projectile points. Experimental results and prehistoric examples. *Journal of Danish Archaeology*, vol. 3: 19 – 46.

Gir'ia E., Pitulko V.V. 1994

High Arctic Mesolithic culture of Zokhov Island: Insert tools and knapping technology. *Arctic Anthropology*, vol. 31/2: 17 – 29.

Goring-Morris A.N. 1987

At The Edge: Terminal Pleistocene Hunter-Gatherers in the Negev and Sinai. Oxford: British Archaeological Reports. (Int. Ser.; N 361).

Goring-Morris A.N. 1998

Complex hunter/gatherers at the end of the Palaeolithic. In *T.E. Levy (ed.). The Archaeology of Society in the Holy Land*. London: Leicester Univ. Press, pp. 141 – 168.

Hayden B. 1979

Ho-Ho Nomenclature Committee. The Ho-Ho Classification and Nomenclature Committee Report. In *B. Hayden (ed.). Lithic Use-Wear Analysis*. New York: Academic Press, pp. 133 – 135,

Henry D.O. 1989

From Foraging to Agriculture. Philadelphia: Univ. of Pennsylvania Press.

Kaufman D. 1976

Typological and Technological Comparisons of Two Epi-Paleolithic Assemblages from the Coastal Plain of Israel. Unpublished M.A. Thesis. Univ. of Tel Aviv.

Kaufman D. 1987

Excavations at the Geometric Kebaran site of Neve David, Israel: A preliminary report. *Quartar*, vol. 37/38: 1989 – 1999.

Kaufman D. 1988

New radiocarbon dates for the Geometric Kebaran. *Paleorient*, vol. 14: 107 – 109.

Komar N., Nuzhnii D., Korniets N., Pean St. 2003

Mezhirich Upper Paleolithic site: The reconstruction of environmental condition of the Late Pleistocene and human adaptation in the Middle Dnieper Basin (Northern Ukraine). *Kamjana doba Ukrainy*, iss. 4: 262 – 277.

Nuzhnyi D. 1990a

Projectile damage on Upper Paleolithic microliths and the use of bow and arrow among Pleistocene hunters in the Ukraine. In *Proceedings of the International Conference of Lithic Use-Wear Analysis, 15 – 17th February 1989 in Uppsala, Sweden.* Uppsala: n.p., pp. 113 – 124. (Societas Archaeologica Upsaliensis; N 14).

Nuzhnyi D. 1990b

Vidy povrezhdenyi na vkladyshevykh mikroliticheskikh detalyakh metatelnykh orudyi v pozdnem paleolite. In *Voprosy arkheologii yuga Vostochnoi Evropy.* Elista: Kalmytsky Gos. Univ., pp. 14 – 26.

Nuzhnyi D. 1992

Razvitie mikrolithicheskoi tekhniki v kamennom veke. Kiev: Naukova dumka.

Nuzhnyi D. 2000

Development of microlithic projectile weapons in the Stone Age. In *La chasse dans la Préhistoire. Actes du Colloque International de Tregnes 3 – 7 octobre 1990.* Bruxelles: n.p., pp. 95 – 101. (Bulletin de la Société Royale Belge d'Anthropologie et de Préhistoire; T. 111).

Nuzhnyi D. 2002

Assemblages of three Epigravettian sites in the Middle Dnieper Basin: A case of variability of residential patterns of mammoth hunters during the warm season. In *Trends in the Evolution of East European Paleolithic (Proceedings of Kostenki Expedition)*, vol. 1. St. Petersburg: n.p., pp. 123 – 137.

Odell G.H., Cowan F. 1986

Experiments with spears and arrows on animal targets. *Journal of Field Archaeology*, vol. 13: 195 – 212.

Pitulko V.V. 1997

Obschie tendentsii v razvitii vkladyshevykh orudiy. In *Kamennyi vek evropeiskikh ravnin: Materialy mezhdunarodnoj konferentsii* Zamostie: n.p., pp. 161 – 167.

Ronen A., Kaufman D., Gofna R., Backler N., Smith P., Amiel A. 1975

The Epipaleolithic site Hefziba, Central Coastal Plain of Israel. *Quartar*, vol. 26: 53 – 72.

Shaul N. 1999

The Geometric Kebaran Site in Neve David. Unpublished M.A. Thesis. University of Haifa, (Hebrew). Haifa.

Shimelmitz R., Barkai R., Gopher A. 2004

The Geometric Kebaran microlithic assemblage of Ain Miri, Northern Israel. *Paleorient*, vol. 30/2: 127 – 140.

Zakheim O., Bar-Oz G. 1998

Hefzibah. *Hadashot Archeologiot: Excavations and Surveys in Israel*, vol. 109: 45 – 46.

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PREHISTORY OF THE SOUTHERN BAHARIYA OASIS, WESTERN DESERT, EGYPT. AN OUTLINE

Bahariya Oasis

Bahariya is one of several oases of the Western Desert dotting the wide space between two important prehistoric provinces of Northeast Africa, the Nile Valley (Egypt) in the east and Cyrenaica (Libya) in the west. The oasis is located between 27°48' and 28°30' N and 28°35' and 29°10' E. It creates an oval depression in the desert plateau, 94 km long and 42 km wide, surrounded by marginal escarpments. The floor, mostly covered by desert as well, is littered with numerous conical mountains, table mountains, and mountain ridges. The base of the depression lies about 120 – 130 m asl, whereas the marginal escarpments rise about 150 m higher.

Whereas the marginal escarpments around southern part of Bahariya are formed by Cretaceous limestone with local outcrops of siliceous cobbles (chert), the individual mountains inside the depression are mostly shaped by erosion of Eocene deposits, and some are capped (and protected) by solid ferrocrete sandstone and quartzite layers of the Oligocene age. Both the chert and the quartzite were used as raw materials for prehistoric lithic industries.

Numerous ancient lakes and lacustrine deposits (mud pans or "playas") recorded by the survey in shallow and undrained basins indicate that the floor of the oasis was considerably more humid in the prehistoric past compared to historic times, and to the present. The available radiocarbon date for basal playa sediments does not exceed 26 ka BP (Hv-8319), and ostrich shells from archaeological sites in vicinity of another playa are dated to 8 – 7 ka BP (GrA-26161, GrA-26162).

The georelief of southern Bahariya, shaped by the soft Tertiary sediments interbedded with harder rocks, is structured into distinct "floors" created by harder sediments on several levels. Such a structured landscape offers a good opportunity for the study of prehistoric adaptations and settlement strategies.

The 2003 – 2005 survey

Unlike all other oases in the Western Desert, which have already provided a wealth of prehistoric evidence (Caton-Thompson, 1946; Schild, Wendorf, 1977; 1981; Marlow, Mills (eds.), 2000; Barich, Hassan, 2000), Bahariya was hitherto insufficiently studied from this viewpoint (Fakhry, 1942; Hassan, 1979). Thus, the establishment of the Paleolithic occupation and the outline of the settlement record were the main goals of a three-year survey project organized by the Czech Institute of Egyptology, Charles University, Prague, and joined, for the prehistoric component, by the Paleolithic and Paleoethnology Research Center at the Institute of Archaeology, Brno (Bárta et al., 2003, 2004; Svoboda 2004).

Three aspects of settlement strategy are important for prehistoric site selection: secure water resources, lithic raw material outcrops, and positions with good views of the surrounding landscape.

Given the structured nature of the landscape, the strategy of the survey was to explore the surfaces of a variety of georelief types, with special attention to ancient lakes (playas), the quartzite and chert outcrops, and the strategic locations within the landscape. The basal plain, including the dry wadis from episodic water erosion, was unattractive for human occupation. The large areas of the plain covered by weathered plaques of sandstone and ferruginous sandstone were evidently especially avoided.

The surveyed area stretches from Gebel Miteili Radwani in the north to Gebel Gharbi in the south (about 30 by 20 km). Coordinates of the artifacts and scatters were recorded using a GPS garmin and mapped. More detailed presentations of this database have been prepared using GPS Pathfinder Office 2.7 and Arc GIS 8.2. Selected sites and samples were spatially documented according to a grid, mapped, and statistically analyzed. The representative artifacts were collected, drawn, and deposited at the Antiquities Department and Museum at Bawiti. The majority of artifacts were analyzed in the field and left *in situ*.

A test excavation of the playa deposits and spatial and typological analyses of additional scatters are reserved for the next stage of this project.

Fig. 2. View of the Bir el-Showish plain. The ancient lake Bir el-Showish, covered by sand dunes with sparse vegetation, is seen in the distance.

The Acheulian (Early Stone Age)

Five isolated bifaces, two of them heavily weathered, were found scattered at considerable distances from each other on the Bir el-Showish plain and on the Gart el Sheikh hill (Fig. 1 – 3). They were made of chert and quartzite. Judging from differences in the degree of weathering and raw material, the bifaces are probably not contemporary. The type of location – a large plain sloping slightly from an active oasis towards a mountain ridge – is quite typical of North African Acheulian sites in general (e.g., Germa (Svoboda, 1980)).

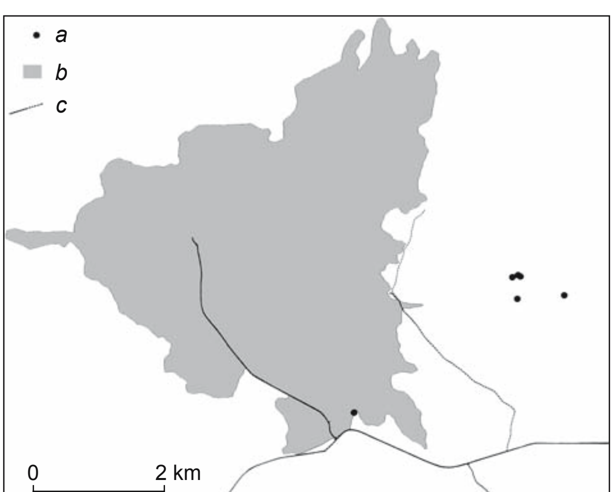

Fig. 1. Provisory map showing the location of Acheulian sites in southern Bahariya. Compiled by V. Bruna.
a – location of Acheulian handaxes; *b* – Bir el-Showish lake deposits; *c* – main roads.

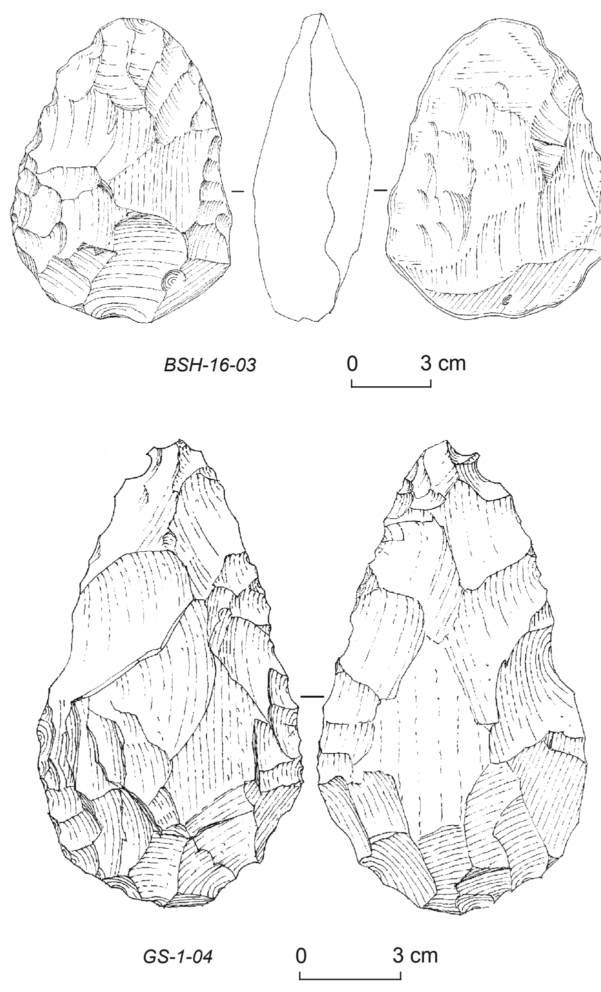

Fig. 3. Examples of Acheulian bifaces from Bir el-Showish (*a*) and Gart es-Sheikh (*b*).

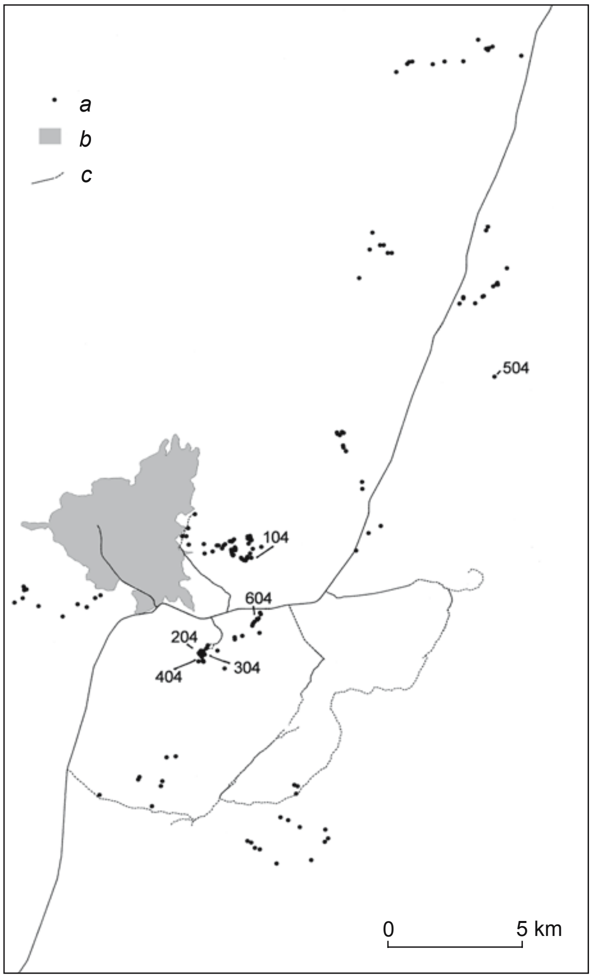

Fig. 4. Provisory map showing the location of Middle Paleolithic sites in southern Bahariya. Compiled by V. Bruna. *a* – location of Middle Paleolithic artifacts (samples 104 – 604); *b* – Bir el-Showish lake deposits; *c* – main roads.

Fig. 5. View of the lacustrine sediments and yardangs of the Umm el-Okhbain Playa. The Epi-Paleolithic site 103 is seen in the distance, at the entrance to the wadi.

The Middle Paleolithic (Middle Stone Age)

The Middle Paleolithic horizon is the most widely distributed across the landscape and is relatively well structured (Fig. 4). Several types of sites were identified and samples were analyzed from each type:

1) cumulative settlements with a high percentage of curated tools (10 – 20 %) and a lower percentage of cores (6 – 12 %), located near ancient water sources or on nearby terraces; artifacts in these areas are widely dispersed and thus their density is relatively low (0.2 – 1.3 artifacts per sq. meter);

2) specialized lithic workshops attached to the chert outcrops on the escarpment plateaus, or to quartzite covers on the tops of isolated mountain ridges; curated tools are nearly absent here (less than 1 %), and, surprisingly, the percentage of cores is not high either (about 5 %); the artifact density (mostly flakes and blades) is the highest ever recorded in this region (about 24 artifacts per sq. meter);

3) episodic sites on escarpment edges, lacking sufficient raw material and water sources, and which possibly served as strategic hunting posts.

Isolated artifacts of Middle Paleolithic character are dispersed over considerable distances on the basal plain, terraces, and pediments across the surveyed landscape.

Cumulative settlements at the playas

Umm el-Okhbain. Umm el-Okhbain is an almost circular playa, a lacustrine deposit with characteristic yardangs on the surface, located in the center of a pan-shaped depression at about 145 m asl and surrounded by isolated mountain peaks (Fig. 5). The advantage of this area is that it remained undisturbed either by historic or modern occupations and activities. The Middle Paleolithic artifacts are scattered at considerable distances from each other all around the fossil lake (and some occur in the center, on the surface of the lake deposit), but more dense accumulations flank the western coast at about 30 – 50 m distance from the shoreline. Three accumulations, 204 (28°01’28.9” N, 28°65’70.2” E), 304 (28°01’23.9” N, 28°65’66.3” E.), and 404 (28°01’21.6” N, 28°65’59.4” E), 10 by 20 m each, were selected for analysis in this area (Tables 1, 2). In all cases, the long axis follows the ancient coastline. Even inside these selected concentrations, however, the density of artifacts was relatively low (about 0.2 – 0.3 artifacts per sq. meter).

The raw material used was mostly brownish to grayish chert, accompanied by brownish quartzite.

The technology is Levallois in the broadest sense of the word. Cores are rare, and most of them are exhausted specimens of small size (the smallest being no more than 2 – 3 cm large).

Table 1. **Analyzed Middle Paleolithic samples**

Parameters	Sample number*					
	104	204	304	404	504	604
Altitude (m asl)	282	150	150	150	253	148
Coordinates: N	28°04'33.4"	28°01'28.9"	28°01'23.9"	28°01'21.6"	28°10'96.7"	28°02'33.6"
E	28°67'11.8"	28°65'70.2"	28°65'66.3"	28°65'59.4"	28°75'50.0"	28°67'52.3"
Studied area, m	3 × 3	10 × 20	10 × 20	10 × 20	4 × 7	10 × 10
Number of artifacts	212	43	35	61	200	128
Artifact density (per sq. m)	23.6	0.2	0.2	0.3	7.1	1.3
Ilam	22.9	15.6	11.1	10.9	19.4	13.1
Cores, %	5.2	7.0	11.4	–	2.0	6.3
Flakes, %	73.6	62.8	68.6	80.4	81.0	72.6
Blades, %	20.3	11.6	8.6	9.8	13.0	10.9
Retouched tools, %	0.9	18.6	11.4	9.8	4.0	10.2

* 104: Gebel el-Showish; 204 – 404: Umm el-Okhbain; 504: "White Mountain"; 604: Mannsaf.

The dimensions of the flakes vary between 2 – 3 and 5 – 6 cm, with a few exceptions (small chips of about 1.5 cm and large flakes up to 10 cm). The mean blade breadth is 2 cm, and the usual length does not exceed 6 cm. A few of the flakes and blades are Levallois, with prepared platforms; some are pointed.

Typologically, sample 204 provided two Mousterian points (one of them with partial flat retouch on the ventral face), sidescrapers, a simple burin, and a retouched blade. Sample 304 included a broken tip of a Mousterian point, a simple burin, and a retouched blade. Sample 404 yielded an elongate leaf-shaped point, pointed flakes, a thick sidescraper, and a splintered piece (Fig. 6).

Mannsaf. Mannsaf is a nearby playa, with the highest yardangs, located at about 145 m asl. An important scatter was located about 150 m south of the visible shoreline of the playa. From this find-spot, measuring 10 by 10 m, sample 604 was analyzed (28°02'33.6" N, 28°67'52.3" E) (see Tables 1, 2). The industry, made of brown chert and violet quartzite, included a leaf-shaped point, two Mousterian points made on larger Levallois flakes, other Levallois flakes, sidescrapers, a simple burin, and truncated blades (Fig. 7).

Comparable materials were recorded at other places in the area, such as Ain Umm Khabata (points, and a sidescraper), Bir Ain-Naga (a point), or GPS Playa (a Levallois flake).

Table 2. **Typology of the Middle Paleolithic industries**

Category	Sample number*					
	104	204	304	404	504	604
Leaf-shaped points	–	–	–	1	–	1
Mousterian points	–	2	1	1	–	2
Sidescrapers	–	3	–	1	–	1
Endscrapers	–	–	–	–	1	–
Notches	1	–	1	1	1	3
Denticulated tools	1	1	–	–	–	–
Splintered pieces	–	–	–	1	–	–
Retouched blades	–	1	1	1	1	–
Truncated blades	–	–	–	–	–	2
Burins	–	1	1	–	–	1
Becs	–	–	–	–	1	–
Irregularly retouched pieces	Many	–	–	–	4	3
Total	2	8	4	6	8	13

*As in Table 1.

Mountain-top workshops

Gebel el-Showish. The densest Middle Paleolithic artifact accumulations were recorded on the peaks of Gebel el-Showish, a dominant horseshoe-shaped mountain ridge located about 3 km east of the Bir-el-Showish area (Fig. 8). The peak areas reach 270 – 280 m asl and form several smaller plateaus. The geomorphology suggests that during more favorable periods, rainwater accumulated in the bow of the horseshoe, from where the ridge was episodically drained by steep and narrow wadis. Generally, however, the hilltop is dry.

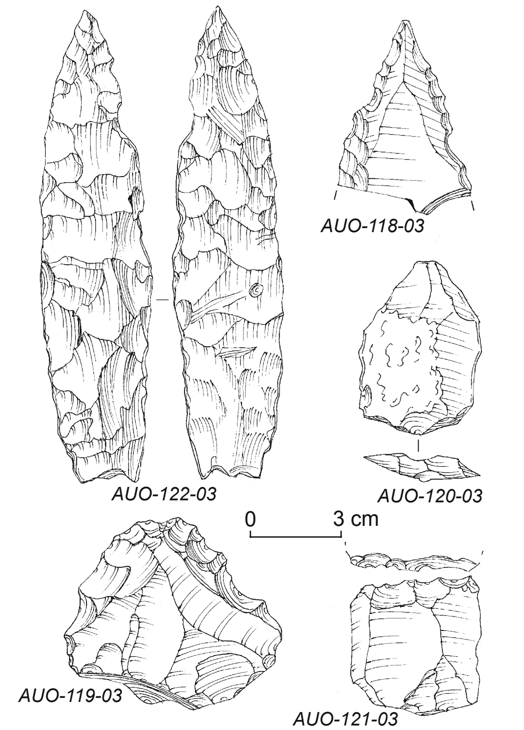

Fig. 6. Middle Paleolithic industry with a leaf-shaped point (brownish chert). Umm el-Okhbain.

The highest parts of the mountain are protected from erosion by weathered remains of solid crusts of siliceous and ferrocrete sandstone and quartzite. Types of raw material outcrops in these areas include: dark brown to violet quartzite, the most widely dispersed and preferred raw material; light brown to yellow quartzite, forming isolated outcrops, and rarely used by prehistoric inhabitants (but more frequently used during historic periods); violet quartzite of lower quality, more weathered; and brownish to reddish chert. The majority of artifacts in the workshops are made of dark brown quartzite and a smaller portion of brown chert. Thus, the raw material composition on the mountain tops is the reverse of that encountered around the playas.

Technologically, most of the cores from the workshops are Levallois (Fig. 9), flat in section, and rounded, rectangular, or triangular in shape. The mean dimensions are around 8 by 5 by 2 cm. Both surfaces are more or less carefully prepared. There are prepared pre-forms, but the majority are cores reduced by one or more unipolar strikes. Some of the flat cores are discoid. More volumetric cores are less regular in shape. Given the relatively high proportion of blades in the analyzed sample, the absence of corresponding blade cores is striking.

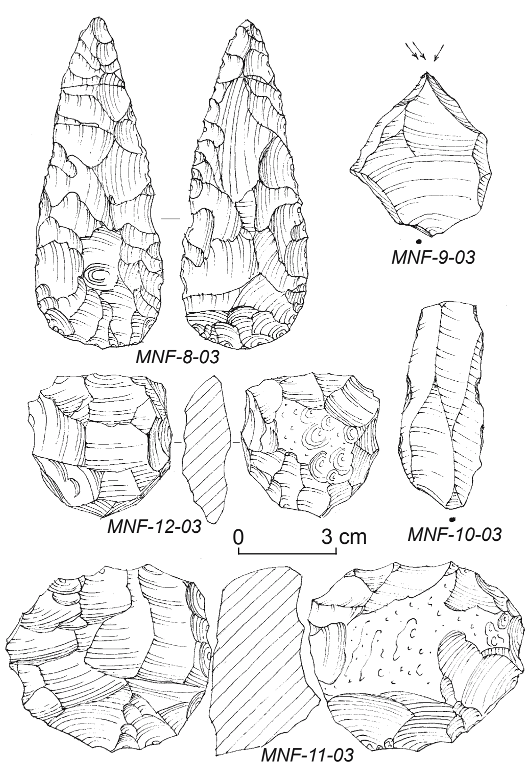

Fig. 7. Middle Paleolithic industry with a leaf-shaped point (brownish chert). Mannsaf Playa.

Fig. 8. Surface of the Gebel el-Showish workshop sites.

The flakes and blades are mostly Levallois, some possess well-prepared striking platforms, and the shapes are ovoid, quadrangular, or pointed. The flakes range in size from the smallest chips of 1 by 1 cm to flakes of around 5 by 4 cm, with the largest ones reaching a size of 10 by 10 cm. There are two groups of blades: small ones, about 1 cm wide and up to 5 cm long, and larger ones, 1 – 3 cm wide and up to 8 – 10 cm long. Some exceptional blades up to 4 cm wide and 12 cm long were recorded.

Without taking into account specimens with irregular marginal retouch, actual retouched tools are extremely rare in this context: a few irregular bifacial implements (possible preforms of leaf-shaped points), questionable burins, rare marginally retouched pieces, notches and denticulates.

A statistical sample of artifacts was collected from site 104 (see Tables 1, 2), which is a square of 3 by 3 m (28°04’33.4” N, 28°67’11.8” E) located at 282 m asl. It is in one of the summit areas attached to the bow of the mountain’s “horseshoe.” Typical dark brown to violet quartzite outcrops at the place, while a smaller outcrop of a reddish chert is situated nearby. The artifacts form a 20 – 30 m wide accumulation, descending on a slight slope from the outcrops towards the saddle. Altogether 212 artifacts were recorded within the analyzed 9 sq. m, which makes the mean artifact density 23.6 artifacts per sq. meter.

In comparison to the other mountain workshops, it seems that the importance and utility of Gebel el-Showish lies not only in the raw material outcrops themselves (which exist at other elevations as well), but also in its dominant position over the Bir el-Showish lake area.

“Black Mountain.” The “Black Mountain,” a dominant ridge located about 6 km further to the northeast (28°08’53.4” N, 28°70’29.0” E), at 320 m asl, provided another, smaller workshop of a similar character. The artifacts formed an accumulation 20 m in diameter on the top platform, and were also dispersed in the slope debris below. The other surveyed mountains with quartzite and chert outcrops at their summits had no artifacts at all, or just isolated finds and find scatters (the Unnamed Table Mountain, 28°14’92.9” N, 28°71’76.6” E; Miteili Radwani, 28°21’85.3” N, 28°74’94.9” E, and around).

Gebel el-Gharbi. A small workshop site was recorded on the surface of the Cretaceous limestone plateau of the Gebel el-Gharbi escarpment (28°03’46.5” N, 28°59’66.0” E). It is located southwest of Bir-el-Showish at 250 m asl. The working area, about 1.5 m in diameter, was attached to outcrops of a light-to-green banded chert. There was a large, partially worked core in the center, surrounded by about 10 large Levallois flakes that do not refit together. Other Levallois artifacts were dispersed on this plane at considerable distances from each other.

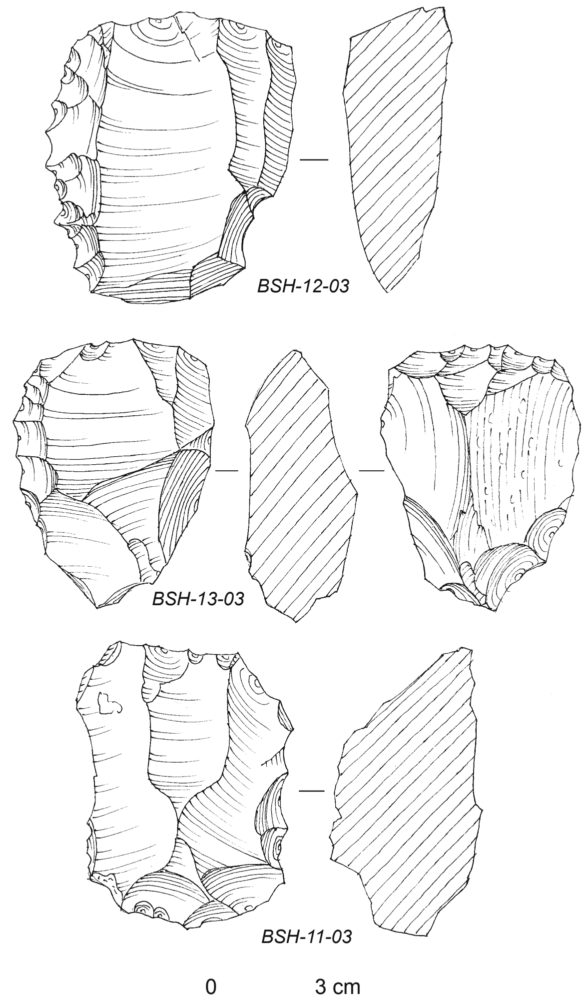

Fig. 9. Middle Paleolithic cores of quartzite. Gebel el-Showish.

An episode on the top of a table mountain

“White Mountain.” The “White Mountain” is an isolated Cretaceous limestone plateau rising to about 250 m asl. Actually, humans have not visited it recently, so the ancient surfaces remain untouched. The limestone is very poor in lithic raw materials – the only local source consists of very rare nodules of dark brown chert, only a few centimeters in size. Only rainwater could have been available at the site during more favorable episodes, as suggested by the erosional ridges on slopes. Nevertheless, one undisturbed artifact accumulation was located at a strategic location at the southern edge of the escarpment (sample 504, 28°10’96.7” N, 28°75’5.0” E) (see Table 1, 2). The size of the documented area was 4 by 7 m, with a west-to-east oriented long axis. The mean artifact density is 7.1 items per sq. meter (Fig. 10).

Fig. 10. "White Mountain," an episodic scatter of lithic artifacts of brown chert. Ridge of the limestone plateau is seen in the distance.

The dominant lithic material at this site was dark brown chert, accompanied by a smaller quantity of light grayish-striped chert. The main (easternmost) concentration was a circle of 2 m in diameter composed mostly of non-cortical flakes, blades, and chips. Cores are represented only by small exhausted specimens. Most flakes are about 3 by 4 cm in size, and the blades are about 2 by 5 cm (one blade of 3 by 9 cm is an exception). A smaller concentration, about 1 m in diameter, was adjacent to the west. The flakes here are slightly larger (5 by 6 cm), and cortical flakes are more frequent. Still further to the west, outside the main concentration, lay two flat cores, the largest found at this site (7 by 8 cm and 6 by 7 cm). Finally, about 6 m from the main concentration, there was a large isolated pointed flake of Levallois type, 7 by 12 cm, possibly the most important artifact at the site.

Thus, there seems to be a certain selection of artifacts from the west to the east according to size and type, with the primary flakes and the larger cores in the east, and accumulations of smaller flakes and chips in the west.

Summary

The variability of Middle Paleolithic site types recorded in the Bahariya oasis raises the classic question of chronological versus functional difference. Given the delimited character of the Middle Paleolithic occupations at the playas and the undifferentiated character of the workshops on the mountains, one may ask to what extent these are interrelated, and whether the morphological differences recorded in the artifacts reflect the classic settlement/workshop dichotomy. Naturally, human presence and activity at lithic material outcrops is archaeologically more "visible" than anywhere else, with the effect of a certain deformation if one aims to compare the artifact densities.

Leaf-shaped points, representing a diagnostic Middle Paleolithic tool-type, are recorded in the context of Saharan Aterian. At Bir Sahara and Bir Tarfawi, Aterian elements appeared early in the Middle Paleolithic, whereas in the Maghreb, the appearance of the typical Aterian is expected between 60 – 40 thousand years, but there is a lack of precision in these dates. A comparably late dating estimate for the Bahariyan Middle Paleolithic with leaf-shaped points would be in accord with the smaller dimensions of a segment of the cores and flakes, which are traditionally considered "late" in Nubia and Egypt.

The composition of the accompanying tool types, including retouched blades, sidescrapers, endscrapers, and Mousterian points, is typically Middle Paleolithic. Technologically, flat Levallois cores dominate, and some are quite small, without any visible tendencies towards the use of more volumetric core types or the production of crested blades or blades in general (Ilam remains between 10 and 16).

The workshops on the mountain tops most probably represent a longer exploitation period compared to the lowland settlements. The generally Levallois character of the production points to the Middle Paleolithic in the broadest sense of the word, but some of the "archaic" flakes on the one hand, and the few crested blades and smaller bladelets on the other, point to a higher technological variability than was recorded at the playa settlements. Certainly, some of the bifacial preforms suggest that at least some of this workshop activity corresponds to the Middle Paleolithic with leaf-shaped points, the most extended occupational horizon on the basal plain. However the quartzite originating from the mountain outcrops is rarely encountered on the playas. In addition, the blade index at the workshops is surprisingly higher than at the settlements (Ilam = 23). Thus, contrary to our expectations, there is no evidence of a direct import of products down from the mountains.

The Epi-Paleolithic (Late Stone Age)

As opposed to the earlier industries, which are widely dispersed across the landscape, the Epi-Paleolithic sites are smaller, more concentrated, and spatially restricted (Fig. 11). The settlement pattern is, in fact, reduced to two types of sites:

1) settlements surrounding ancient lakes and the playas. In this group, we can isolate sites located around lakes that were still active and resettled during historic (Roman) times, such as Bir el-Showish and Bir Ain-Naga, and sites around playas without later occupations.

Naturally, the second site type offers a greater potential for finding intact prehistoric surfaces and is more promising for surveys. At some of these sites, artifact density reaches 5 – 20 items per sq. meter. Until now, however, only two of them were analysed spatially and statistically (samples 103 and 203) (Tables 3, 4);

2) higher-elevation primary workshops at chert outcrops, with correspondingly higher artifact densities (Gebel Gharbi).

Settlements at ancient lakes

Bir el-Showish. This extended fossil lake**,** now partly covered by thick sand dunes, was intensively reoccupied during historic times (Bárta et al., 2003, 2004). Therefore, only individual bladelets and grindstones were recorded as intrusions within the Roman-period materials.

Bir Ain-Naga. Another, linear fossil lake, covered by thick sand dunes, was also intensively settled during historic times. Nevertheless, an intact artifact scatter, of 10 m in diameter, was identified at Bir Ain-Naga (sample 203, 27°98'02.2" N, 28°68'43.2" E). This assemblage included a backed point, a tanged point (Neolithic intrusion?), a blade burin, and laterally retouched blades (Fig. 12). The site was partially overlain by a shallow sand dune.

Umm el-Okhbain. The Umm el-Okhbain playa is surrounded by individual Epi-Paleolithic finds, but a structured site, consisting of a circle 6 m in diameter, was recorded above its northwestern shore (sample 103, 28°01'36.5" N, 28°65'80.3" E), at the entrance to a side wadi leading towards the west (see Fig. 5). Typologically, this sample included two elongated microlithic triangles, backed blades, and bilaterally retouched blades (Fig. 13). Larger stones were also concentrated in this area. Ostrich shells collected from the same settlement cluster provided two radiocarbon dates: 8155 ± 45 BP (GrA-26162) and 6920 ± 45 BP (GrA-26161).

Mannsaf. This smaller, circular playa provided individual finds and small artifact scatters on the surface of the lake sediments (28°02'48.7" N, 28°67'68.5" E). Two large grindstones of quartzite (28 by 20 by 12 cm and 36 by 22 by 13 cm), with impact marks on the working surface, were recorded in association with scattered cubical microblade cores, blades, bladelets, and flakes (Fig. 14).

"Under the Tooth" Playa. At this smaller, shallow playa, below a characteristic "tooth-shaped" mountain, we located an artifact scatter measuring 5.5 by 7 m and with artifact density of 5 – 10 pieces per sq. meter (28°11'33.37" N, 28°69'90.0" E). The assemblage comprises bipolar and unipolar microblade cores, numerous blades and bladelets (including pointed bladelets), and flakes. Larger stones and some ostrich eggshells were associated with

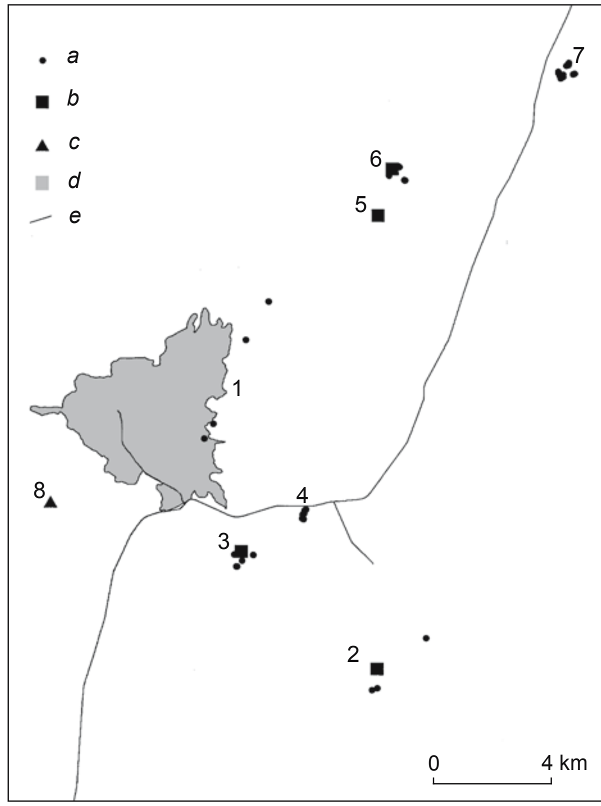

Fig. 11. Provisory map showing the location of Epi-Paleolithic sites in southern Bahariya.

1 – Bir el-Showish, 2 – Bir Ain-Naga (sample 203), 3 – Umm el-Okhbain (sample 103), 4 – Mannsaf, 5 –"Under the Tooth" Playa, 6 – GPS Playa, 7 – "Pyramid" Playa, 8 – Gebel Gharbi.

a – individual Epi-Paleolithic artifacts; *b* – larger settlements; *c* – primary lithic workshop; *d* – Bir el-Showish lake deposits; *e* – main roads.

Table 3. **Analyzed Epi-Paleolithic samples**

Parameters	Sample number*	
	103	203
Altitude (m asl)	150	130
Coordinates: N	28º01'36.5"	27º98'02."
E	28º65'80.3"	28º68'43.2"
Studied area, m	3 × 6	3 × 3
Number of artifacts	110	162
Artifact density (per sq. m)	6,1	18
Ilam	29	8
Cores (n)	–	2
Flakes (n)	70	140
Blades (n)	29	13
Retouched tools (n)	11	7

* 103: Umm el-Okhbain; 203: Bir Ain-Naga.

Table 4. **Typology of the Epi-Paleolithic industries**

Category	Sample number*	
	103	203
Elongate triangles	2	–
Backed points	2	1
Backed microblades	2	–
Tanged points	–	1
Burins	–	1
Laterally retouched blades	5	1
Retouched fragments	–	3
Total	11	7

*As in Table 3.

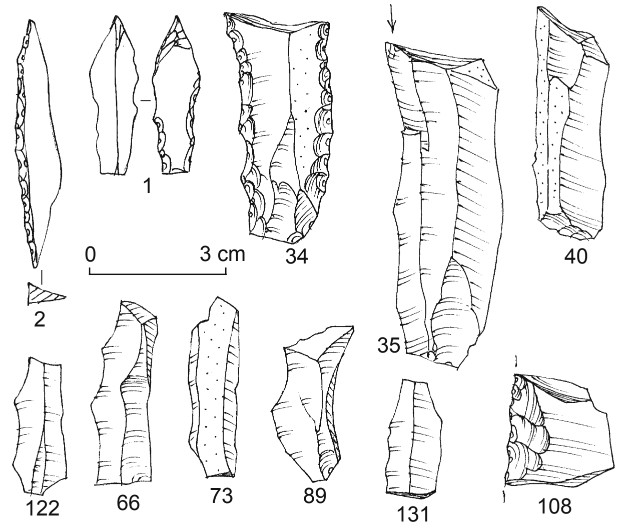

Fig. 13. Epi-Paleolithic industry (chert). Umm el-Okhbain.

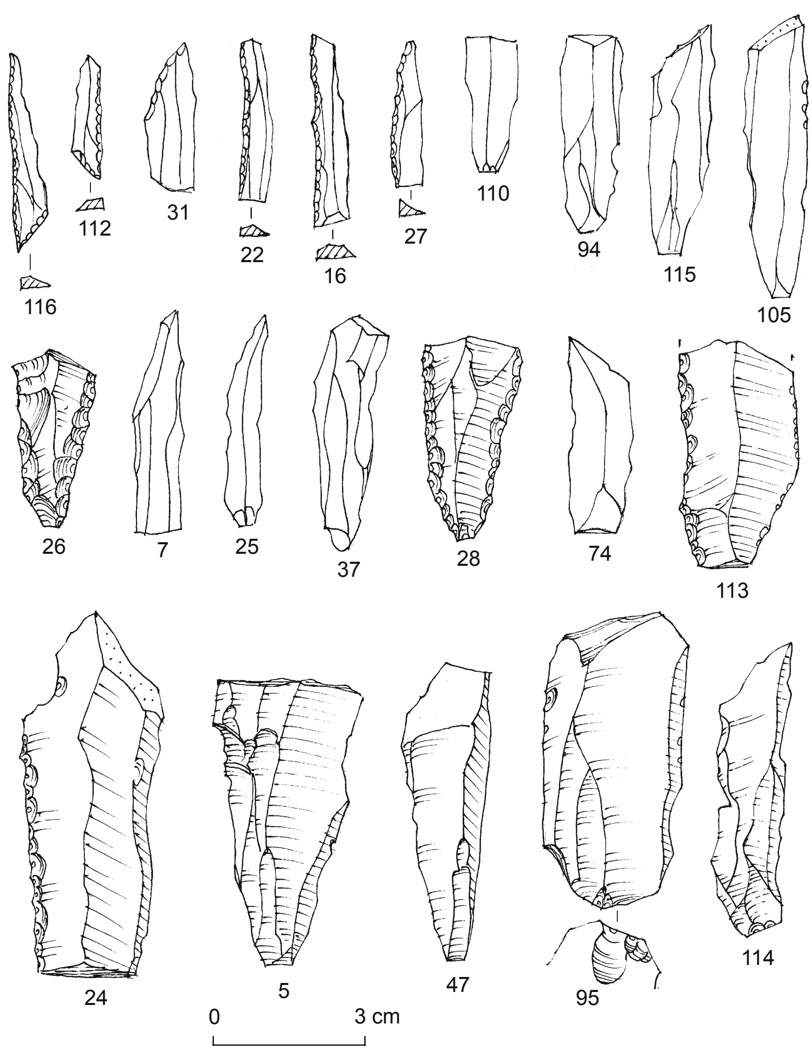

Fig. 12. Epi-Paleolithic industry (chert). Bir Ain-Naga.

this scatter. The area was partly covered by eolian sand.

GPS Playa. Survey of this shallow playa revealed two sites and isolated finds (flakes, grindstones) along the ancient shorelines. The eastern site (28°12’38.0” N, 28°70’72.1” E) provided two desk-shaped quartzite grindstones (22 by 14.5 by 2 cm and 21 by 13 by 2.5 cm) with impact marks on the working surface, surrounded by a few microblades and flakes (Fig. 15). The western site (28°12’72.0” N, 28°70’32.6” E) is formed by a dense, oval-shaped accumulation of artifacts, only 4 by 2.5 m in size, with a density of 15 – 20 pieces per sq. meter. Short (cubical) microblade cores (unipolar and bipolar), blades, bladelets, and flakes were recovered there.

“Pyramid” Playa. Only individual artifacts and smaller scatters were recorded on the shorelines of this extensive but shallow playa. A grindstone fragment associated with a scatter of cubical microcores, blades, and bladelets, about 5 m in diameter, was encountered (28°15’89.4” N, 28°75’59.0” E). Another scatter of artifacts, which were found widely

Fig. 14. Two quartzite grindstones *in situ*. Mannsaf Playa. Yardangs of the lacustrine deposits are seen behind.

Fig. 15. Quartzite palette found *in situ* at the ancient playa shores. GPS Playa.

dispersed from each other, includes a larger grindstone (30 by 30 by 12 cm) and several blades and cores.

Workshop

Gebel Gharbi (Gherd bir el-Gebel). The limestone plateau of the southwestern marginal escarpment is covered by a layer of chert pebbles containing rare artifacts. However, a specialised workshop for blade and microblade production, about 30 m in diameter, was recorded at the escarpment margin (28°02’81.5” N, 28°59’14.3” E). The lithic assemblage includes long prismatic and short cubical cores, and numerous blades struck from such cores, two of which could be refitted (Fig. 16).

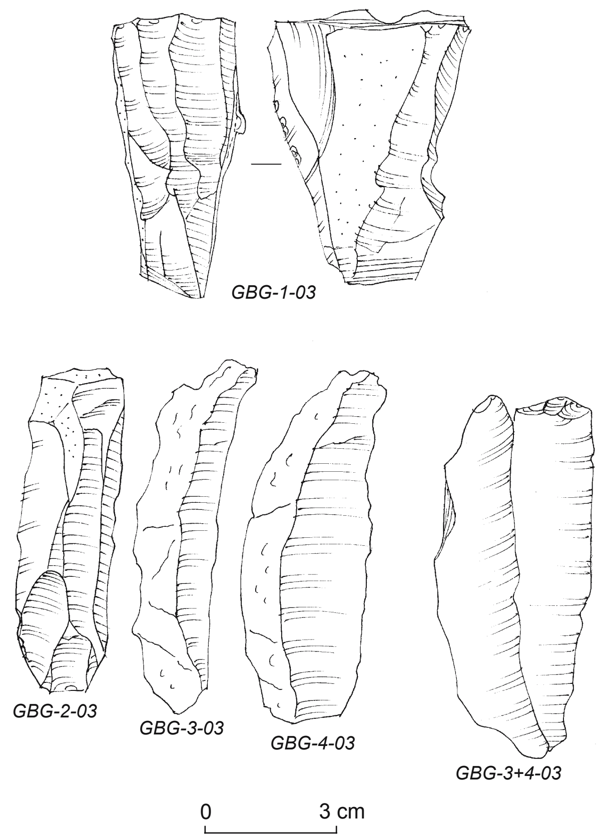

Fig. 16. Lithic industry from the Epi-Paleolithic workshop. Gebel Gharbi.

Summary

Even if only two of the Epi-Paleolithic sites were hitherto analyzed spatially and statistically (samples 103 and 203), certain general characteristics of the Epi-Paleolithic assemblage structure may be proposed. The primary workshop site at the chert outcrops of Gebel Gharbi shows an emphasis on the production of blades and microblades from prismatic and cubical, bipolar or unipolar cores. At the playa settlements, we encounter the same or similar types of chert, sometimes accompanied by quartzite. The cores at these secondary workshops are smaller and shorter, of a more cubical form, but still preferentially used for blade and microblade production. The curated tools are relatively rare. The diagnostic types are the microlithic triangles from Umm el-Okhbain, accompanied by current blades and microblades, retouched or backed. This latter site is radiocarbon dated relatively late (6 – 7 cal ka BC), but more dates from other sites are needed to locate the Bahariyan Epi-Paleolithic more precisely in time.

Typical finds at Epi-Paleolithic settlements are grindstones, mostly made of quartzite (see Fig. 14, 15;

cf. (Banks, 1980)). They are either large blocks or palettes, with visible traces of impact marks creating circular working areas on the working surfaces. Based on the character of the impact marks and analogies, these artifacts may have been used for grinding seeds and/or breaking harder plant tissues such as nuts, tubers, or roots, or even for grinding ochre. Another indication of their possible functions may be deduced from their context, i.e. the location within shoreline zones of the ancient lakes, together with a few flakes or blades, but preferably outside of the dense artifact concentrations.

Preliminary conclusions: Climate, settlement, and lithic technologies

In areas which are arid and hyperarid today, the archaeologically recorded periods of increased intensity of human settlement and activities may reflect certain humid periods in the past. Even if Bahariya is still little explored from this viewpoint, the preliminary results may suggest a meaningful picture (Table 5), especially if they can be correlated with similar results from other oases of the Western Desert.

The prehistoric occupation of southern Bahariya starts with rare Acheulian finds from the Bir el-Showish plain. The main trend that may be recognized during the subsequent Middle Paleolithic is the development of the bifacial Acheulian handaxes toward eventual fine leaf-shaped points (the latter associated with Mousterian points and flat-retouched sidescrapers), and probably also a tendency toward reduction in the size of cores and flakes. These trends are conservative in principle and do not display tendencies toward increased blade production or Upper Paleolithic technology. A parallel development, both in terms of settlement dynamics and technology, is recorded at the oases of Fayyoum and Kharga (Caton-Thompson, 1946), Dakhla (Schild, Wendorf, 1977; Marlow, Mills (eds.), 2000), Bir Sahara and Bir Tarfawi (Schild, Wendorf, 1981), etc.

However, the Middle Paleolithic period in Northeast Africa was climatically unstable, with several important fluctuations that possibly impacted cultural and technological developments (Paulissen, Vermeersch, 1987; Rognon, 1989). In addition, Northeast Africa as a whole displays a mosaic-like pattern composed of several technological trends, including the ones characterized by progressive laminar production.

In the Nile Valley, excavations in the Taramsa lithic exploitation area yielded an industry representing (on basis of numerous refittings) an adapted Levallois concept aimed to produce elongated blanks and blades, but with no associated Upper Paleolithic technology or tool types. OSL dates suggest that this “Taramsan,” in general, starts around 60 ka, while OSL dates of an associated burial pit containing a modern human child are more variable and less clear (Van Peer, 2004; Van Peer, Vermeersch, 2005). After 37 ka BP, the tendency towards leptolithization in the Nile Valley culminates in the Upper Paleolithic industry of Nazlet Khater, associated with additional modern human burials (Vermeersch, 2002; Crevecoeur, Trinkaus, 2004).

In Cyrenaica, the Haua Fteah cave (McBurney, 1967) provided another important sequence of industries. It starts with Middle Paleolithic blade industries (“Preaurignacian” of McBurney), followed by a Levallois-dominated flake Mousterian and then the Dabba culture with advanced backed blade technology and Upper Paleolithic tool types (radiocarbon dated to 31 – 26 ka). Following the calculation by Bordes (1976 – 1977), backed blades make up 25 – 47 % of tools, burins – 18 – 23 %, and endscrapers – 12 – 22 %, whereas *chanfreins* are important only in the lower Dabban layers. It should be repeated here that the Haua Fteah cave evidence strongly calls for a continuation of fieldwork, fresh evidence and new dates, should we wish to proceed further in understanding Northeast African prehistory.

Together with related industries of western Asia (Emirian and Ahmarian), parts of Northeast Africa were an important center of technological advancement and acceleration. In this sense, the Taramsan in the Nile Valley and the Dabba culture in Cyrenaica (even if in

Table 5. **Summary table of settlements around the fossil lakes and playas**

Settlement/playa	Bir el-Showish	Bir Ain-Naga	Umm el-Okhbain	Mannsaf	“Tooth”	GPS	“Pyramid”
Acheulean	Rare	–	–	–	–	–	-
Middle Paleolithic	»	Rare	Abundant	Abundant	–	Very rare	Very rare
Epi-Paleolithic	»	Abundant	»	Rare	Abundant	Abundant	Rare
Historic	Abundant	»	Very rare	Very rare	–	–	Very rare

a different sense in each region) possibly impacted the origin and dispersal of larger cultural entities encountered later in Eurasia: the Levallois-leptolithic industries such as the Bohunician in the first case, and the backed blade industries such as the Gravettian in the second case (Svoboda, 2005).

The Middle Paleolithic with leaf-shaped points, as encountered in Bahariya, contributed little to these progressive trends. Because of the absence of archaeological evidence after the Middle Paleolithic and before the Epi-Paleolithic at Bahariya, we may even expect its longer persistence in this region. However, the cool, windy, and dusty period of "Upper Paleolithic hyperaridity" or "Ogolian desert," as recorded in both the Nile Valley and the Sahara (Paulissen, Vermeersch, 1987; Rognon, 1989) also suggests the more likely possibility that Bahariya remained unsettled during this time period.

The Epi-Paleolithic occupation opens the Holocene history of southern Bahariya. The settlement is related to a period of increased humidity and closely tied to the shorelines of ancient lakes (see Table 5). The first two radiocarbon dates from Umm el-Okhbain are relatively late for the Epi-Paleolithic, around 6 – 7 cal ka BC, but they fit well with the radiocarbon evidence for increased human activity during both the Epi-Paleolithic and Neolithic at other oases in the Western Desert (Fayyum, Farafra, Dakhla, etc.) (Kobusiewicz, 1976; Barich, Hassan, 2000; Nicoll, 2001).

No clear evidence of Neolithic occupation, either in the form of pottery or diagnostic lithics, has hitherto been recorded in southern Bahariya (with the possible exception of a tanged point (see Fig. 13, *1*)). The historic occupation, especially late Roman, shows a dramatic increase in population and in the range of activities, but at the same time, a spatial restriction to the largest, now mostly sand-covered lakes such as Bir el-Showish, Bir Ain-Naga, Riz area, etc. (Bárta et al., 2003, 2004). A few of the playas (Umm el-Okhbain, Mannsaf, "Pyramid") produced some rare potsherds of historic age, but others show no trace of human occupation later than the Epi-Paleolithic ("Under the Tooth" and "GPS" playas) and these were evidently dry during historic times. This settlement pattern (see Table 5), therefore, provides indirect evidence of progressive desertification of the Bahariyan landscape after the Epi-Paleolithic.

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References

Banks K.M. 1980
The grinding implements of Wadi Kubbaniya. In *Loaves and Fishes: Prehistory of Wadi Kubbaniya*, F. Wendorf, R. Schild, A.E. Close (eds.). Dallas: Southern Methodist Univ., pp. 239 – 244, 358 – 363.

Barich B.E., Hassan F.A. 2000
A stratified sequence from Wadi el-Obeiyd, Farafra: New data on subsistence and chronology of the Egyptian Western Desert. In *Recent Research into the Stone Age of Northeastern Africa*, L. Krzyzaniak (ed.). Poznań: pp. 11 – 20. (Studies in African Archaeology; vol. 7).

Bárta M., Bruna V., Černý V., Musil J., Svoboda J.A., Verner M. 2004
Report on the survey and trial excavations of the Czech Institute of Egyptology, carried in the area of El-Hayez, Baharia Oasis (Second season, 6.3. – 31.3. 2004). *Přehled výzkumů*, vol. 45: 23 – 28.

Bárta M., Bruna V., Svoboda J.A., Verner M. 2003
El-Hayez, Bahariya oasis, Egypt. First survey report by the Czech Institute of Egyptology. *Přehled výzkumů*, vol. 44: 11 – 16.

Bordes F. 1976 – 1977
Le paléolithique hors d'Europe. Bordeaux: Univ. de Bordeaux, Inst. de Quaternaire.

Caton-Thompson G. 1946
The Levalloisian industries of Egypt. *Proceedings of the Prehistoric Society*, vol. 12: 57 – 120.

Crevecoeur I., Trinkaus E. 2004
From the Nile to the Danube: A comparison of the Nazlet Khater 2 and Oase 1 Early Modern Human mandibles. *Anthropologie*. Vol. 42: From the Nile to the Danube, pp. 203 – 213.

Fakhry A. 1942
The Egyptian Deserts. Bahria Oasis, vol. 1. Cairo: Government Press.

Hassan F.A. 1979
Archaeological explorations at Baharia Oasis and the West Delta, Egypt. *Current Anthropology*, vol. 22: 806.

Kobusiewicz M. 1976
The prehistory of North-Eastern Africa between the sixteenth and fifth millenium B.C. *Preglad Archeologiczny*, vol. 24: 5 – 102.

Marlow C.A., Mills A.J. (eds.) 2000
Dakhleh Oasis Project. Oxford. (Oxbow Monographs in Archaeology; N 6).

McBurney C.B.M. 1967
The Haua Fteah (Cyrenaica) and the Stone Age of the South-East Mediterranean. Cambridge: Cambridge Univ. Press.

Nicoll K. 2001
Radiocarbon chronologies for prehistoric human occupation and hydroclimatic change in Egypt and Northern Sudan. *Geoarchaeology*, vol. 16: 47 – 64.

Paulissen E., Vermeersch P. 1987
Earth, man and climate in the Egyptian Nile Valley during the Pleistocene. In *Prehistory of Arid North Africa*, A. Close (ed.). Dallas: Southern Methodist Univ. Press, pp. 29 – 67.

Rognon P. 1989
Variations de l'aridité au Sahara depuis 125 000 B.P., en relation avec les "contraintes" orbitales et glaciaires. *Bull. Soc. géol. France*, vol. 5: 13 – 20.

Schild R., Wendorf F. 1977
The Prehistory of Dakhla Oasis and Adjacent Desert. Wrocław, Warszawa, Kraków, Gdańsk: PAN.

Schild R., Wendorf F. 1981
The prehistory of an Egyptian Oasis. Wrocław, Warszawa, Kraków, Gdansk, Łódź: PAN

Svoboda J. 1980
Le gisement acheuléen de Germa, Wadi Ajjal, Libye. *Anthropologie*, vol. 18: 209 – 224.

Svoboda J. 2004
The Middle Paleolithic of Southern Bahariya Oasis, Western Desert, Egypt. *Anthropologie.* Vol. 42: From the Nile to the Danube, pp. 227 – 241.

Svoboda J. 2005
Near East and Northern Eurasia: Analyzing and interpreting technologies with overcontinental distribution. In *Rethinking the Human Revolution*, P. Mellars et al. (eds.). Cambridge. Preprint, pp. 68 – 69.

Van Peer P. 2004
Did Middle Stone Age moderns of Sub-Saharan African descent trigger an Upper Paleolithic revolution in the lower Nile Valley? *Anthropologie*. Vol. 42: From the Nile to the Danube, pp. 215 – 225.

Van Peer P., Vermeersch P. 2005
An interpretation of behavioral change in North-East Africa during the Late Middle and Early Upper Pleistocene with a specific focus on the Taramsa 1 burial. In *Rethinking the Human Revolution*, P. Mellars et al. (eds.). Cambridge. Preprint, pp. 76 – 77.

Vermeersch P. 2002
Two Upper Paleolithic burials at Nazlet Khater. In *Palaeolithic Quarrying Sites in Upper and Middle Egypt*, P.M. Vermeersch (ed.). Leuven: pp. 273 – 282. (Egyptian Prehistory Monographs; N 4).

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LITHIC TECHNOLOGY AND THE TRANSITION FROM THE MIDDLE TO UPPER PALEOLITHIC IN KOREA

Introduction

During the last decade, some important sites demonstrating the gradual development of lithic technology from the Middle to Upper Paleolithic have been excavated in Korea (Fig. 1). These include Jungnae-ri near Suncheon City (Lee G.K. et al., 2000), Dosan in the Hwasun County (Lee G.K., 2002a), Gorye-ri in the Milyang County (Park, Seo, 2004), Wolpyeong near Suncheon City (Lee G.K., 2002b; Lee G.K. et al., 2004), Noen-dong (Han et al., 2003) and Yongho-dong near Daejeon City (Han, 2002), Jingeneul in the Jinan County (Lee G.K., 2004a), Hahwagae-ri in the Hongcheon County (Choi, 2004), Jangheung-ri near Jinju City (Park, Seo, 2004), Hopyeong-dong in the Namyangju County (Hong, 2003, 2004), Jeongok-ni in the Yeoncheon County (Bae et al., 2001), Geumpa-ri in the Paju County (Bae, 1999; Bae, Kim, 2004), and Bukgyo-ri Sinbuk in the Jangheung County (Lee G.K., 2004b).

The sites of Jungnae-ri, Yongho-dong, and Hahwagae-ri have four Middle to Upper Paleolithic cultural layers, and the sites of Gorye-ri, Jingeuneul, Hopyeong-dong, Jangheng-ri, Sinbuk, and Wolpyeong contain from one to four Upper Paleolithic cultural layers (Fig. 2, 3). Most of the sites yield typical artifacts such as blade cores, microblade cores, endscrapers, burins, and tanged points. Reliable radiocarbon dates have been recently obtained for many of the sites.

New data have enabled researchers to establish a scientifically sound chronology of the Korean Paleolithic and to understand the process of cultural development. In this article, the Middle to Upper Paleolithic transition in Korea will be discussed in terms of raw material selection, knapping technique, and tool types.

Raw material selection

There were changes in raw material selection during the Middle to Upper Paleolithic transition. During the Middle Paleolithic, vein quartz, quartzite, and tuff were the main raw materials used, while during the Upper Paleolithic,

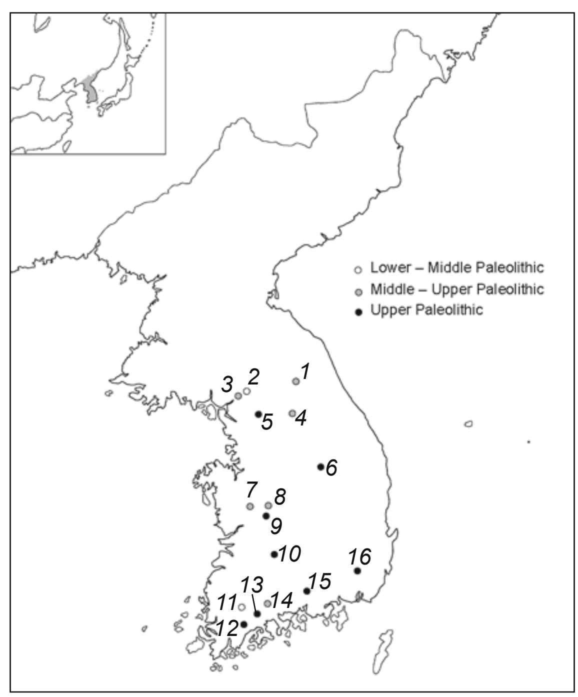

Fig. 1. Map showing the location of typical Paleolithic sites in Korea.
1 – Sangmuryong-ri; *2* – Jeongok-ni; *3* – Geumpa-ri; *4* – Hahwagae-ri; *5* – Hopyeong-dong; *6* – Suyanggye; *7* – Seokjang-ni; *8* – Yongho-dong; *9* – Noen-dong; *10* – Jingeneul; *11* – Dosan; *12* – Sinbuk; *13* – Wolpyeong; *14* – Jungnae-ri; *15* – Jangheung-ri; *16* – Gorye-ri.

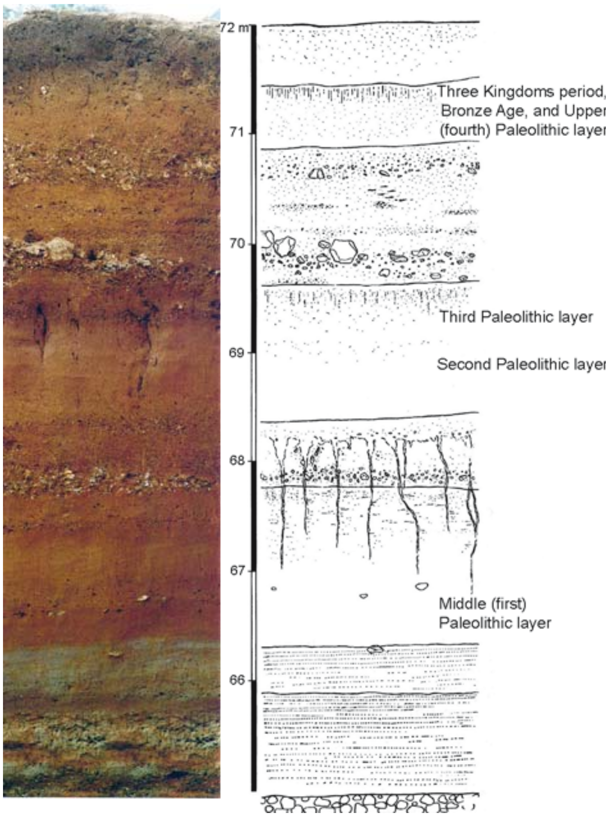

Fig. 2. Stratigraphic profile of Jungnae-ri.

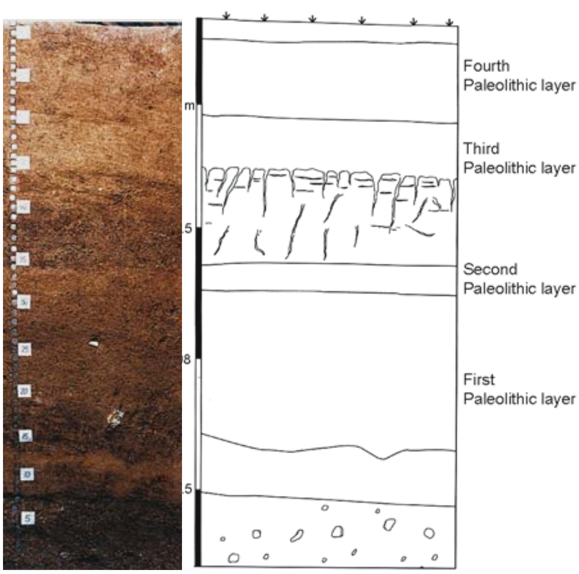

Fig. 3. Stratigraphic profile of Wolpyeong.

rhyolite, hornfels, siliceous shale, obsidian, hyalite quartz, and high quality vein quartz supplemented these materials.

Generally, high quality vein quartz was easier to obtain than rhyolite, hornfels, siliceous shale, obsidian, and hyalite quartz. Therefore, it was used for knapping flakes and making most tools such as choppers, chopping tools, spheroids, small handaxes, endscrapers, sidescrapers, notches, and awls among others. The quartz vein could easily be modified to produce the flat bottom surface of various scrapers.

Rhyolite, hornfels, siliceous shale, obsidian, and hyalite quartz are harder and more homogeneous, elastic, and fine grained than tuff and quartzite. They were mainly used for knapping blades and microblades and for manufacturing elaborate tools like tanged points, thick bifacial points, and burins.

In the lithic assemblages of the Jungnae-ri, Hopyeong-dong, and Wolpyeong sites, the share of artifacts made of high quality vein quartz was 70 – 90 %, and that of rhyolite, hornfels, siliceous shale, obsidian, and hyalite quartz was 10 – 30 %.

In southern Korea, in addition to high quality vein quartz, the primary raw material was rhyolite and the secondary ones were hyalite quartz and obsidian. In the Chungcheong Province of central Korea, the primary raw materials were siliceous shale and hornfels and the secondary one was obsidian. In the Gangwon and Gyeonggi Provinces of central Korea, the primary raw material was obsidian and the secondary one was hyalite quartz or rhyolite.

This pattern is closely associated with the distribution of raw materials. Obsidian sources are located in the central and northern parts of Korea, while rhyolite is distributed broadly in its southern part.

Throughout the Middle to Upper Paleolithic transitional period, mainly pebbles were used in the manufacture of stone artifacts. Most of the raw materials were brought from stream beds near the sites, but obsidian was imported or exchanged from outside.

Knapping technique

Three primary reduction strategies (flake, blade and micro-blade production) and several secondary treatment techniques have been identified in the Middle and Upper Paleolithic assemblages.

In the Middle Paleolithic, two kinds of flaking technique were practiced. One is typical hard hammer percussion for detaching ordinary flakes (Fig. 4); the other technique is the so-called “swing method” for knapping large flakes (12 cm and larger) from a large boulder (exceeding 20 cm in diameter). The swing method (Fig. 5) consists of smashing a boulder placed between the legs with a large hammer stone (Schick, Toth, 1993: 246 – 247). A tuff core knapped by the swing method from the Jungnae-ri site shows that scars resulting from previous removals were utilized as striking platforms for later removals. Successive flaking could have been executed in multiple directions and large, medium

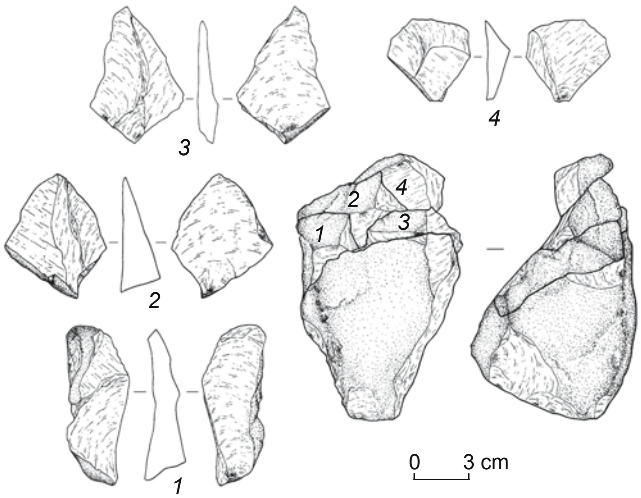

Fig. 4. Refitted core and flakes of vein quartz from cultural layer 1 of Jungnae-ri.

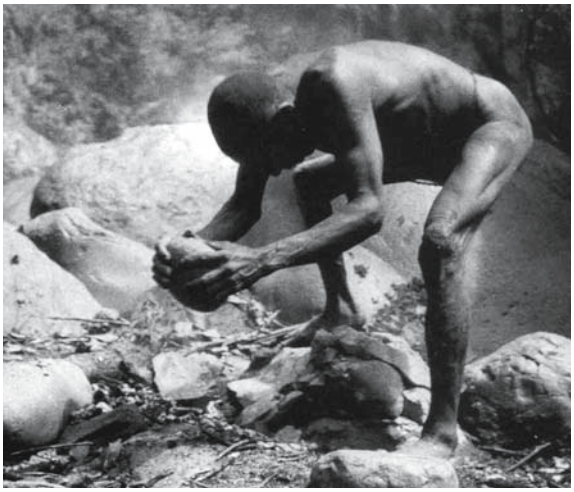

Fig. 5. Technique of knapping stone (Schick, Toth, 1993).

(7 – 12 cm), and small (7 cm and smaller) flakes were detached (Fig. 6).

Comparison of the Middle and Upper Paleolithic flakes has demonstrated that on the latter, the proportion of small flakes is higher, the butts (residual striking platforms) are smaller, traces of preparation are more distinct, and the bulbs of percussion are less prominent than on the former. These characteristics show that the knapping technique had certainly improved by the Upper Paleolithic.

During the Upper Paleolithic, anvils were utilized at Jungnae-ri for stone knapping using the well-known bipolar technique as well as hard hammer percussion after resting the blank obliquely on an anvil. The former was applied to high quality vein quartz for detaching small, narrow, and thin flakes, while the latter method had the advantage of getting more flakes from small and hard materials like rhyolite (Fig. 7, 8).

Typical blade technology appeared and prevailed during the Upper Paleolithic. Large quantities of blade cores and blades along with crested blades, striking platform rejuvenation flakes, "plunging" flakes and conjoining pieces of cores and blades were found at the Gorye-ri and Jingeunel sites (Fig. 9).

The blade cores can be classified into pyramidal, prismatic, and irregular types. Blades from the lower layer of Gorye-ri average 10 cm in length, while blades from the upper layer are approximately 20 cm long (Park, Seo, 2004). These blades were often modified into tanged points, burins, and endscrapers.

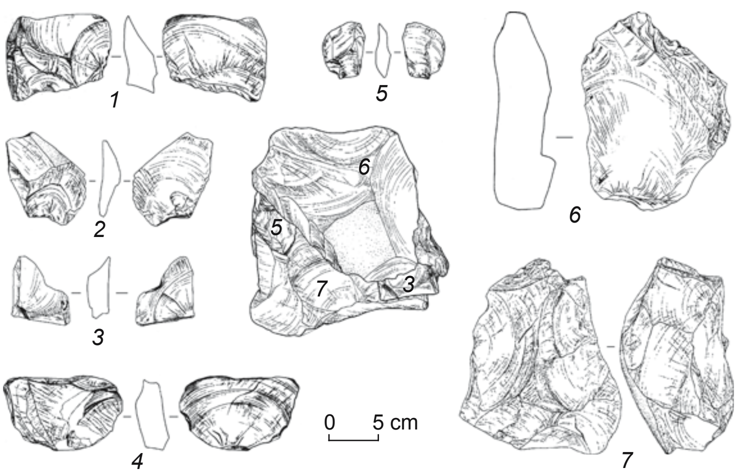

Fig. 6. Refitted tuff core and flakes from cultural layer 1 of Jungnae-ri.
1 – 6 – flakes; *7* – core.

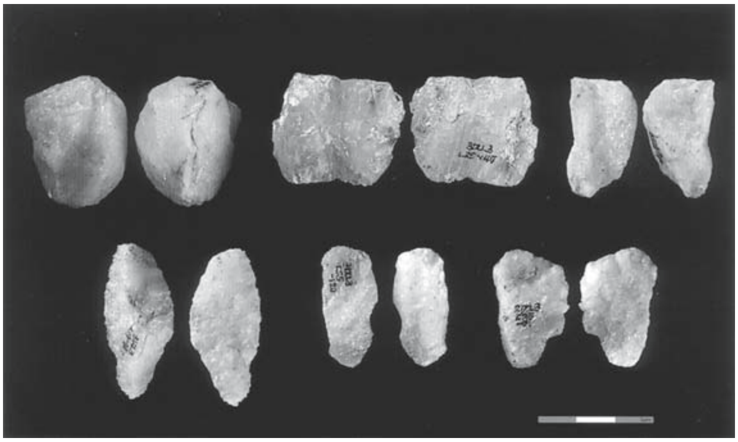

Fig. 7. Bifacial cores and flakes from cultural layer 4 of Jungnae-ri.

Fig. 8. Refitted rhyolite core and flakes from cultural layer 4 of Jungnae-ri.

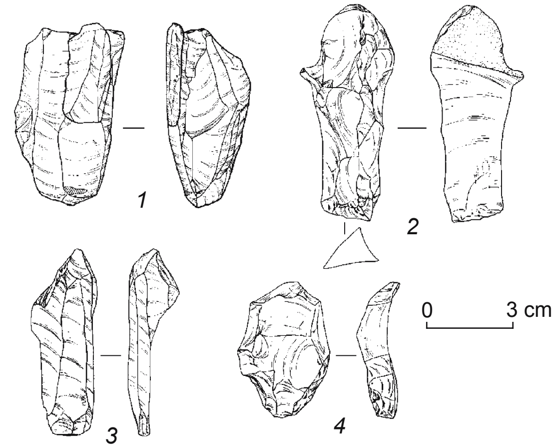

Fig. 9. Blade-based industry from Jingeneul.
1 – refitted blade core and blades; *2* – crested blade; *3* – "plunging" flakes; *4* – rejuvenation spall.

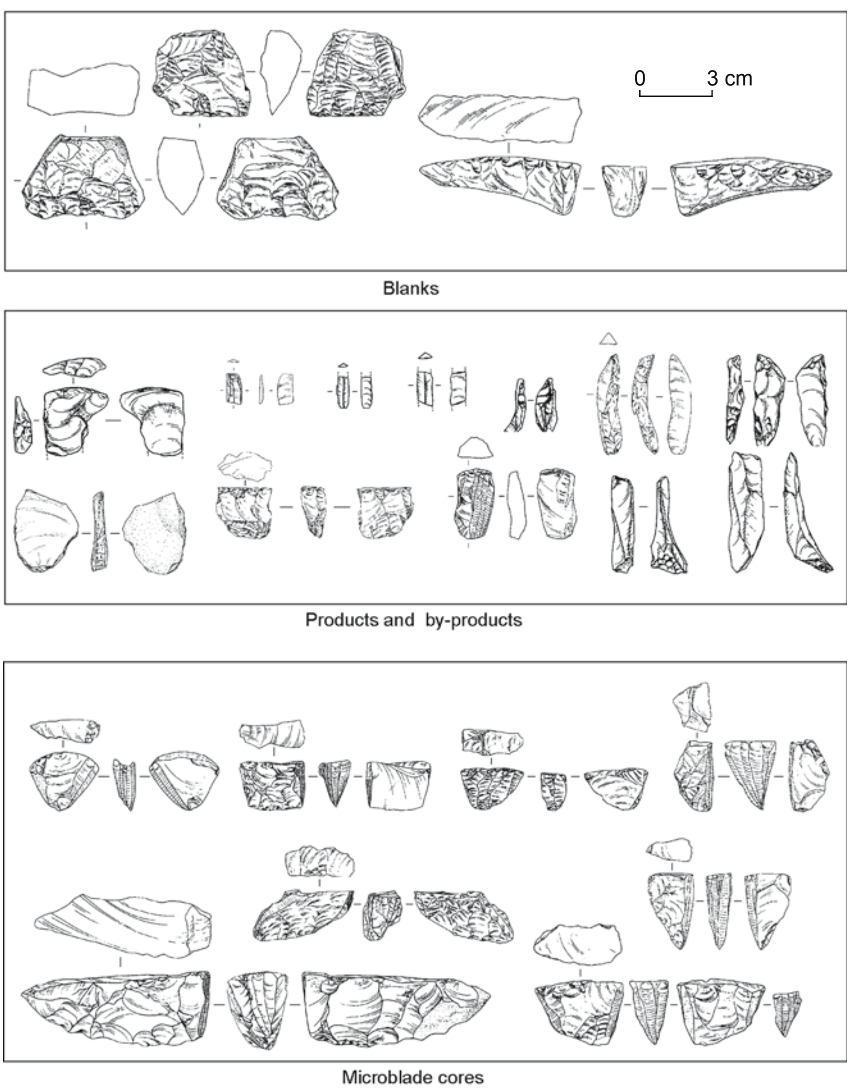

Fig. 10. Microblade-based industry from Wolpyeong.

Plenty of microblade cores were unearthed from Suyanggye (Lee Y.J., 1985), Sinbuk, Jangheung-ri, Hopyeong-dong, Seokjang-ni (Sohn, 1993), Sangmuryong-ri (Hwang, Shin, 1989), and Wolpyeong. Along with cores, ski-like spalls, crested blades, and platform rejuvenation flakes were also found (Fig. 10). A bifacial piece (Yubetsu type) or a flake was used as a blank for microblade core production. The microblade cores can be divided roughly into four categories according to their forms: boat-shaped, wedge-shaped, pyramidal, and irregular. Among these, the Yubetsu, Horoka, Lankoshi, Togeshita, and Hirosato types are identified (Fig. 11).

Tool types

The Middle Paleolithic toolkit includes not only heavy duty implements such as choppers, chopping tools, handaxes, cleavers, picks, polyhedrons, spheroids, but also light instruments like scrapers, notches, denticulates, and awls (Fig. 12). During the Upper Paleolithic, the proportion of heavy duty tools decreased markedly and handaxes were smaller. New types of tools such as tanged points, trihedral points, leaf-

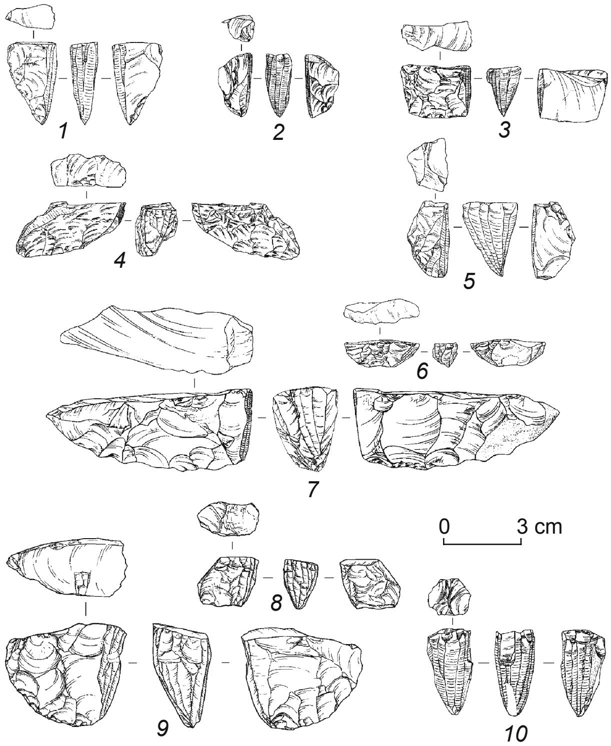

Fig. 11. Various types of microblade cores.
1 – 7 – Wolpyeong; *8*, *9* – Sinbuk; *10* – Geumseng.

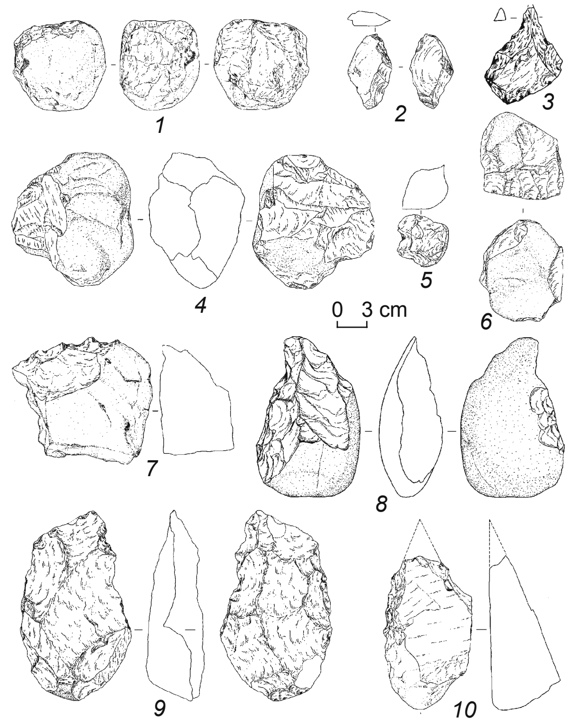

Fig. 12. Middle Paleolithic industry from Dosan (*1*, *2*, *4 – 7*, *10*), Jungnae-ri (*3*), Noen-dong (*8*), and Hwagok (*9*), Jeollanam-do Province.
1 – semi-spheroid; *2* – scraper; *3* – awl; *4* – chopping tool; *5* – notch; *6* – large scraper; *7* – chopper; *8* – handaxe; *9* – cleaver; *10* – pick.

shaped bifacial points, endscrapers, and burins appeared (Fig. 13). These new implements were very good for hunting animals and processing skin, wood, bone, and antler.

Endscrapers and burins were made on flakes and blades. Endscrapers are represented by fan-shaped, boat-shaped, nose-shaped (museau), thumb-shaped, and round varieties (Fig. 14). Assemblages also contain various simple and multiple angle and longitudinal burins on breaks and truncations (Fig. 15). These tools are similar to European Upper Paleolithic implements (Piel-Desruisseanu, 1986; Inizan et al., 1999).

Unexpectedly, an adze (axe) with an abraded edge, whetstones, a flaked and ground slab, pecked and ground pebbles and microblades were unearthed at Sinbuk (Fig. 16). The AMS dates for the site range from 18,500 – 25,500 BP. Axes with ground edges were also found at the Jangheung-ri and Songchon-dong sites near Jeonju City (Lee H.W., 2004). This demonstrates that in Korea, the grinding technique was adopted during the middle Upper Paleolithic and that a comparison with early Upper Paleolithic axes from Japan (Otake, 2004) should be conducted.

Conclusions

The Middle to Upper Paleolithic transition was characterized by changes in knapping technique, raw

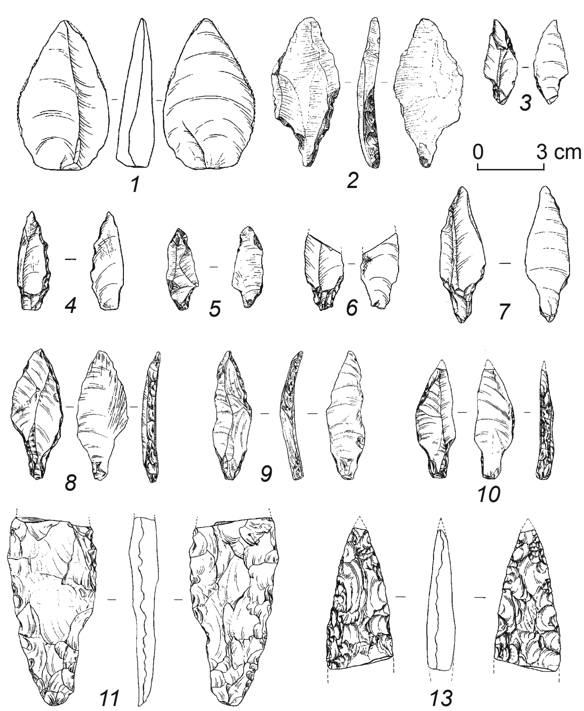

Fig. 13. Tanged points (*1 – 10*) and heavy bifacial points (*11 – 13*).
1 – 6, *11* – Wolpyeong; *7*, *12* – Sinbuk; *8 – 10* – Jingeneul.

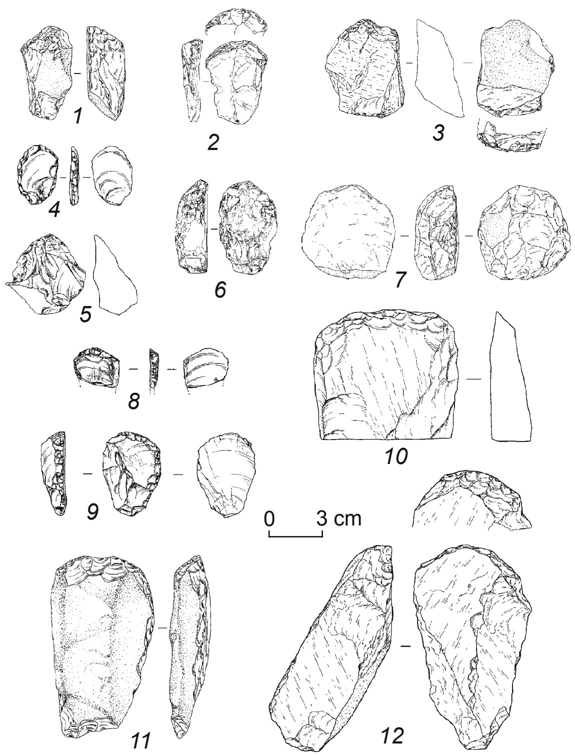

Fig. 14. Endscrapers of various types from Wolpyeong (*1 – 7*), Sinbuk (*8 – 10*), and Jingeneul (*11*, *12*).
1, *3* – nose-shaped; *2*, *9* – fan-shaped; *4*, *8* – thumb-shaped; *5*, *6* – boat-shaped; *7* – round; *10 – 12* – large.

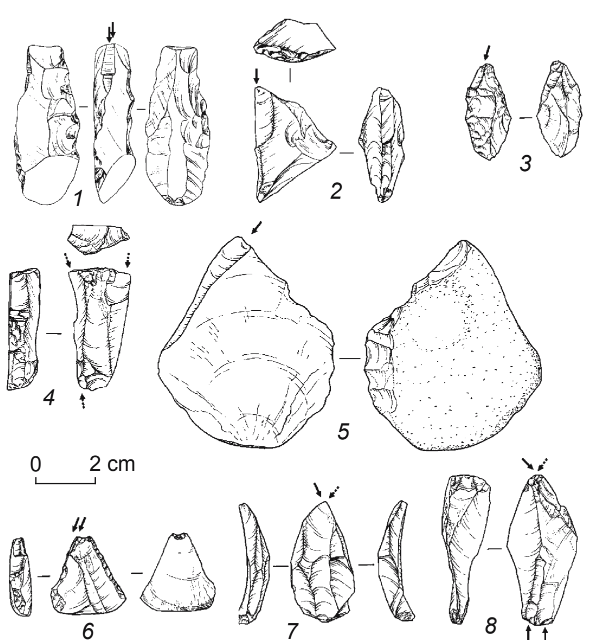

Fig. 15. Burins of various types from Wolpyeong (*1*, *2*) and Sinbuk (*3 – 8*).
1 – simple angle burin on transverse break; *2* – simple angle burin on truncation; *3* – simple dihedral burin; *4* – multiple angle burin on a transverse spall; *5* – simple dihedral burin on truncation; *6* – simple angle burin on truncation; *7* – simple burin (*déjeté*); *8* – multiple dihedral burin.

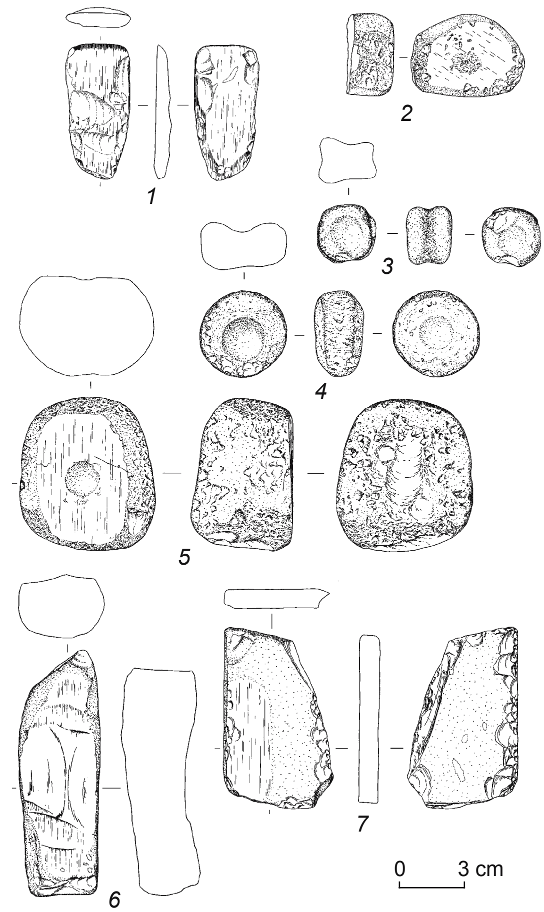

Fig. 16. Ground lithic artifacts from Sinbuk.
1 – adz (ax) with ground edge; *2 – 5* – pecked and ground pebbles; *6* – whetstone; *7* – flaked and ground slab.

material selection, and tool types. First of all, large flakes (12 cm and larger) almost disappeared and blades and microblades prevailed. Secondly, more homogeneous, elastic, fine-grained, and hard rocks (rhyolite, siliceous shale, obsidian, and hyalite quartz) were utilized; some of them were transported and imported. Thirdly, more refined tools such as typical endscrapers, burins, and points of various kinds appeared.

The development of new flaking techniques and the procurement of suitable raw materials enabled Upper Paleolithic humans to make more refined and smaller tools. Blades were the main blanks for tanged points, burins, and endscrapers. Microblades were essential elements for composite tools. In addition, the grinding technique was employed.

The Korean Middle Paleolithic lithic assemblages, including large flakes, are very similar to the Dingcun assemblages in China (Pei et al., 1958; Wang et al., 1994). It is notable that the Levallois technique prevailing in Siberia has not yet been recorded on the Korean Peninsula (Derevianko, Petrin, Rybin, 2000).

Archaeological investigations have shown that during the Upper Paleolithic, Korea constituted a part of the Northeast Asian Paleolithic province where microblade industries were distributed. On the other hand, there are locally distinctive features present such as numerous tanged points, the co-existence of microblade cores and tanged points, and partially polished adzes (axes).

Acknowledgments

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References

Bae K.D. 1999
The Geumpa-ri Paleolithic Site. Seoul: National Research Inst. of Cultural Properties, (in Korean).
Bae K.D., Hong M.Y., Lee H.Y., Kim Y.Y. 2001
Jeongokni Paleolithic site. Ansan: Inst. of Cultural Properties of Hanyang Univ, (in Korean).
Bae K.D., Kim D.I. 2004
The Paju Geumpa-ri Paleolithic site. In *Proceeding of Korean Paleolithic Symposium*. Seoul: Korean Paleolithic Society, pp. 67 – 74, (in Korean).
Choi B.K. 2004
Paleolithic and Mesolithic of Hahwagae-ri III site in the Hongcheon County. In *Proceeding of Korean Paleolithic Symposium*. Seoul: Korean Paleolithic Society, pp. 27 – 32, (in Korean).
Derevianko A.P., Petrin V.T., Rybin E.P. 2000
The Kara-Bom site and the characteristics of the Middle to Upper Paleolithic transition in the Altai. *Archaeology, Ethnology and Anthropology of Eurasia*, N 2 (2): 33 – 52.
Han C.G. 2002
Daejeon Yongho-dong Paleolithic site. In *Paleolithic Studies in Northeast Asia*. Ansan: Inst. of Cultural Properties of Hanyang Univ., pp. 163 – 171, (in Korean).
Han C.G., Kim K.W., You K.J., Heo S.Y., Jeon I.K., Seo D.W., Gu J.J. 2003
Daejeon Noeun-dong Site. Daejeon: Hannam Univ. Museum, (in Korean).
Hong M.Y. 2003
Second Preliminary Report of Hopyeong-dong Site in the Namyangju County. Suwon: Inst. of Cultural Properties of Gijeon, (in Korean).
Hong M.Y. 2004
Third Preliminary Report of Hopyeong-dong Site in the Namyangju County. Suwon: Inst. of Cultural Properties of Gijeon, (in Korean).
Hwang W.H., Shin B.S. 1989
Excavation of the Kyeonghee University. In *Sangmuryong-ni*. Chuncheon: Gangwon Univ. Museum, pp. 481 – 660, (in Korean).
Inizan M.-L., Reduron-Ballinger M., Roche H., Tixier J. 1999
Technology and Terminology of Knapped Stone. Nanterre: Cercle de Recherches et d'Etudes Préhistoriques.
Lee G.K. 2002a
Hwasun Dosan Paleolithic Site. Gwangju: Chosun Univ. Museum, (in Korean).
Lee G.K. 2002b
Suncheon Wolpyeong Site: Excavations in 1998. Gwangju: Chosun Univ. Museum, (in Korean).
Lee G.K. 2004a
The Jingeuneul Upper Paleolithic site in the submerged area near the Yongdam dam in the Jinan County and its significance. In *Honam Gogo Hakbo 19*. Gwangju: Honam Archaeological Society, pp. 5 – 23, (in Korean).
Lee G.K. 2004b
The Sinbuk Upper Paleolithic site in the Jangheung County, Jeollanamdo Province, Korea. In *Evaluating the Cultural Features of the Sinbuk Upper Paleolithic Site in the Northern Asia*. Gwangju: Chosun Univ. Museum, pp. 31 – 38, (in Korean).
Lee G.K., Choi M.N., Kim E.J. 2000
Suncheon Jungnae-ri Site. Gwangju: Chosun Univ. Museum, pp. 1 – 276, (in Korean).
Lee G.K., Kim E.J., Kim S.J., Yoon J.G., Kim S.A. 2004
Suncheon Wolpyeong Site: Excavations in 2001. Gwangju: Chosun Univ. Museum, (in Korean).
Lee H.W. 2004
Preliminary excavation report of the Songchon-dong site at Jeonju City. N.p.: Inst. of Cultural Properties of Jeonbuk, (in Korean).
Lee Y.J. 1985
Excavation Report of Suyanggae Paleolithic Site in Danyang. Cheongju: Chungbuk Univ. Museum, pp. 101 – 252, (in Korean).
Otake N. 2004
Polished stone axes of the Paleolithic Period in the Japanese Archipelago. In *Evaluating the Cultural Features of the Sinbuk Upper Paleolithic Site in the Northern Asia*. Gwangju: Chosun Univ. Museum, pp. 125 – 135, (in Japanese).
Park Y.C., Seo Y.N. 2004
Milyang Goryeo-ri and Jinju Jiphyeon Jangheung-ri sites. In *Twentieth Anniversary of Youngnam Archaeology*. Busan: Yongnam Archaeological Society, pp. 15 – 29, (in Korean).
Pei W.C., Chia L.P., Wang C.Y., Woo J.K., Liu H.T., Chow M.C. 1958
Report on the Excavations of Paleolithic Sites at Tingtsun, Hsiangfen-Hsie, Shansi Province. Beijing: IVPP, pp. 1 – 144, (in Chinese).
Piel-Desruisseaux J.-L. 1986
Outils Préhistoriques: Forme, fabrication, utilisation. Paris: Masson.
Schick K.D., Toth N. 1993
Making Silent Stones Speak. London: Weidenfeld and Nicolson.
Sohn P.K. 1993
Seogjang-ni Prehistoric site. Seoul: Dong-a Publishing Co., (in Korean).
Wang J. et al. 1994
Preliminary report on investigations and excavations of Dingcun Paleolithic Sites. *Journal of Chinese Antiquity*, N 3, (in Chinese).

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FLAKED BONE TOOLS AND THE MIDDLE TO UPPER PALEOLITHIC TRANSITION: A BRIEF PERSPECTIVE

Introduction

In the past decade, research on the Middle to Upper Paleolithic transition focused on social and cognitive factors. Technological changes in stone and polished bone tools were central to this research. This paper, however, focuses on flaked bone tools and bone materials from the transitional sites in Central Europe, and East and North Asia, and it attempts to propose an alternative classification of flake bone tools and to view the Middle to Upper Paleolithic transition from this alternative perspective.

As in the case of stone tools, two distinct flaking processes are involved in the manufacture of flaked bone tools. Primary flaking on a long bone produces one or two spiral flakes. Then secondary flaking along the flake margins produces the final form. For Upper Paleolithic polished bone tools, the so-called "groove and splinter technique" was widely used to produce long and thin blanks. There are some examples of direct polishing without flaking on late Middle Paleolithic *Mammuthus primigenius* rib bones, for example at Salzgitter-Lebenstedt in Germany, but these examples are rare (Gaudzinski, 1998, 1999).

Dates of the sites also need to be reconsidered. The recent calibration curve of IntCal 04 extends to ca 26,000 cal BP, but high precision calibration of radiocarbon dates by tree-rings is only possible down to 12,400 cal BP (Reimer et al., 2004). The CalPal_2004_SFCP, University of Cologne, extends its calibration curve back to 50,000 cal BP. The calibration data set is practical when the time range is between 26 ka and 50 ka (Weninger, Jöris, Danzeglocke, 2004). However, this calibration curve is still only a rough guideline to the true date (Plicht et al., 2004). Therefore, the radiocarbon dates used in this paper are uncalibrated.

Characteristics of bone fracture

In the production of lithic flake tools, most fractures are "extension fractures." The formation of a Hertian cone, or fracture cone, is usually visible on glassy textured materials (Fig. 1). Bones are more plastic than stone materials, but fractures on compact bones will occur in much the same way as fractures on stone.

One of the distinctive features of a bone fracture, as compared to a lithic fracture, results from the tubular structure of a long bone (Fig. 2). A strong impact (dynamic loading) on the center of a long bone diaphysis makes X-shaped cracks, and, ideally, it makes an oval spiral flake. The impact point is crushed into powder, and a crushed hole is visible on the long bone. In rare cases, however, a bone cone under the impact point will remain. The characteristic features of human breakage of bones using hammer stones are: (1) a small impact bone chip (Binford, 1981: 154), (2) the negative flake scars inside the spiral flake, and (3) an impact notch on the outer cortical edge of the spiral flake (Lyman, 1994: 326). The main purpose for breaking fresh (green) bone was to get the marrow. The materials for flaked bone tools were then selected from the resulting bone flakes.

Three different production series for bone tool production from long bones can be distinguished (Fig. 3). All types of bone tools, either flaked or polished, can be explained with these schematic models (Ono and the Nojiri-ko Excavation Research Group, 1986; Ono, 2001).

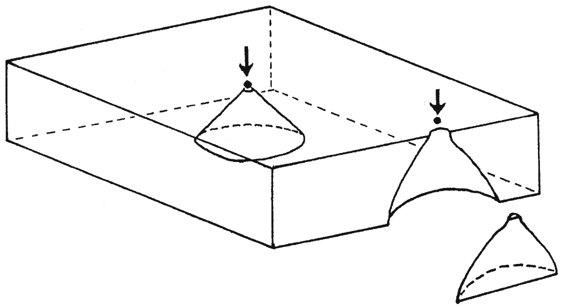

Fig. 1. Fracture cone on glassy lithic materials (Ono, 2001).

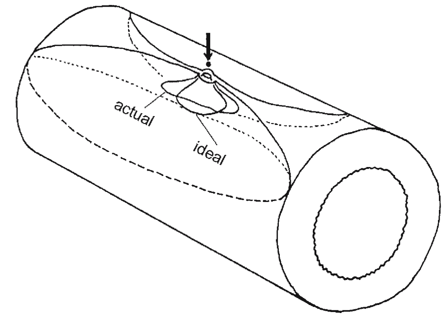

Fig. 2. Fracture cone on a compact bone (*Substantia compacta*) and spiral flakes for a long bone (Ono, 2001).

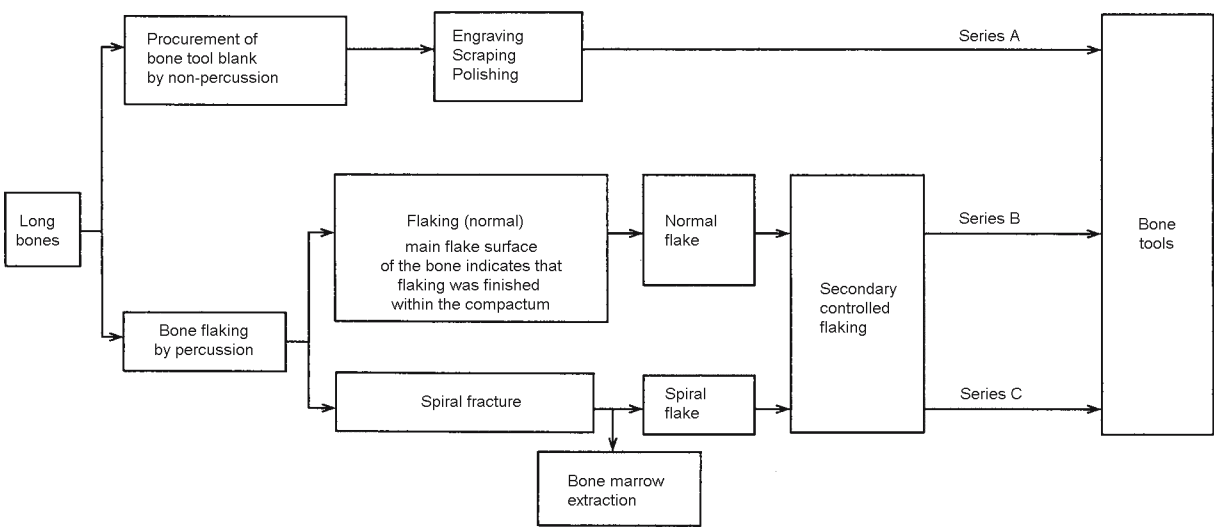

Fig. 3. Classification of bone working procedure (Ono and the Nojiri-ko Excavation Research Group, 1986; Ono, 2001).

Series A: A tool blank is obtained by a non-percussion or "groove and splinter" technique. This blank serves for producing polished bone tools by engraving, scraping, shaving, and polishing.

Series B: Tool blanks are made by normal percussion flaking, meaning the flaking is finished within the compact bone, and the main flake surface shows analogous features to those of lithic flakes. Secondary flaking produces the final tool.

Series C: Tool blanks are made with the so-called spiral fracture, producing spiral flakes. This appears to be a product of fresh-bone flaking. Secondary controlled flaking on the bone surface margins produces the final tool.

Classification of bone tools

Up to now, most interest in Paleolithic bone tools has concentrated on the polished materials from the Upper Paleolithic. The manufacturing processes and the morpho-typology of flaked bone tools have not yet been studied, probably because of their complexity and the difficulty of regulating (controlling) their forms. Bone tools that fit the lithic tool typology are very uncommon from excavations. In contrast, however, the so-called "expedient bone tools," or at least flakes produced by human agencies, clearly show high percentages among the total bone materials.

The shapes of bone flakes and fragments excavated from archaeological layers show wide variation. Vast quantities of these "expedient" bone tools remain to be classified into morpho-types. This is the main difficulty with the flaked bone tool classification.

However, most "curational" flaked bone tools in fact can be classified into basic morphological categories. The lithic classification terminology can be applied to flaked bone tools, although it does not completely parallel the bone flakes (Fig. 4). Some tools, such as handaxe, cleaver and chopper, are the same whether made from stone or from bone. The Lower and Middle Paleolithic peoples do not seem to have been sensitive to the distinction between these materials for producing specific forms of tools (Dobosi, 1983, 1988). This is particularly evident in the flaked bone tools from the Lower Paleolithic sites such as Bilzingsleben in Germany (Mania, 1990a, b, 1998; Mania, Weber, 1986), Ranuccio and Castel di Guido in Italy (Biddittu et al., 1979; Pitti, Radomilli, 1984), and Vértesszölös in Hungary (Kretzoi, Dobosi, 1990).

The Paleolithic flaked (non-polished) bone tools, including both bone core-tools and bone flake-tools, seem to have been made for the purposes of killing, butchering, and dismembering animals. However, the classification of flaked bone tools is not yet well evaluated from the point of view of production techniques or the relationship with analogous stone tools.

The morphology of bone tools inevitably appears to reflect the forms of the long bones from which they are made, at least to some extent. Here, an alternative classification of bone tools, distinct from the lithic morpho-typological scheme, is set out tentatively (Fig. 5).

The following three attributes are considered: (1) the material blank forms, (2) the place of secondary flaking, i.e., unifacial retouch or bifacial retouch, and (3) the place of polish. These three attributes and their combinations make it possible to classify all forms of flaked bone tools.

Aspects of the Middle to Upper Paleolithic transition viewed from flaked bone tools and materials

Central Europe (Germany). It might be possible to see a transition of bone tools and materials from various parts of Europe, but here are clear examples from Germany.

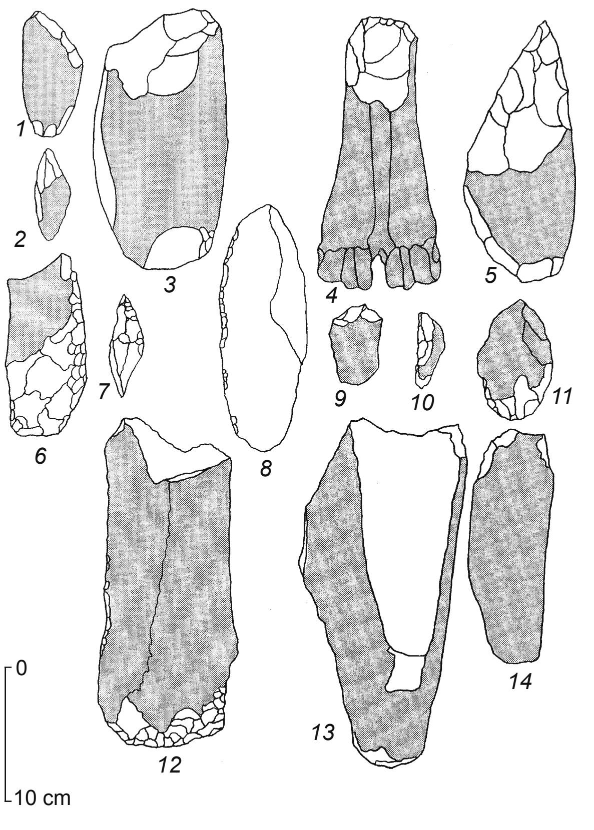

Fig. 4. Representative morphological types of flaked bone tools from various archaeological sites (Ono, 2001).
1, *2*, *10* – Vértesszölös (Hungary); *3* – Ranuccio (Italy); *4*, *11*, *12* – Bilzingsleben (Germany); *5* – Castel di Guido (Italy); *6*, *8* – Tateganhana, Lake Nojiri (Japan); *7* – Geissenklösterle (Germany); *9* – Oberneder (Germany); *13*, *14* – Lange/Ferguson, USA.
1 – chopper; *2* – pointed chopper; *3*, *4* – chopping tools; *5* – handaxe; *6* – cleaver; *7* – point; *8* – *10* – endscrapers; *11* – wedge-like tool; *12* – chisel; *13* – core; *14* – flake.

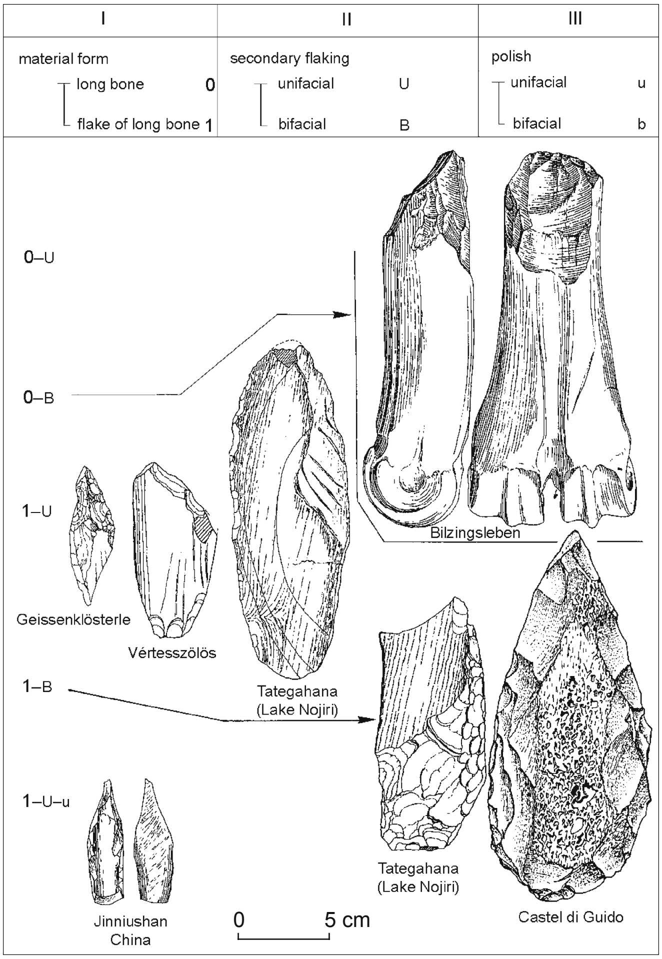

Fig. 5. Tentative classification of flaked bone tools, based on the combination of material forms and secondary flaking (Ono, 2001).

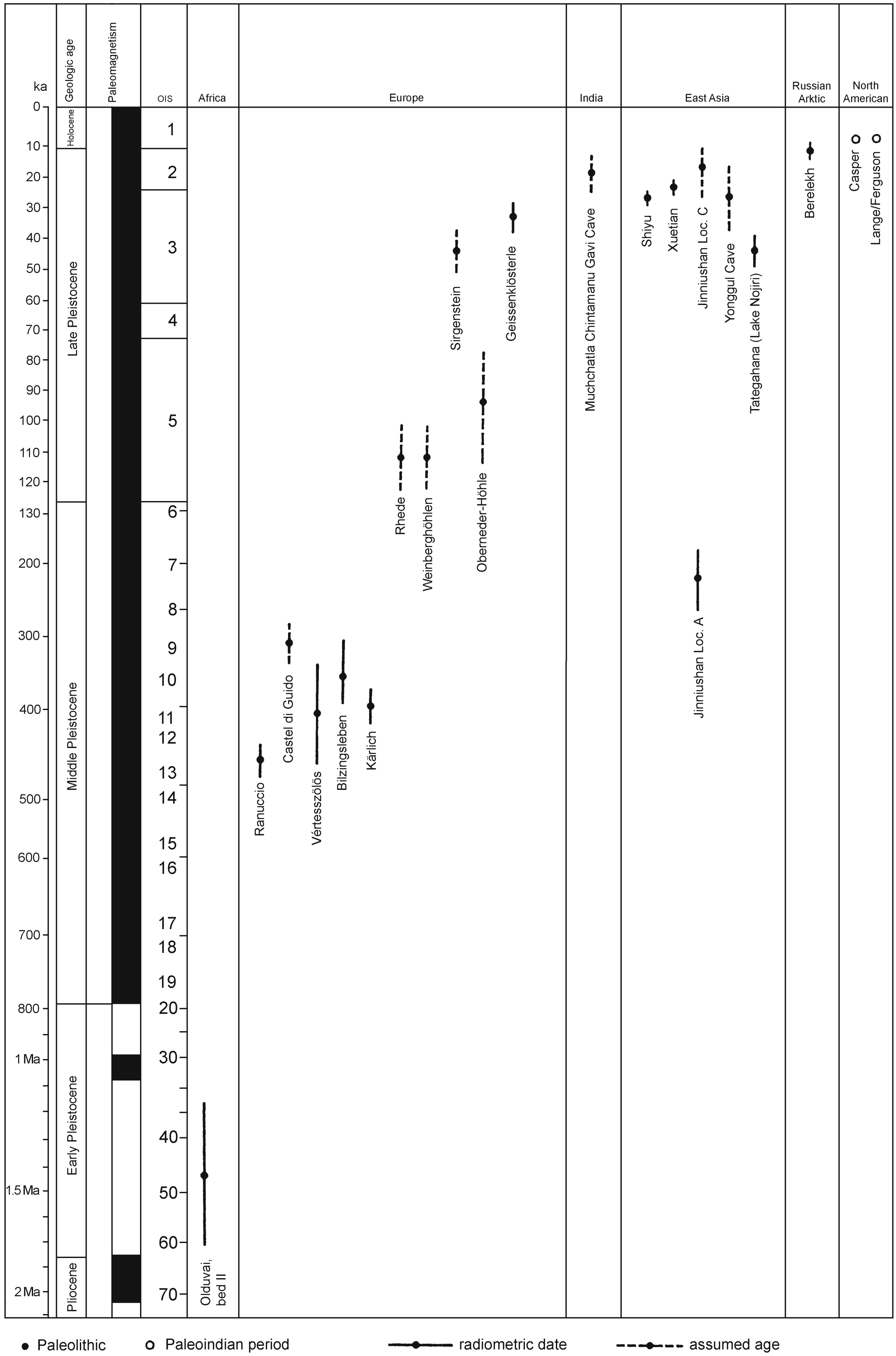

Fig. 6. Chronology of archaeological sites yielding flaked bone tools (Ono, 2001).

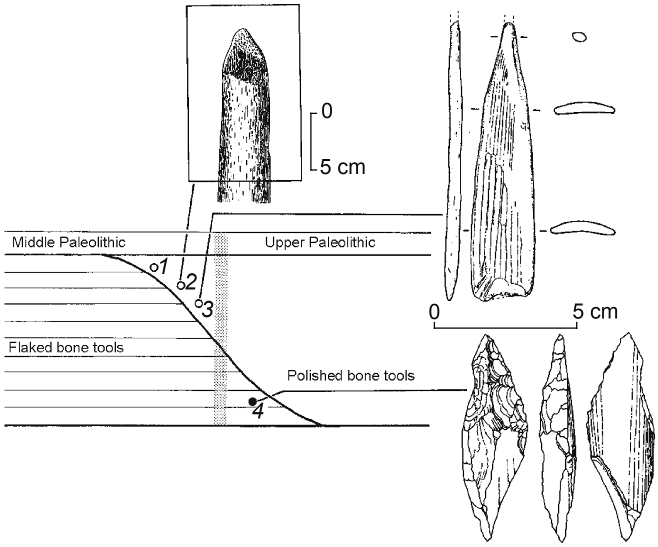

Fig. 7. Flaked/polished bone tools of the Middle to Upper Paleolithic transition.
1 – Grosse Grotte; *2* – Salzgitter-Lebenstedt; *3* – Vogelherd VI; *4* – Geissenklösterle.

At the Middle Paleolithic sites of Rhede (Tromnau, 1983), Sirgenstein (Hahn, 1976), and Obemeder (Freund, 1987), archaeologists have found a flaked bone handaxe, a sidescraper, an endscraper, and a sidescraper, respectively (Fig. 6). Several polished bone points were found in the early Aurignacian horizons at the Vogelherd cave site in southwestern Germany (Riek, 1934; Müller-Beck, 1983). This suggests a rapid transition, but a polished bone point was found in the late Middle Paleolithic horizons at the Vogelherd VI and Salzgitter-Lebenstedt sites. Likewise, flaked bone tools were still present in the Upper Paleolithic Aurignacian horizon at the Geissenklösterle cave site (Hahn, Owen, 1985) (Fig. 7).

Tools such as the handaxe, cleaver, chopper, chopping-tool, and scraper take the same forms whether made of stone or of bone. This indicates that the forms of bone tools were conceptualized and regulated by the norms for stone tools. But the "groove and splinter technique" freed bone

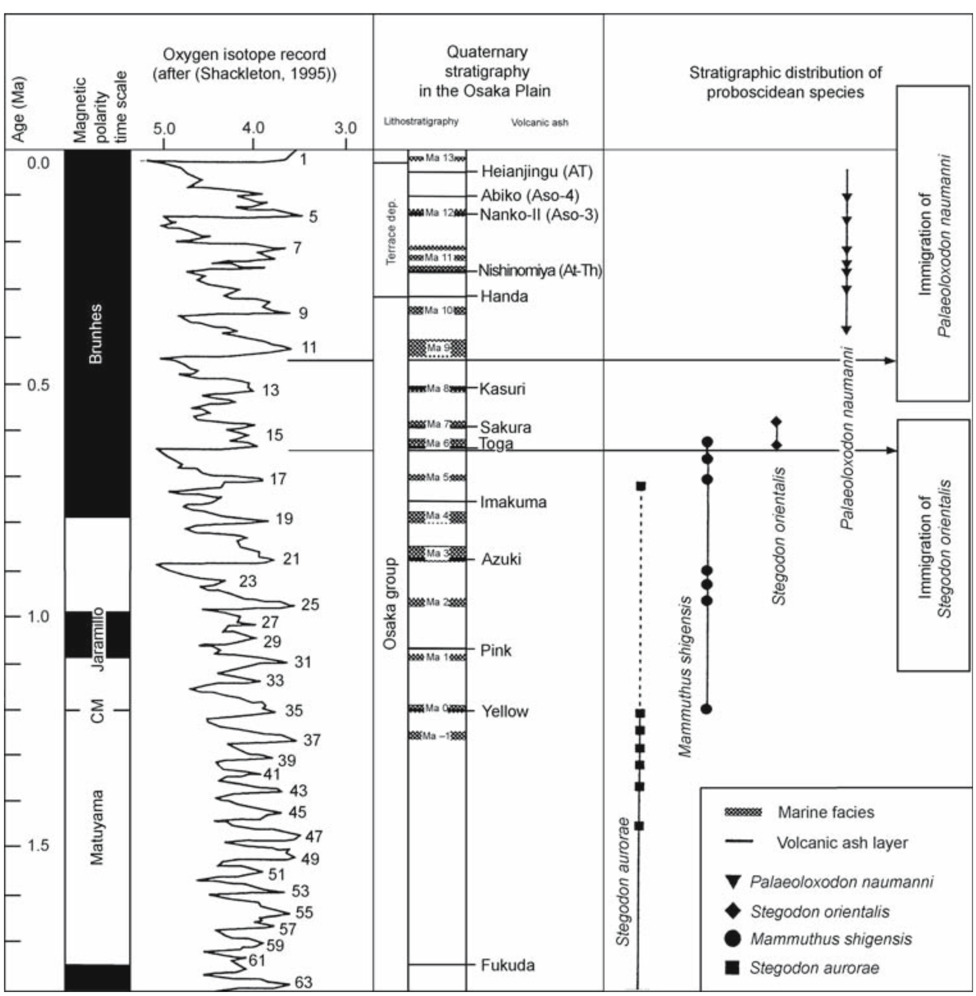

Fig. 8. Relationships between the oxygen isotope stratigraphy and the distribution of probocidean species.

tool production from the domination of the lithic norms.

The transition from the Middle to the Upper Paleolithic parallels this transition from flaked to polished bone tools, and, thus, it is explainable by this techno-structural context, specifically, the emergence of the groove and splinter technique that was introduced by the burin in the kit of blade-based tools.

Japanese Archipelago: Tategahana site (Lake Nojiri). Landbridges between the Korean Peninsula and the Japanese Archipelago existed at least twice in the Middle Pleistocene, once at OIS 16 (ca 0.63 Ma) and again at OIS 12 (ca 0.43 Ma). No landbridges existed in the Late Pleistocene, even at the last glacial maximum (LGM), except between the northernmost island, Hokkaido, and the continent.

The megafauna migrations from the Chinese mainland to the Japanese islands along landbridges are now thought to have occurred only at OIS 16 and OIS 12: the Stegodon elephant (*Stegodon orientalis*) coming during the first landbridge and the Naumann's elephant (*Palaeoloxodon naumanni*) coming during the second landbridge (Fig. 8).

No certain traces, either lithic or skeletal, of hominid occupation of the Japanese Archipelago have been found corresponding to these megafauna migrations. Well preserved hominid fossils from the later part of the Late Pleistocene were found in a fissure in the limestone quarry at Minatogawa, Okinawa Island. The fissure deposits, however, did not yield artifacts or other remains of occupation.

Fig. 9. Location of Tateganhana site at Lake Nojiri in early spring. Photograph by A. Ono.

Fig. 10. Footprints of Naumann's elephant and Yabe's giant deer from Lower Member III. Photograph by A. Ono.

The Tategahana site at Lake Nojiri, in north-central Japan, is a unique site. Geologists, archaeologists, and many other experts from various disciplines of Pleistocene research have excavated from the lacustrine sediments there a considerable number of footprints of Naumann's elephant (*Palaeoloxodon naumanni*) and Yabe's giant deer (*Sinomegaceros yabei*), as well as the fossil bones of both these and many other mammalian species, together with many Paleolithic artifacts (Fig. 9 – 11).

The chronometric framework of the Nojiri-ko Formation (the lacustrine deposits of the site) is based on a number of AMS determinations (Fig. 12): Lower Member – 50,000 to 42,000 BP; Middle

Fig. 11. Footprint of a Naumann's elephant from Lower Member III (Nojiri-ko Excavation Research Group, 1994). Photograph by A. Ono.

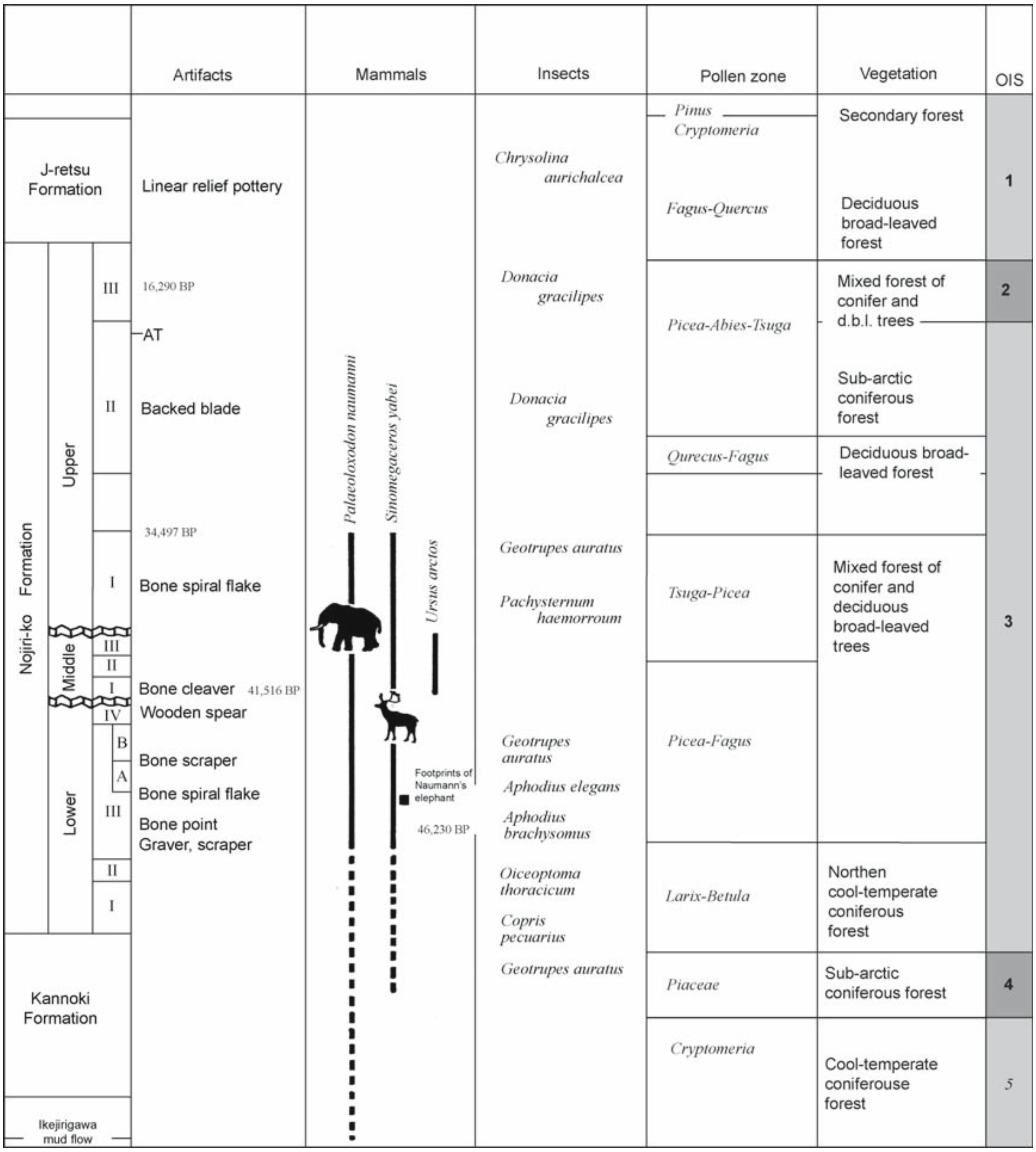

Fig. 12. Stratigraphic sequence of Lake Nojiri, north-central Japan (Nojiri-ko Excavation Research Group, 1994).

Member – 42,000 to 35,000 BP; and Upper Member – 35,000 to 12,000 BP.

The greater part of the mammalian fossils are from just two species: the Naumann's elephant represents 91.9 % and Yabe's giant deer represents 7.9 % of the total mammalian fossils. The minimum number of individual (MNI) Naumann's elephants in the collections recovered up to the 1980 excavation is calculated as 23. Ten of these are from Lower Member III, two – from Middle Member I, two – from Middle Member II, one – from Middle Member III, and eight – from Upper Member. The age profile of the Naumann's elephants, based on 66 molars (31 upper and 35 lower molars), shows two clear peaks of age classes, one at ages 25 – 36 (prime adults, 39 %) and the other at ages 49 – 60 (senile, 29 %). This age profile suggests selective big game hunting by the Paleolithic hunters.

The typical bone tools from the Lake Nojiri site are an oval sidescraper, a cleaver, a knife-shaped tool, and flakes with retouched bases (Fig. 13 – 16). Lithic tools (such as scrapers and drills) and flakes have been excavated with the bone materials in the same layer.

In Middle Member I, in particular, a bone cleaver and refitted bone flakes with retouched bases, and refitted bone chips (see Fig. 16) were also found in the same concentration (Nojiri-ko Excavation Research

Group, 1984, 1994; Ono and the Nojiri-ko Excavation Research Group, 1991). As the time span of OIS 3 indicates ca 57,000 to 30,000 BP (Jöris, 2004), Middle Member I corresponds to the middle of OIS 3. This evidence suggests that some areas of the Tategahana site functioned as a kill-butchering locale on the shore of the lake, implying that the elephant hunters also made flaked bone tools during their kill and butchering activities. The bone tools were all manufactured by direct flaking because the "groove and splinter technique" had not yet appeared (Ono, 2001).

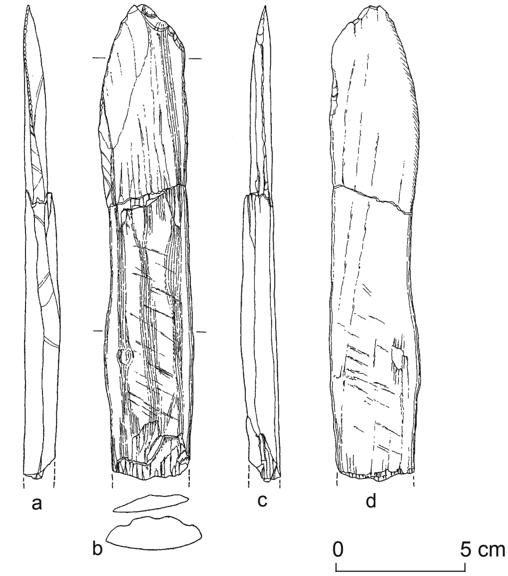

Fig. 15. Knife-shaped tool (class 0-U) made from a rib of a Naumann's elephant, Lower Member IIIB1 at Tategahana (Nojiri-ko Excavation Research Group, 1984).

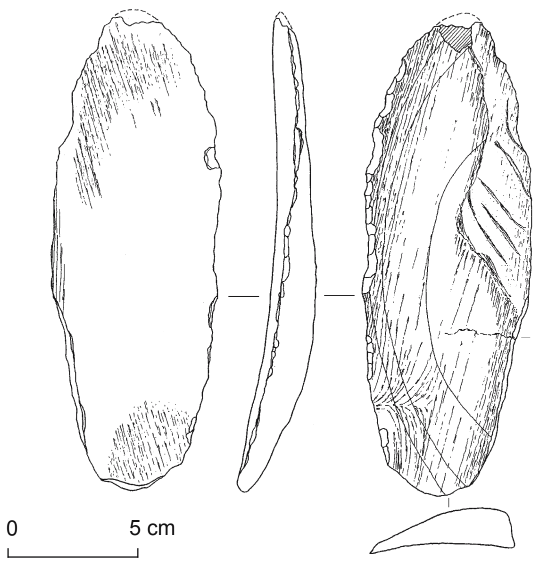

Fig. 13. Scraper (class 1-U (*cf.* Fig. 5)) made from left tibia of a Naumann's elephant, Lower Member IIIB1 at Tategahana (Nojiri-ko Excavation Research Group, 1984).

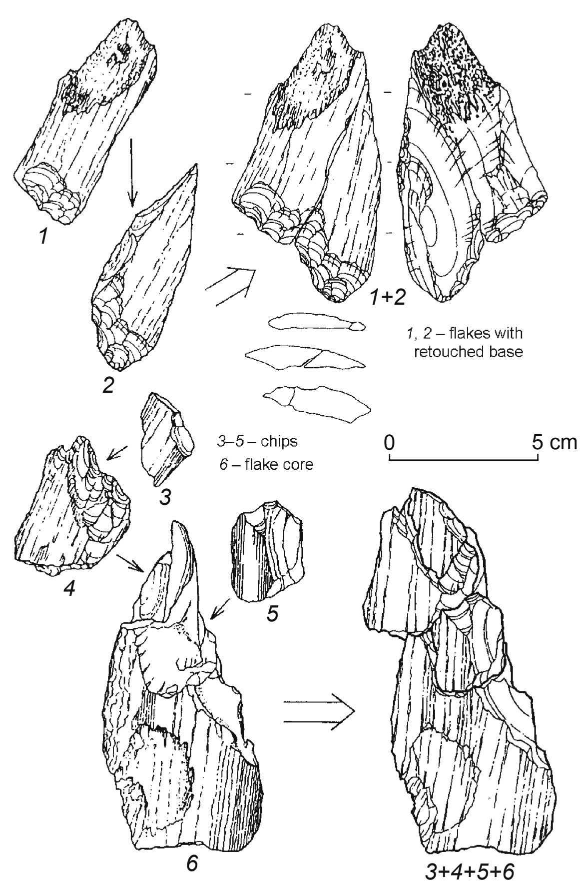

Fig. 16. Refitted flakes and chips (classes 1=1-U, 2=1-U) made from bone fragments of a Naumann's elephant, Middle Member I (41,516 BP) at Tategahana (Nojiri-ko Excavation Research Group, 1997).

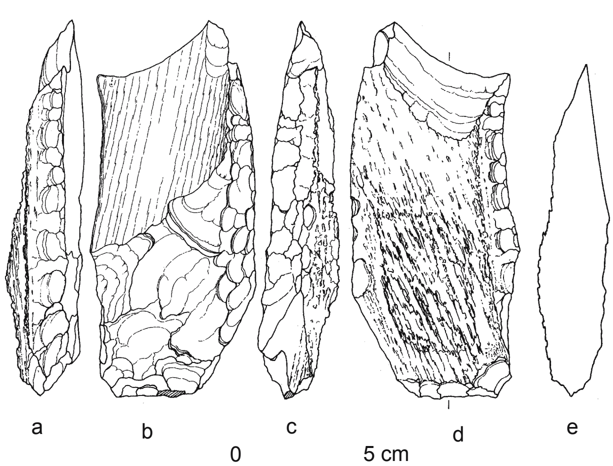

Fig. 14. Cleaver (class 1-B) made from humerus of a Naumann's elephant, Middle Member I (41,516 BP) at Tategahana (Anthropology..., 1990).

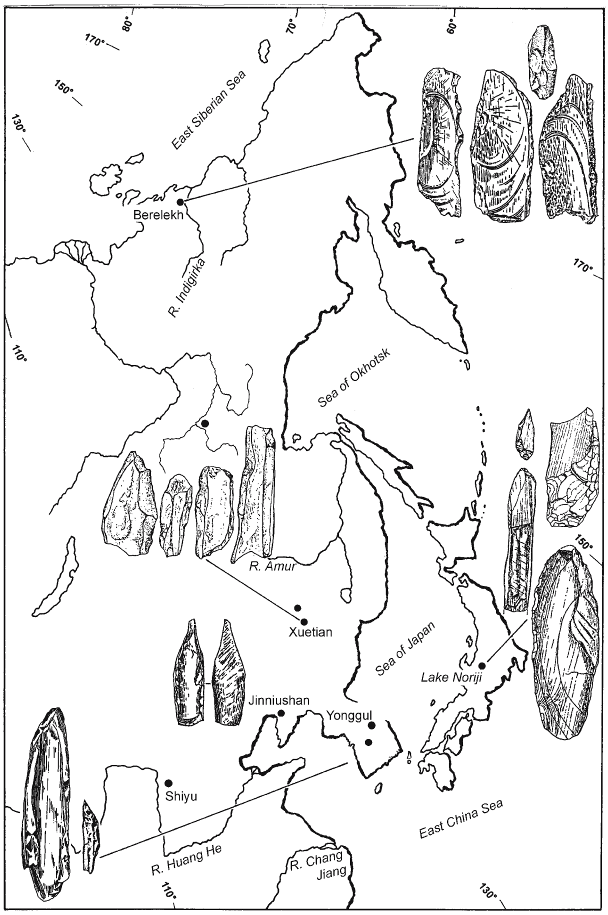

Fig. 17. Flaked bone and ivory tools from the North and East Asian Paleolithic, middle of OIS 3 and 2 (Ono, 2001).

In East and North Asia outside of Japan, flaked bone tools have been found at several archaeological sites: Junniushan Loc. C (Zhang S., 1993), Shiyu (Zhang J., 1991), and Xuetian (Yu, 1988) in China; Yonggul cave (Sohn, 1988) in Korea; and Berelekh in the Russian Arctic (Mochanov, Fedoseeva, 1996). All these sites belong to the Upper Paleolithic (Fig. 17). Only two sites in these regions pre-date the Upper Paleolithic: Jinniushan Loc. A is dated to ca 230 – 200 ka, and Tategahana, Lake Nojiri, belongs to the middle of OIS 3.

Conclusion

Contrary to Europe, flaked bone tools continued to be used, together with polished bone tools, until the end of the Upper Paleolithic in East and North Asia. A clear interpretation is still difficult, but there is a possible causal relationship between the development of the "groove and splinter technique" and a stable number of burins in the artifact assemblages. Burins are less common in the East Asian Upper Paleolithic toolkits than in the Central European toolkits. Further discussion of this topic requires more data on flaked bone tools with exact geochronological and radiometric dates, especially in East Asia.

Acknowledgments

I am grateful to the Nojiri-ko Excavation Research Group for their collaboration in a bone breakage experiment and for their constructive comments on the evaluation of the large mammal bone remains from Lake Nojiri. I thank Prof. Emeritus H. Müller-Beck, the late Prof. J. Hahn, and Prof. N.J. Conard for their permission to observe the bone tools and materials from Vogelherd and Geissenklösterle. Thanks are also due to Prof. C.T. Keally for the revision of my early English draft.

References

Anthropology and Archaeology Research Group for the Nojiri-ko Excavation. 1990
Bone tools from the 10th excavation season of the Tategahana site, Lake Nojiri. *The Quaternary Research*, vol. 29, N 2: 89 – 103, (in Japanese with English abstract).

Biddittu I., Cassoli P.F., Brozolo F.R. di, Segre A.G., Nodini E.S., Villa I. 1979
Anagni, a K-Ar dated Lower and Middle Pleistocene site, Central Italy: Preliminary report. *Quternaria*, vol. 21: 53 – 71.

Binford L.R. 1981
Bones: Ancient Men and Modern Myths. New York: Academic Press.

Dobosi V.T. 1983
Die Knochenartefakte von Vértesszölös. *Ethnographisch-Archäologische Zeitschrift*, vol. 24: 349 – 361.

Dobosi V.T. 1988
Le site paléolithique inférieur de Vértesszölös, Hongrie. *L'Anthropologie*, vol. 92 (4): 1041 – 1050.

Freund G. 1987
Das Paläolithikum der Oberneder-Höhle (Landkreis Kelheim/Donau). *Quartär Bibliothek*, N 5, Teil 1. Bonn: Ludwig Röhrscheid Verlag, pp. 210 – 215.

Gaudzinski S. 1998
Knochen und Knochengeräte der mittelpaläolithischen Fundstelle Salzgitter-Lebenstedt (Deutschland). *Jahrbuch des Römisch-Germanischen Zentralmuseums Mainz*, vol. 45: 163 – 220.

Gaudzinski S. 1999
Middle Paleolithic bone tools from the open-air site Salzgitter-Lebenstedt (Germany). *Journal of Archaeological Science*, vol. 26: 125 – 141.

Hahn J. 1976
Der Sirgenstein, eine urgeschichtliche Höhlenstation im Achtal. *Kulturdenkmale in Baden-Württemberg*. Blatt 24: 4.

Hahn J., Owen L.R. 1985
Blade technology in the Aurignacian and Gravettian of Geissenklösterle Cave, Southwest Germany. *World Archaeology*, vol. 17 (1): 61 – 75.

Jöris O. 2004
Zur chronostratigraphischen Stellung der spätmittelpaläolithischen Keilmessergruppen. *Bericht der Römisch-Germanischen Kommission*, vol. 84: 49 – 153.
Kretzoi M., Dobosi V. T. (eds.) 1990
Vértesszölös : Man, Site and Culture. Budapest: Académiai Kiady.
Lyman R.L. 1994
Vertebrate Taphonomy. Cambridge: Cambridge Univ. Press.
Mania D. 1990a
Auf den Spuren des Urmenschen. Berlin: Deutscher Verlag der Wissenschaften.
Mania D. 1990b
Urmenschen in Thüringen. *Archäologie in Deutschland*, vol. 3: 12 – 23.
Mania D. 1998
Die ersten Menschen in Europa. *Archäologie in Deutschland,* Sonderheft.
Mania D., Weber T. 1986
Bilzingsleben. Berlin: VEB Deutscher Verlag der Wissenschafte.
Mochanov Yu.A., Fedoseeva S.A. 1996
Berelekh, Allakhovsk region. In *American Beginnings*, F.H. West (ed.). Chicago: Univ. of Chicago Press, pp. 218 – 222.
Müller-Beck H. 1983
Sammlerinnen und Jäger von den Anfängen bis vor 35000 Jahren. In *Urgeschichte in Baden-Württemberg*, H. Müller-Beck (Hrsg.). Stuttgart: Konrad Theis Verlag, pp. 241 – 272.
Nojiri-ko Excavation Research Group. 1984
The Lake Nojiri Excavation 3. *The Association for the Geological Collaboration in Japan, Monograph* N 27: 1 – 267, (in Japanese with English abstract).
Nojiri-ko Excavation Research Group. 1994
The Late Quaternary environment around Lake Nojiri in central Japan. In *Proceedings of the 29th International Geological Congress*, pt. B. N.p.: pp. 269 – 277.
Nojiri-ko Excavation Research Group. 1997
Natural environment and humans in the Last Glacial. Tokyo: Kyoritsu Publishing Co., Ltd., (in Japanese).
Ono A. 2001
Flaked Bone Tools: An Alternative Perspective on the Paleolithic. Tokyo: Tokyo Univ. Press, (in Japanese with English abstract).
Ono A. and the Nojiri-ko Excavation Research Group. 1986
Bone technology in the Late Paleolithic of East Asia: A Nojiri-ko case study. *The Pleistocene Perspective: The World Archaeological Congress*, vol. 1: 1 – 14.
Ono A. and the Nojiri-ko Excavation Research Group. 1991
Archaeology of Lake Nojiri: A kill-butchering site of north-central Japan in Later Pleistocene. In *The INQUA International Symposium on Stratigraphy and Correlation of Quaternary Deposits of the Asian and Pacific Regions*, J. Harding (ed.) CCOP/TP22: 159 – 166.
Pitti C., Radmilli A.M. 1984
Castel di Guido. In *I Primi Abitanti d'Europa*. Museo Nazionale Preistorico Etnografico "Luigi Pigorini."
Plicht J. van der, Beck J.W., Bard E., Bailie M.G.L., Blackwell P.G., Buck C.E., Friedrich M., Guilderson T.P., Hughen K.A., Kromer B., McCormac F.G., Ramsey C.B., Reimer P.J., Reimer R.W., Remmele S., Richards D.A., Southon J.R., Stuiver M., Weyhenmeyer C.E. 2004
NotCal 04 – comparison/calibration ^{14}C records 26 – 50 cal kyr BP. *Radiocarbon*, vol. 46: 1225 – 1238.
Reimer P.J., Bailie M.G.L., Bard E., Bayliss A., Beck J.W., Bertrand C. J.H., Blackwell P.G., Buck C.E., Burr G.S., Cutler K.B., Damon P.E., Edwards R.L., Fairbanks R.G., Friedrich M., Guilderson T.P., Hogg A.G., Hughen K.A., Kromer B., McCormac G., Manning S., Ramsey C.B., Reimer R.W., Remmele S., Southon J.R., Stuiver M., Talamo S., Taylor F. W., Plichit J. van der, Weyhenmeyer C. 2004
IntCal 04 terrestrial radiocarbon age calibration, 0 – 26 cal kyr BP. *Radiocarbon*, vol. 46: 1029 – 1058.
Riek G. 1934
Die Eiszeitjägerstation am Vogelherd im Lonetal. Tübingen: Akademische Verlagsbuchhandlung Franz F. Heine.
Sohn P. 1988
Bone tools of Yonggul cave at Chommal, Korea. *The Paleoenvironment of East Asia from the Mid-Tertiary* (University of Hong Kong), N 2: 1124 – 1185.
Tromnau G. 1983
Ein Mammutknochen-Faustkeil aus Rhede, Kreis Borken (Westfalen). *Archäologisches Korrespondenzblatt*, N 13 (3): 287 – 289.
Weninger B., Jöris O., Danzeglocke U. 2004
Cologne Radiocarbon Calibration and Paleoclimate Research Package. www.calpal.de.
Yu H. 1988
A brief study of Late Paleolithic localities at Xuetian village of Wuchang Country, Heilongjiang Province. *Acta Anthropologica Sinica*, N 7 (3): 255 – 262, (in Chinese with English abstract).
Zhang J. 1991
A study of the bone fragments of Shiyu site. *Acta Anthropologica Sinica*, N 10 (4): 333 – 344, (in Chinese with English abstract).
Zhang S. 1993
Comprehensive study on the Jinniushan Paleolithic site. *Memoirs of Institute of Vertebrate Palaeontology and Palaeoanthropology, Academia Sinica*, vol. 19: 1 – 163, (in Chinese with English abstract).

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MIDDLE AND UPPER PALEOLITHIC SITES IN THE LOWER JORDAN VALLEY

Introduction

This study reports on Middle and Upper Paleolithic sites discovered in the Manasseh Hill Country survey on the eastern slopes of the Samaria Hills. The Manasseh Hill Country survey was initiated by Prof. Adam Zertal in 1978 in order to collect data for his study of geographic and historic problems in Samaria during the Iron Age (Zertal, 1984). At that time, the research of Samaria was practically non-existent and surveys and publications were few. The area was virgin soil for a thorough survey, on foot and meter by meter. Soon after it started, an immense quantity of data, concerning all periods, was collected. It became clear that the goal of the survey had to be changed. The survey of a limited area turned to a general archaeological and ecological survey of a larger area, describing, mapping and analyzing all visible archaeological sites and phenomena, including roads, water sources, soil condition, elevation, and visibility. To date, the survey has documented about 1500 archaeological sites or phenomena, most of them formerly unknown, and 968 of these have been published (Zertal, 1992, 1996, 2004, 2005; Zertal, Mirkam, 2000).

The importance of on foot surveys for drawing a regional picture of different periods cannot be underestimated. They open a wide window for future studies and document facts which could be lost forever whenever the bulldozers of civilization arrive. These were the guidelines for the Manasseh Hill Country survey which continues, under the direction of Zertal, uninterrupted until today.

During the earlier years, the teams were fully aware of ceramic sherds, architecture, waterholes and cisterns, caves etc., but prehistory and prehistoric flint artifacts were seemingly beyond the scope of the survey. This situation changed later and flint, the main raw material for Stone Age tools in this country, was collected providing an important contribution to the knowledge about prehistoric sites and populations in an area which had been practically *terra incognita*.

The studied area is a hilly, arid region (Zertal, 2005: 24 – 25, fig. 9), and since historic times human activities have been concentrated mainly in the valleys (Fig. 1). The hills of the region have been disturbed only minimally thus providing ideal conditions for a comprehensive surface survey. Here, in a limited area (Fig. 2), an unusually high number of Paleolithic sites, rather flint concentrations, were located, as opposed to the scarce prehistoric finds in the more “civilized” areas of the survey. This was the main reason for this special study. Even though flint artifacts were found at sites from many periods, we deal here only with previously unknown sites or artifact occurrences from the Middle and Upper Paleolithic. They were discovered at different times and mentioned during the last decade in various publications: the northern sites at the Ras el-Kharube massif – Kh I – Kh XI (Table 1) (Winter, 1996, 1997) and the southern sites at the Sartaba massif – regularly numbered (Tables 2, 3) (Winter, 2005). In many cases, the number of tools was relatively high compared to the quantity of waste and debitage. This phenomenon indicates that artifacts were collected in a selective manner, with a preference for shaped artifacts, and small items were overseen. At the earlier stages of the survey (the Ras el-Kharubeh massif, Table 1), this fact is emphasized. Some of the sites were occupied more than once. The number of

Fig. 1. Sartaba massif, arid hills, and the fertile valley. Photograph by M. Einav.

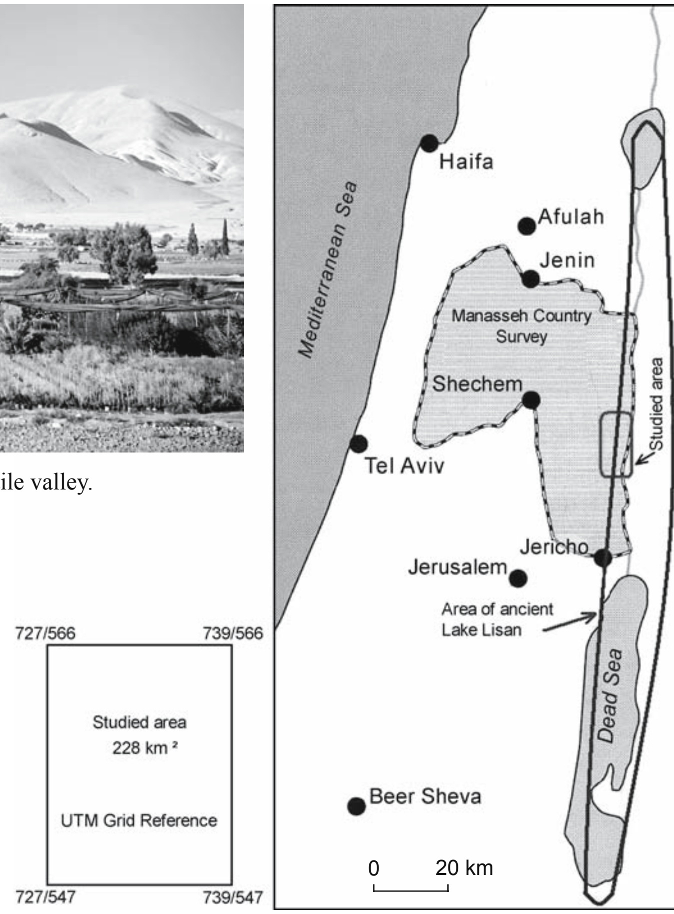

Fig. 2. Studied area and approximate location of ancient Lake Lisan.

flint artifacts listed in the tables includes those of all periods of occupation. This short study combines the data from these two areas, which make an entirety.

Nahal Fazael sites, at the southeastern part of the studied area, were discovered by the Lower Jordan Valley project directed by O. Bar-Yosef and published (Goring-Morris, 1980).

The climate, setting, and dating

The studied area is on the eastern fringes of the Samaria hills, which slope to the Jordan

Table 1. **Middle Paleolithic sites on the Ras el-Kharube massif (Winter, 1996, 1997)**

Site/flint concentration	Israel Grid Ref.	UTM Grid Ref.	Sea level, m +/-	Number of waste and debitage	Number of tools	Id.*
Kh I	1980/1781	7373/5651	+/–0	10	14	H
Kh II	1998/1779	7373/5649	–10	5	11	H
Kh III	1959/1769	7370/5638	+50	45	54	H
Kh IV	1958/1767	7350/5636	+10	82	74	H
Kh V	1965/1763	7357/5631	+150	52	36	H
Kh VI	1976/1722	7367/5563	–70	29	55	H
Kh VII	1956/1750	7347/5619	–50	41	23	H
Kh VIII	1972/1750	7363/5620	+120	31	16	H
Kh IX	1972/1746	7363/5615	+90	19	12	H
Kh X	1975/1737	7366/5606	–70	134	133	H
Kh XI	1968/1756	7360/5626	+190	6	18	H

* Id.: H – highly reasonable identification

Table 2. **Middle Paleolithic Sites on the Sartaba massif (Winter, 2005)**

Number	Site/flint concentration	Israel Grid Ref.	UTM Grid Ref.	Sea level, m +/–	Number of waste and debitage	Number of tools	Id.**
126	Umm Sawaneh (3)	1912/1722	7303/5590	+100	149	13	H
137	Jebel el-Mahjarha (3)	1910/1712	7900/5580	+290	31	8	H
138	Jebel el-Mahjarha (1)	1905/1710	7293/5578	+300	19	8	H
143	‘Ain Abu Daraj (1)	1910/1700	7300/5568	+300	32	14	H
149	EP 173 (1)	1895/1692	7285/5560	+100	63	25	R
151/153	EP195 (2)* EP195 (1)	1904/1694 1902/1692	7294/5562 7292/5560	+190 +195	257	121	H
164	Ras Quneitra	1928/1673	7317/5542	+300	58	36	H
169	‘Ain el-Mana’	1914/1663	7303/5531	–80	79	19	H
197	‘Urqan el- Mastara*	1932/1639	7320/5508	–10	26	27	H
198	Tal’at ‘Amreh	1929/1632	7317/5501	–175	8	15	H
202	Mugharet Sad Khariz	1910/1625	7298/5493	–100	18	26	H
203	Monument (2)	1937/1626	7325/5495	–140	41	32	H

* Sites with both Middle and Upper Paleolithic artifacts.
** Id.: H – highly reasonable identification; R = reasonable identification.

Table 3. **Upper Paleolithic Sites at the Sartaba massif (Winter, 2005)**

Number	Site/flint concentration	Israel Grid Ref.	UTM Grid Ref.	Sea level, m +/–	Number of waste and debitage	Number of tools	Id.**
151/153	EP195 (2)* EP195 (1)	1904/1694 1902/1692	7294/5562 7292/5560	+190 +195	257	121	H
172	Lower Sartaba	1936/1669	7324/5537	+316	10	5	P
173	Qarn Sartaba	1938/1670	7326/5539	+337	12	3	P
185	Urkan Umm Safa	1908/1647	7297/5515	–50	216	38	H
197	‘Urqan el-Mastara*	1932/1639	7320/5508	–10	26	27	R
204	Monument (3)	1938/1662	7326/5491	–210	58	57	H

* Sites with both Middle and Upper Paleolithic artifacts.
** Id.: H = Highly reasonable identification; R = reasonable identification; P = possible identification.

valley from an elevation of approximately 400 m asl to 350 m below present sea level. The region is mostly a hilly semi-desert terrain. The main topographic features are the Sartaba and Makhruk ridges, with steep slopes to the Jordan rift valley in the east and moderate, westward slopes toward the central Samaria hill region and Shechem. The ridges are dissected by tectonic faults forming Wadi Far’ah, the Bukea valley, and further north Wadi Malikh and Nahal Bezek. The geomorphology is associated with the tectonic process which created the Jordan valley while later erosion created east-bound, steep, eroded gorges, and fertile valleys.

The main valley in the studied area is Nahal Tirzah (Wadi Farah) with a developed, irrigated agriculture and few permanent water sources. This wide valley separates the Ras el-Kharube massif in the north from the Sartaba massif in the south.

The present climate of the eastern slopes of the Samaria hills is semi-arid with relatively little rainfall (Zertal, 2005: 24 – 25, fig. 9). Today all water sources are exploited for irrigation and no perennial streams flow in this area. Fertile soils concentrate mainly in the valleys (see Fig. 1), but the area is not suitable for agriculture without irrigation.

During the periods under study, climate was different even though it fluctuated over time (see indications in the discussion below). From about 65 to 15 ka BP, a period relevant for this study, Nahal Tirzah and large parts of the area were flooded by Lake Lisan. This lake is the last of several lakes, which existed in the Jordan rift valley earlier in the Pleistocene. Following a series of fluctuations, the lake reached its maximum elevation of 164 m below present sea level about 27 ka BP (Bartov et al., 2002: 20, fig. 7) (Fig. 3). It is difficult to locate, on the present surface, *in situ* prehistoric finds from periods earlier than 15 – 17 ka BP and lower than 164 m below sea level, because no sites could exist in the flooded area. Furthermore, over thousands of years marls (the Lisan marls) were deposited to a depth up to 40 – 50 m (Ibid.: table 2, fig. 6), thus earlier sites (also these existing prior to 65 ka BP) were flooded and buried later by the lake deposits. Artifacts from these earlier sites may be found on the surface only if they have been unearthed by natural forces, by human activity or at sites flooded only over a short period.

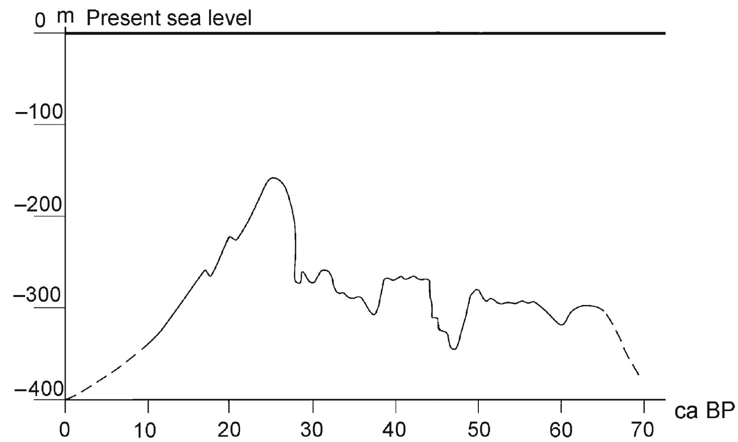

Fig. 3. Lake Lisan level (after (Bartov et al., 2002)).

Methodology

The methodology adopted for a general survey does not necessarily comply with the criteria suggested for prehistoric surveys in arid regions (Bar-Yosef, Goren, 1980). However, the attempt to date the flint collections from the survey was the main goal of our work. The possibilities to analyze and date surface finds, collected at random, are limited and one has to rely mainly on typological considerations. For the classification we used publications from excavations, summarizing studies and general type lists (Bordes, 1961; Hours, 1974). We also considered the morphological data of cores, debitage, and tools.

Identification of the period, according to typological considerations only, is possible to some extent, even though it has certain disadvantages:

– surface finds do not necessarily represent the real character of the site (technologies, tool types, and the composition of the assemblage);

– it is difficult to define some assemblages according to a certain list because they do not comply with any list;

– some technologies and tools served for long periods during several stages of prehistory and are therefore useless for the chronological identification of the assemblage;

– in some cases, there is no correlation between the dating by typological features and by radiometric techniques (Hovers, Marder, 1991: 51 – 53).

For these reasons, results should be considered as preliminary. We tried to rely on additional evidence, whenever it was available. Examples for this are the small and insignificant assemblages from the sites of Lower Sartaba (172) and Qarn Sartaba (173) (see Table 3). These are geographically close localities, and even though the single assemblage did not allow conclusions, combined, they contribute to a wider understanding of the chronology and the Upper Paleolithic presence in the studied area.

Summarized information of the procedures we used and some types and technologies, which served for the identification, are as follows.

1. As the number of artifacts at most localities was modest and did not allow analyses by statistical methods used at excavated sites, three levels for the reliability of the identification have been applied: H – highly reasonable identification; R – reasonable identification; P – possible identification. In most cases, the identification of the period was highly reasonable. However, the data did not allow a proper dating within the cultural entity or prove the contemporaneity of sites.

2. Characteristics for the identification of Middle Paleolithic assemblages include: the presence of Levallois cores; a high share of artifacts produced by the Levallois technique; faceting of striking platforms and presence of *chapeau de gendarm* pieces; and a relatively large number of sidescrapers.

3. Characteristics for the identification of Upper Paleolithic assemblages include: a relatively large share of blades and blade tools; the presence of a microlithic element; relatively large numbers of endscrapers and burins; and the presence of carinated endscrapers.

4. At multi-period sites, we had to rely on artifacts typical of the period (*fossile directeure*) in order to date the site. No conclusions were drawn from single typical artifacts represented by a single specimen.

Flint concentrations and their distribution

Within the studied area of 228 sq. km (UTM Grid ref. 727/547 – 727/566 – 739/566 – 739/547) 11 Middle Paleolithic flint concentrations/localities were discovered on the Ras el- Kharube massif (Winter, 1996, 1997) and 12 on the Sartaba massif (Winter, 2005) (Fig. 4). Although many caves are situated in this hilly area, all Middle Paleolithic concentrations were at open-air locations, similar to the open-air sites in the Negev highlands. Only a few new Upper Paleolithic sites were found, all of them around the Sartaba massif (Ibid.) and no one on the Ras el- Kharube massif. The Upper Paleolithic Fazael sites to the south-east, also close to the Sartaba, were discovered earlier (Goring-Morris, 1980) (Fig. 4). Except for Urqan Umm Safa (185), located in a cave, all Upper Paleolithic concentrations were also at open-air locations.

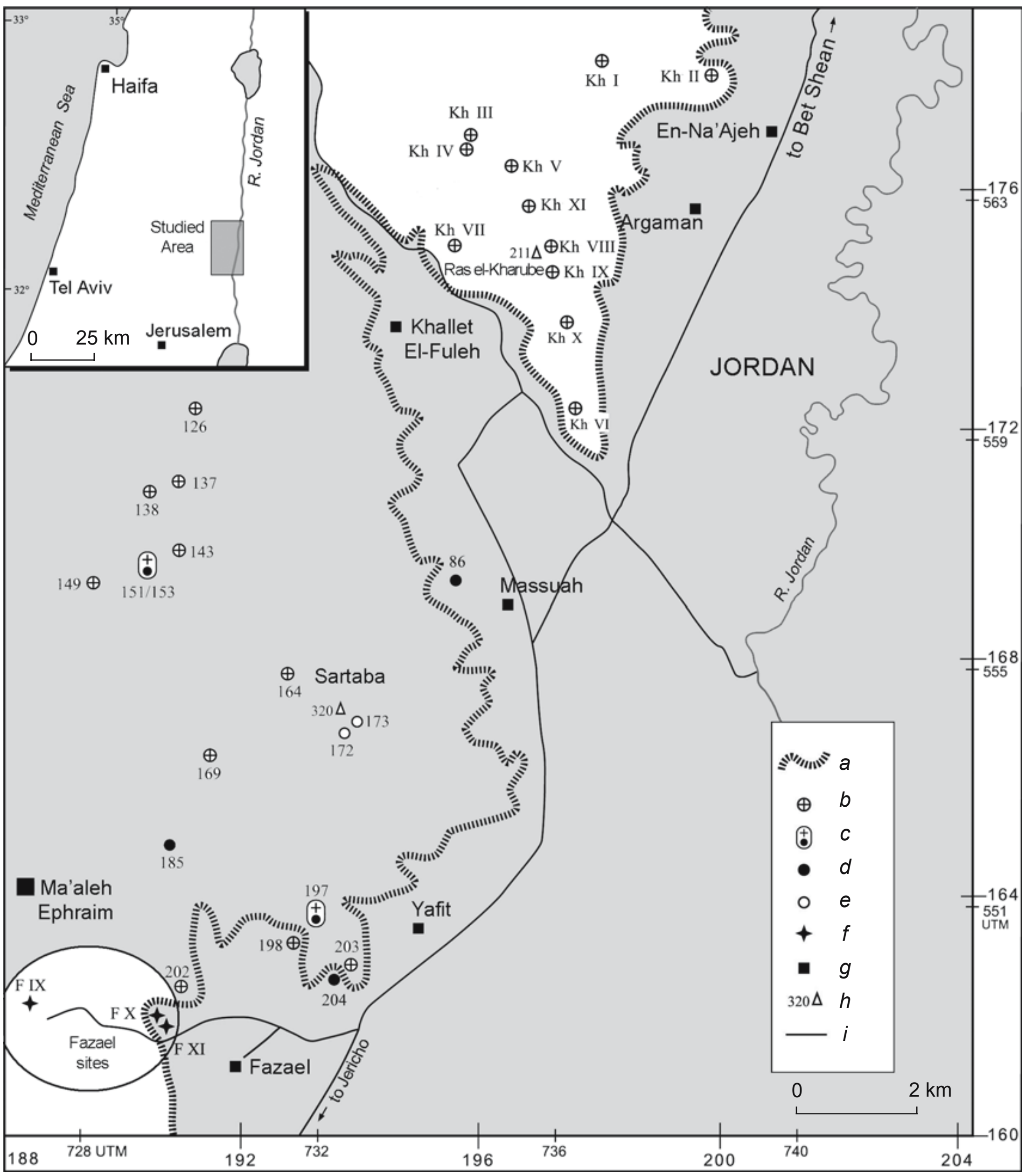

Fig. 4. Map showing the location of sites.
a – Lake Lisan shoreline (164 m below sea level); *b* – Middle Paleolithic site; *c* – Middle and Upper Paleolithic site; *d* – Upper Paleolithic site; *e* – site possibly attributable to the Upper Paleolithic; *f* – Fazael Upper Paleolithic site; *g* – settlement; *h* – elevation; *i* – road.

Artifacts

The Levallois technique was dominant in the industry of the Middle Paleolithic. Artifacts include Levallois cores (Fig. 5), Levallois flakes, blades and points (Fig. 6), various retouched tools on Levallois pieces (Fig. 7, 8), and numerous sidescrapers, many of these on Levallois pieces (Fig. 9). Few tools were produced on cortical pieces (see Fig. 8, *1*, *2*, *5*; 9, *2*). Cores showed faceted platforms and so were the butts of many Levallois artifacts. An unusual phenomenon was observed at three sites, Urqan el-Mastara, Tal'at 'Amreh, and Monument 2 (see Table 2; Fig. 4), located at a distance of about 1 km from each other. At each of these sites, a bifacial hand axe was found (Fig. 10). Such tools are normally not found at Middle Paleolithic sites, though at the Tabun Cave they are present in Mousterian levels and especially numerous in the lower Mousterian levels (McPherron, 2003: table 3.1). A discussion of this interesting phenomenon is beyond the scope of this study.

The Upper Paleolithic is period was characterized by the presence of blades and some bladelets (Fig. 11, *2 – 5*), tools made on blades (Fig. 11, *7*, *10*), endscrapers (Fig. 12), burins (Fig. 13, *1 – 8*), and especially carinated endscrapers, a tool indicative for the period (see Fig. 11, *8*, *9*; 12, *6*, *10*).

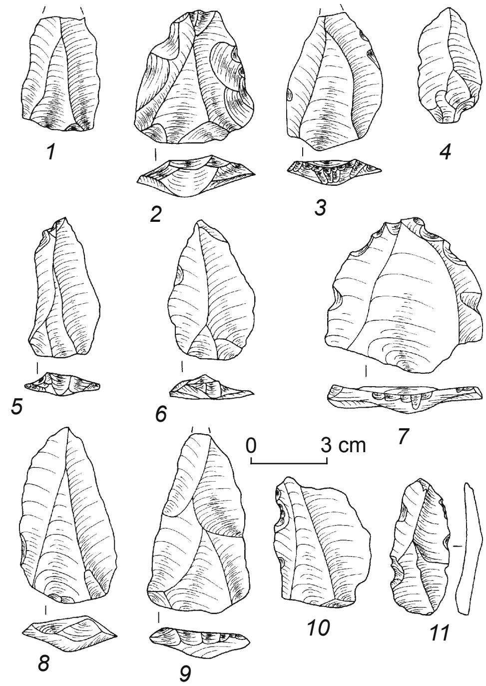

Fig. 6. Middle Paleolithic artifacts.
1 – 9 – Levallois flakes and points; *10*, *11* – notches.
1 – Kh III; *2* – Kh X; *3* – Kh XI; *4* – Umm Sawaneh 3 (126); *5*, *6*, – Jebel el-Mahjarha 1 (137); *7*, *8* – Ras Quneitra (164); *9*, *10* – Mugharet Sad Khariz (202); *11* – Monument 2 (203).

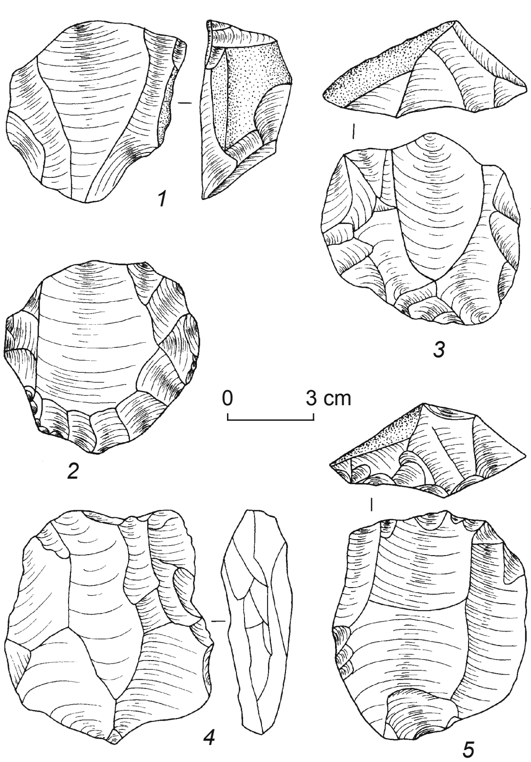

Fig. 5. Cores. Middle Paleolithic.
1 – Kh IV; *2* – Kh XI; *3* – 'Ain Abu Daraj 1 (143); *4* – EP195-2/EP195-1 (151/153); *5* – Monument 2 (203).

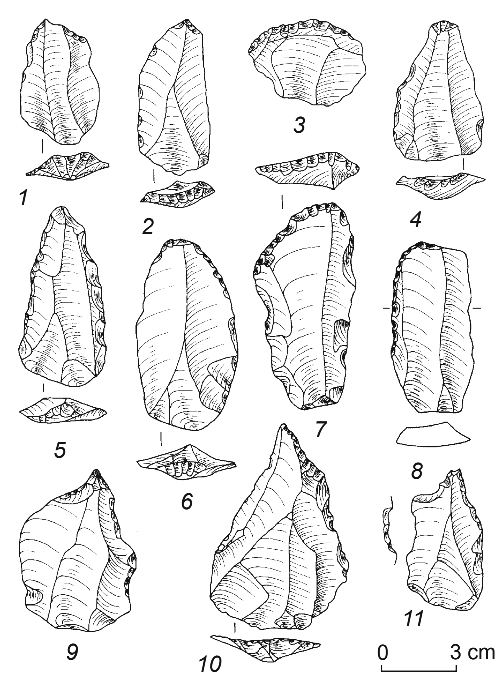

Fig. 7. Middle Paleolithic tools.
1, *2*, *6*, *8* – retouched Levallois pieces; *3, 4, 7* – scrapers; *5* – Mousterian point; *9, 11* – perforators; *10* – retouched Levallois point.
1 – Kh I; *2* – Kh III; *3* – Kh IV; *4* – Kh X; *5* – 'Ain Abu Daraj 1 (143); *6* – Jebel el-Mahjarha 1 (137); *7*, *8* – 'Urqan el-Mastara (197); *9* – EP195-2/EP195-1 (151/153); *10* – Monument 2 (203); *11* – Ras Quneitra (164).

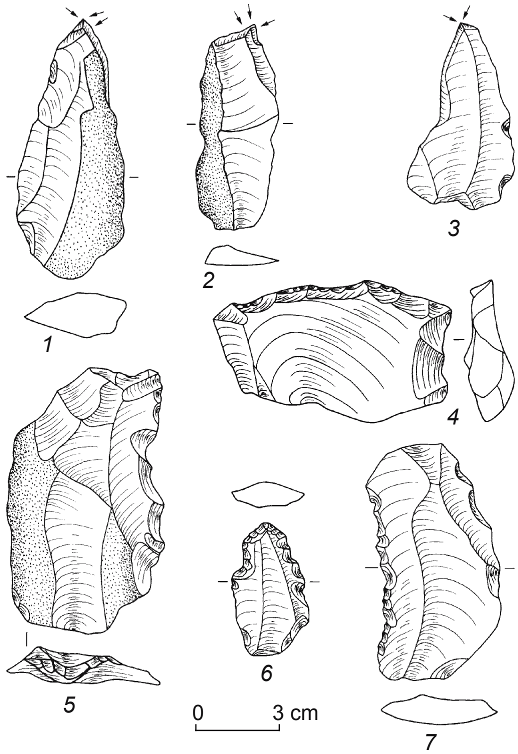

Fig. 8. Middle Paleolithic tools.
1 – 3 – burins; *4* – transversal scraper; *5 – 7* – denticulates on Levallois flakes; *6* – notch on a retouched flake.
1 – Umm Sawaneh 3 (126); *2*, *5* – 'Ain Abu Daraj 1 (143); *3* – 'Ain el-Mana' (169); *4*, *7* – Tal'at 'Amreh (198); *6* – Mugharet Sad Khariz (202).

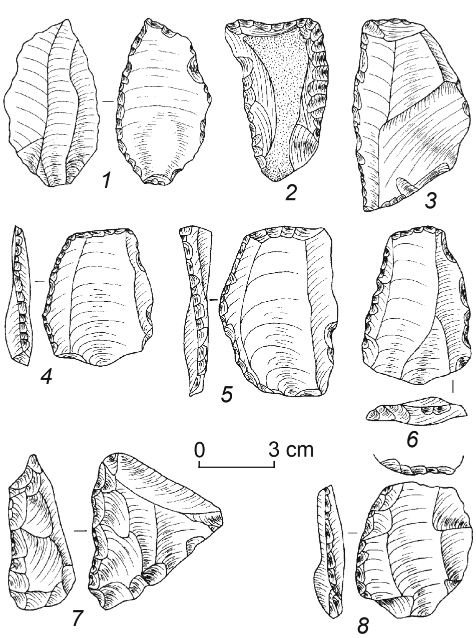

Fig. 9. Sidescrapers. Middle Paleolithic.
1 – Kh I; *2* – Kh III; *3* – Kh IV; *4* – Ras Quneitra (164); *5* – 'Ain el-Mana' (169); *6* – Mugharet Sad Khariz (202); *7*, *8* – 'Urqan el-Mastara (197).

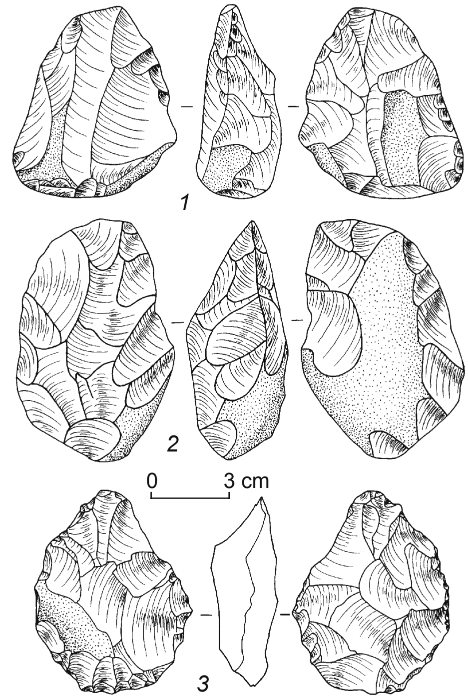

Fig. 10. Bifaces (handaxes). Middle Paleolithic.
1 – 'Urqan el-Mastara (197); *2* – Tal'at 'Amreh (198); *3* – Monument 2 (203).

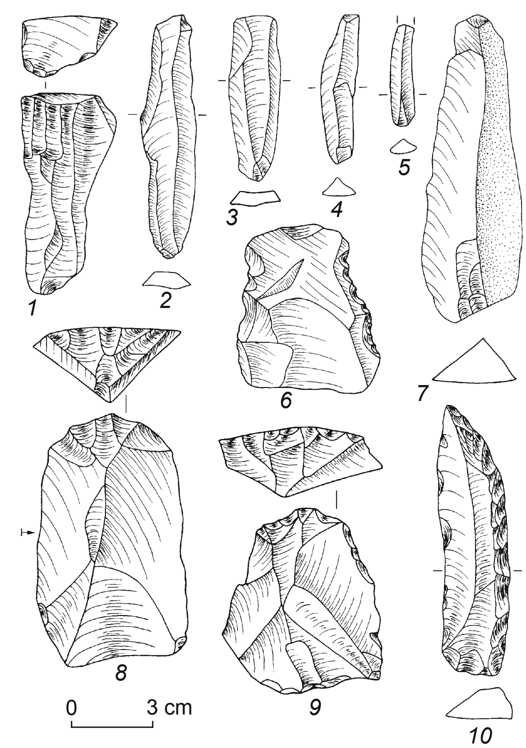

Fig. 11. Upper Paleolithic artifacts.
1 – core; *2 – 4* – blades; 5 – bladelet; *6* – denticulate; *7* – naturally backed knife; *8, 9* – carinated scrapers; *10* – backed knife.
1, *10* – Ruj'm e-Zia (86); *2*, *4*, *5* – Urqan Umm Safa (185); *3*, *6 – 9* – Monument 3 (204).

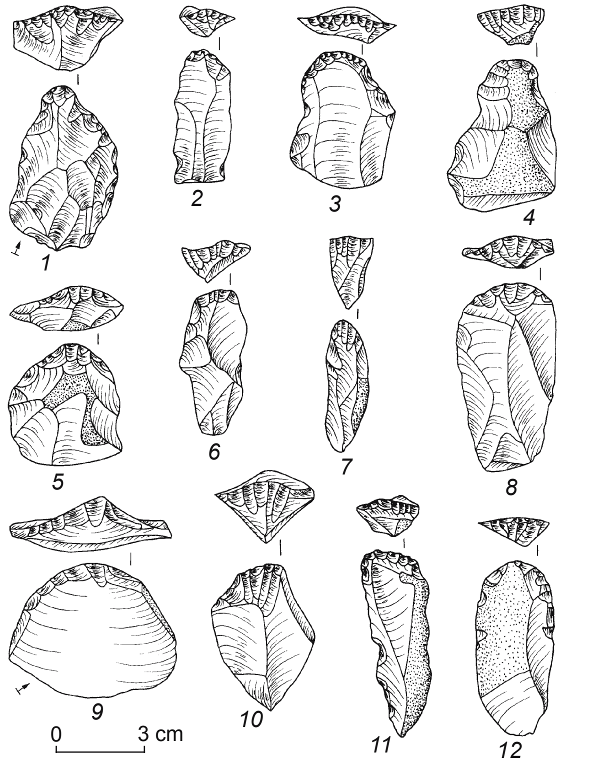

Fig. 12. Endscrapers. Upper Paleolithic.
1 – 3 – Ruj'm e-Zia (86); *4 – 7* – EP195-2/EP195-1 (151/153);
8 – 10 – Urqan Umm Safa (185); *11* – 'Urqan el-Mastara (197);
12 – Monument 3 (204).

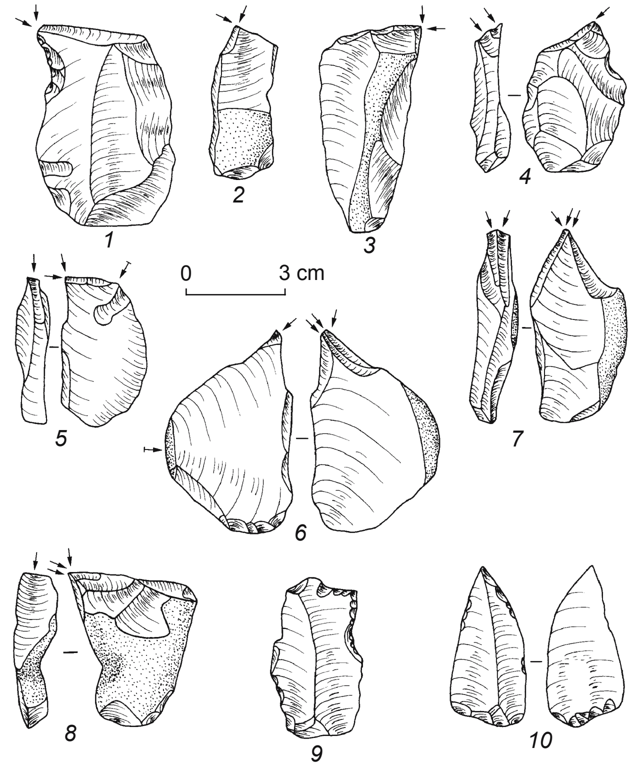

Fig. 13. Upper Paleolithic tools.
1 – 8 – burns; 9 – perforator; *10* – Emireh point.
1 – 3, *9*, *10* – Ruj'm e-Zia (86); *4*, *5* – EP195-2/EP195-1 (151/153);
6 – 8 – Urqan Umm Safa (185).

Discussion

The Middle Paleolithic. The sites and localities of the period were concentrated in two areas, on the Ras el-Kharubeh massif north of Nahal Tirzah and the Sartaba massif to the south of it. The lowest site Tal'at 'Amreh-1 (198), located at an elevation of 175 m below sea level (very close to the highest level of 164 m below sea level), was seemingly flooded only for a short period and the flint artifacts were exposed later. All other sites and localities spots were situated higher than 140 m below sea level and never flooded. Flint artifacts survived on or close to the surface and could be easily found. Sites at lower elevations – if such sites existed – were flooded for long periods, and their remnants were buried by the marl deposits of the Lisan Formation.

At present semi-arid climatic conditions, similar to those on the Negev highlands located about 100 km to the south, prevail in the area. The mountainous setting and the terrain cut by deep valleys are also similar to those on the Negev highlands. In the studied area, most sites were overlooking the ancient landscape, the gorges and valleys with springs or streams flowing to ancient Lake Lisan (or earlier Lake Samra). Similarly, the Negev Middle Paleolithic site of Rosh Ein Mor (D15) (Crew, 1976: 76) was overlooking steady water sources in Nahal Zin, and the site of Nahal Aqev (D35) (Munday, 1977: 36) was close to a present day fossil spring and overlooking perennial springs in Nahal Aqev. The evidence from these sites proves that over long spans of time a more humid "Mediterranean" climate prevailed. Woodlands and water sources supported wildlife, creating a firm base for human subsistence. Palynological and geological evidence point to a cold and wet phase (see (Crew, 1976: 76 – 78; Munday, 1977: 35 – 36)). Even though earlier attempts to date the Middle Paleolithic site of Rosh Ein Mor pointed to a quite young date, a recent reliable Th/U analysis of ostrich eggshell dated it at >200 ka BP (Rink et al., 2003: 200).

Although the Middle Paleolithic flint assemblages of the studied area show certain similarities to the collections of the Negev highlands, it would be far reaching to assume that the sites in both areas are contemporaneous. The period of about 200 ka is to long for such an assumption. Furthermore, no precise dating of the sites within the studied area, or the contemporaneity of the sites there are possible as till now no radiometric or palynological data are available. In addition, the question if some of the localities were outposts of base camps cannot be answered

Table 4. **Indices of sites 203 and 204 (after (Winter, Ronen, 2005: table 6))**

Indices	Monument 2 (203)	Monument 3 (204)
IL	18.5	6.2
IL ty	38.8	9.4
ILame	28.4	26.5
IR	18.4	15.6
III	2.0	12.5

by present data. Generally, it can be assumed that during the studied period a similar way of life presumes similar climatic and environmental conditions, creating a similar base for human existence.

The Upper Paleolithic. The sites of this period were discovered only on and around the Sartaba massif at elevations from 210 m below sea level up to 337 m asl, some of them were flooded for a certain period and exposed by human earth works (Ruj'm e-Zia, site 86) (Winter, 2005: 592) or by erosion at the Wadi banks of Nahal Fazael at the southwestern corner of the studied area (Fazael IX, X, and XI) (Goring-Morris, 1980). The reason for the scarcity of Upper Paleolithic sites compared to their predecessors could be a relatively shorter period or reasons created by the forces of nature such as deteriorating climatic conditions at the onset of this period.

The question whether during the Middle to Upper Paleolithic transition (ca 40 –50 ka BP) new populations did replace the autochthonous Middle Paleolithic population cannot be answered by the present data, but there are two facts which deserve attention. At two sites in the studied area, the assemblages (even though these were only surface finds) have been collected thoroughly and analyzed by conventional methods (Winter, Ronen, 2005: table 6). The Middle Paleolithic site of Monument 2 (203) yielded a rather high blade index (ILame) and very low Upper Paleolithic index (group III) (Table 4). The Upper Paleolithic site of Monument 3 (204) showed a presence of certain Levallois elements (IL and IL ty) and a rather high index of *racloirs* (IR) (Table 4). It should also be mentioned that at two other sites, EP 195 (151/153) and Urqan el-Mastera (197) the assemblages contained artifacts which could be attributed to both the Middle and Upper Paleolithic. All these facts could indicate continuity, a hypothesis still to be proved by comprehensive research and analyses.

It should be emphasized that additional sites of both periods could probably exist in the studied area but they were either overseen by the surveyors or concealed by the Lisan marls.

Conclusions

This short paper has no pretension to draw a full picture of the periods. It rather intends to emphasize the potential of the area and serve as a possible trigger for further research. The hilly, unfertile terrain was only minimally disturbed by human activities throughout the millennia, thus providing ideal conditions for such research before the bulldozers arrive. Because the dating of the sites relied mainly on the identification of the collected flint artifacts, a by-product of the general survey, and surveyors had no special know-how of flint typology, data are possibly incomplete.

Anyhow, the data collected by a surface survey only cannot provide answers for important questions and some of these are presented below.

1. No indications for the Early Paleolithic periods were found in this part of the Levantine corridor. Were these sites concealed by geological processes or was there no human presence in the area during this period? Further north, in the Jordan valley, the Early Paleolithic period is firmly documented at Ubediya, Gesher Benoth Ya'acob, and Ma'ayan Barukh.

2. The survey did not find Middle Paleolithic sites in the lower regions (except one close to the highest lake level). Did such sites exist during the earlier phases of the period, before the area was flooded, and today they are covered by the deposits of the Lisan formation?

3. Is the presence of few bifacial hand axes at Middle Paleolithic open-air sites a local or a chronological phenomenon?

4. Upper Paleolithic sites are few compared to the younger and well-documented Epi-Paleolithic presence in the lower parts of the area. During the Epi-Paleolithic period, the lake level was low and sites were never flooded (Bartov et al., 2002: 20). Were most of the Upper Paleolithic sites concentrated in the lower elevations and concealed later by the Lisan deposits?

No doubt, new understandings raise new questions and there are no easy answers to these questions. Let us hope that political and environmental conditions will allow future scholars to find appropriate solutions.

References

Bartov Y., Stein M., Enzel Y., Agnon A., Reches Z. 2002

Lake Lisan and sequence stratigraphy of Lake Lisan, the Late Pleistocene precursor of the Dead Sea. *Quaternary Research*, vol. 57: 9 – 21.

Bar-Yosef O., Goren N., 1980

Afterthoughts following prehistoric surveys in the Levant. *Israel Exploration Journal,* vol. 30: 1 – 16.

Bordes F. 1961
Typologie du paléolithique ancien et moyen, Memoire No. 1, Bordeaux: Publications de I'Institut de Préhistoire de l'Univ. de Bordeaux.
Crew H.L. 1976
The Mousterian site of Rosh Ein Mor. In *Prehistory and Paleoenvironment in the Central Negev, Israel I*, A.E. Marks (ed.). Dallas: Southern Methodist Univ. Press, pp. 75 – 112.
Goring-Morris A.N. 1980
Upper Paleolithic sites from Wadi Fazael. *Paléorient*, vol. 6: 173 – 192.
Hours F. 1974
Remarques sur l'utilisation de listes-types pour l'étude du paléolithique superieur et de l'epipaléolithique du Levant. *Paléorient*, vol. 2 (1): 3 – 18.
Hovers E., Marder O. 1991
Typo-chronology and absolute dating of the Kebaran Complex: Implications from the second season of excavations at Urkan E-Rub IIa. *Mitekufat Haeven*, vol. 24: 34 – 58.
McPherron S.P. 2003
Technological and typological variability in the bifaces from Tabun Cave, Israel. In *Multiple Approaches to the Study of Bifacial Technologies*, M. Soressi, H.L. Dibble (eds.). Philadelphia: Univ. of Pennsylvania, pp. 55 – 74.
Munday F.C. 1977
Nahal Aqev (D35): A stratified open-air Mousterian occupation in the Avdat/Aqev area. In *Prehistory and Paleoenvironment in the Central Negev, Israel*, vol. 2, A.E. Marks (ed.). Dallas: Souhtern Methodist Univ. Press, pp. 35 – 55.
Rink W.J., Richter D., Schwarcz H.P.,
Marks A.E., Monigal K., Kaufman D. 2003
Age of the Middle Paleolithic site of Rosh Ein Mor, Central Negev, Israel: Implications for the age range of the Early Levantine Mousterian of the Levantine Corridor. *Journal of Archaeological Science*, vol. 30/2: 195 – 204.
Winter H. 1996
App. 1. The flint finds in the Eastern Valleys. In *Zertal A. The Mannasseh Hill Country Survey*. Vol. 2: The Eastern Valleys and the Fringes of the Desert. Haifa: Haifa Univ. and Ministry of Security Publications, pp. 611 – 680, (in Hebrew).
Winter H. 1997
Flint finds from the Manasseh Hill Country. *Mitekufat Haeven*, vol. 27: 101 – 119.
Winter H. 2005
App. 1. The flint artifacts. In *Zertal A. The Mannasseh Hill Country Survey*. Vol. 4: From Nahal Bezek to the Sartaba massif. Haifa: Haifa Univ. and Ministry of Security Publications, pp. 565 – 647, (in Hebrew).
Winter H., Ronen A. 2005
Two new Paleolithic sites in the Southern Jordan Valley. In *Major Issues in the Eurasian Paleolithic: Proceedings of the Symposium "Early Human Habitation of Central, North and East Asia: Archaeological and Paleoecological Aspects*. Novosibirsk: Izd. IAE SO RAN, pp. 36 – 44.
Zertal A. 1984
Arubboth, Hepher and the third Solomonic District. Tel Aviv: Hakibbutz Hameuchad Publishing House, (in Hebrew).
Zertal A. 1992
The Manasseh Hill Country Survey. Vol. 1: The Shechem Syncline. Haifa: Haifa Univ. and Ministry of Security Publications, (in Hebrew).
Zertal A. 1996
The Manasseh Hill Country Survey. Vol. 2: The Eastern Valleys and the Fringes of the Desert. Haifa: Haifa Univ. and Ministry of Security Publications, (in Hebrew).
Zertal A. 2004
The Manasseh Hill Country Survey. Vol. 1: The Shechem Syncline. Brill, Leiden; Boston.
Zertal A. 2005
The Manasseh Hill Country Survey. Vol. 4: From Nahal Bezek to the Sartaba. Haifa: Haifa Univ. and Ministry of Security Publications, (in Hebrew).
Zertal A., Mirkam N. 2000
The Manasseh Hill Country Survey. Vol. 3: From Nahal 'Iron to Nahal Shechem. Haifa: Haifa Univ. and Ministry of Security Publications, (in Hebrew).

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GROUND-STONE AXES IN THE UPPER PALEOLITHIC OF JAPAN

Introduction

Among the stone tools dated to the first half of the Upper Paleolithic in Japan, there are axes with ground edges. These kinds of tools were discovered for the first time during archaeological excavations at the site of Iwajuku in 1949. Subsequently, stone tools started to be found in all parts of Japan and the number of ground-stone axes has also increased. Traditionally, the presence or absence of such tools marks the Neolithic and Paleolithic periods, respectively. The discovery of ground tools in a Paleolithic context led a number of archaeologists to attribute the corresponding culture to the Pre-Ceramic Neolithic. However, the dating of the artifacts has shown that all such tools belong to the first half of the Upper Paleolithic. In connection with this, a question arises whether stone tools with ground edges dated to the early stage of the Upper Paleolithic should be considered an exclusively Japanese trait, or whether they represent a part of a much wider Eurasian cultural phenomenon. At present, it is impossible to embrace and analyze all the information contained in the literature devoted to Eurasian sites. The author hopes that this paper, introducing Japanese materials, will prove useful for colleagues working in mainland Eurasia.

On ground-stone tools

These artifacts are also called "partly ground axes," to distinguish them from the tools ground over the whole surface. The partly ground axes are characteristic of the stone inventory of the first half of the Japanese Upper Paleolithic, as well as the Early Neolithic, starting with the Sosoki stage of the Jomon period. However, the Upper Paleolithic and Neolithic axes are rather different in their morphologies. While many of the Upper Paleolithic tools have rather weak grinding that is confined to the edge of only one face, the edges of the Neolithic axes are carefully ground from both sides, resembling the edges of *hamaguri* shells. Some of the Neolithic axes retain parts covered with pebble cortex.

The geological deposits corresponding to the first and second halves of the Japanese Upper Paleolithic are separated by the AT tephra layer (ash of the Aira-Tanzawa volcano). The archaeological assemblages dated to the period prior to the tephra deposition are dominated by knife-like tools and stone axes, whereas the assemblages from layers overlying the Aira-Tanzawa ash are dominated by points, burins, and various types of endscrapers. The knife-like tools are much less numerous than in the earlier assemblages. In addition, a characteristic of the later period is the well-expressed miniaturization of tools. As to the ground-stone axes, they are absent in layers above the tephra. The disappearance of axes may be related to a radical change in the composition of the hunted fauna. Recently conducted palynological analyses in different regions of Japan suggest significant fluctuations in the climatic and environmental conditions, affecting the distribution of fauna and flora. The descriptions of ground-stone axes that

Ground-edge axes from the Kanto region

Site	N	Raw material	Length, cm	Width, cm	Thickness, cm	Weight, g	Notes	Sources
Iwajuku	1	Slate	9.50	5.50	2.30	159.00	–	Sugihara, 1956
	2	»	10.00	6.80	2.80	281.00	–	Ibid.
	3	»	10.90	5.90	2.30	184.50	Material of Aizawa Tadahiro	Aizawa, Sekiya, 1988
Suzuki	1	Andesite	8.85	5.20	1.15	87.50	–	Tateno, 1980
	2	Slate	8.45	4.75	2.45	111.50	–	Ibid.
	3	Sandstone	10.19	6.68	2.60	210.30	There is a blade struck to resharpen the working edge	»
	4	Sericitic schist	1.31	3.89	0.51	(3.30)	Working edge is broken	»
Simofure-ushifuse	1	Chlorite slate	–	–	–	105.68	Bifacial grinding	Iwasaki, 1986
	2	Same	–	–	–	40.25	Bifacial grinding	Ibid.
	3	Aleurolite	–	–	–	46.00 ± ± 101.43	Basal part and working edge are broken	»
	4	Slate	–	–	–	145.98	–	»
	5	Andesite	–	–	–	41.48	–	»
	6	Black slate	–	–	–	(4.88)	Working edge is absent	»
	7	Chlorite slate	–	–	–	172.90	Four objects amenable to refitting	»
	8 – 10	–	–	–	–	–	There are blades struck to resharpen the working edge	»
Musashidai	1	Obsidian	–	–	–	–	Layer X-a, axe with one working edge	Yokoyama, 1984
	2	Sandstone	–	–	–	–	Layer X-b, bifacial grinding, including the middle part of the ventral surface	Ibid.
	3	–	–	–	–	–	Layer X-b, working edge is partly broken	»
	4	Sandstone	–	–	–	–	Layer X-b, refitted tool	»
	5	–	–	–	–	–	Same	»
	6	–	–	–	–	–	»	»

follow below (see Table) are restricted to the Upper Paleolithic period only.

The **Iwajuku** site is situated in the Gumma Prefecture. It was identified by Aizawa Tadahiro in 1946 and represents the first Paleolithic site discovered in Japan. Excavations were carried out in 1949 and yielded a stone inventory consisting of ground-stone axes, knife-like tools, and other artifacts. No stone axes were found in the upper layer. In the course of the subsequent excavations (Aizawa, Sekiya, 1988), just one ground-stone tool and several pebble choppers were found in the lower layer.

Two stone axes found in 1949 are made on massive flakes. Originally they were described as handaxes. Of special interest is the low quality of grinding (Sugihara, 1956). The tools are made of slate and their surfaces bear clear traces of weathering. The stone axe found by Aizawa Tadahiro has well expressed traces of grinding on both sides on the middle part of the tool and near the working edge. These three ground-stone axes, found in the AT layer and black layer of Akagi-kanuma pumice (Ag-KP, ca 32 ka BP), belong to the first half of the Upper Paleolithic.

The site of **Suzuki** is situated in the town of Kohei of the Tokyo metropolitan area. Archaeological investigations were carried out in 1974 and encompassed an area of 4880 m^2. As a result of this work, the materials of six archaeological cultures, ranging from the early to the late stages of the Upper Paleolithic, were found.

Three axes with ground edges were recovered from the lowermost cultural horizon IX, belonging to the lower part of the secondary Tachikawa loams. In addition, there were some flaked axes, large oblong flakes, sidescrapers, knife-like tools, hammerstones, and other tools. The AT layer, which serves as a stratigraphic marker, lies above layer IX and corresponds to cultural horizon VI. Tools from layers IV and III, dating to the second half of the Upper Paleolithic, are notable for their small size. Layer IV yielded a large number of knife-like tools and points, while layer III was abundant in microblades.

The site of **Simofure-ushifuse** is situated near the village of Kyuakabori and the town of Isesaki in the Gumna Prefecture. Excavations were carried out from November of 1982 to March of 1983 over an area of 33,000 m^2. The Paleolithic material was found in the upper (cultural layer 1) and middle (cultural layer 2) parts of the loam. Cultural layer 1 yielded seven concentrations of pebbles arranged in the form of irregular circles. The distance between the accumulations was 3 – 4 m. Each of them consisted of hundreds of pebbles of different sizes. The tool-kit contained a significant number of points, knife-like artifacts, burins, and small sidescrapers.

Cultural layer 2 yielded 2037 artifacts forming 21 concentrations. Each concentration had an irregular ellipsoid shape and contained tools. Among the latter were 10 ground-stone axes as well as 10 blades that have been refitted to these axes.

The **Musashidai** site is located in the town of Futyu of the Tokyo metropolitan area. The site has a good view of the Musashidai valley. Excavations were carried out from 1981 to 1983 over an area of 2868 m^2. The general thickness of the section, including the basal alluvial gravel, was 8 m; the deposits were subdivided into 25 lithological horizons. Ten of them contained cultural remains dating from the first half of the Upper Paleolithic to the historical period. Three cultural horizons were distinguished in the lower part of the AT layer, and five horizons in the upper part.

Ground-stone axes came from the lower part of the AT layer: five from the lowermost cultural horizon X-b, and one from the overlying horizon X-a, which also contained a blade struck from this axe. The axe from horizon X-a was made of obsidian, while those from horizon X-b were sandstone. In addition, horizon X-a contained knife-like tools, burins, sidescrapers, and some other tools, and horizon X-b yielded flaked axes and numerous stone blades of irregular shape with some traces of utilization.

The site of **Hinatabayashi-B** is situated near Lake Nojiri in the Nagano Prefecture. Many concentrations of stone tools were found there. They included flaked axes, knife-like and pebble tools, as well as a number of ground-stone axes. A specific feature of this site is an oval sandstone grinding stone 16.5 cm in length. Its central portion bears a small depression resulting from grinding. This object suggests an association with small stone mortars of the *ishizara* type, dating from the Jomon period.

The sites of **Tsukinoki** and **Ookubo-minami** in the Nagano Prefecture also contained knife-like tools and ground-stone axes. The site of Tsukinoke yielded grinding stones made of sandstone and similar to that from Hinatabayashi-B, but larger in size. Their length reached 23.7 cm. Similar finds were also reported from the region of Kanto (for instance, the **Nanokamachi** site in the Hyogo Prefecture) and some other places.

Ground-stone axes associated with knife-like tools were also found at the sites of **Boyama** and **Minami-sarizuka-miyahara-1,** the Chiba Prefecture, and at the site of **Shimosato-motomura** (Tokyo metropolitan area).

Conclusions

1. The period of use of ground-stone axes was limited to the first half of the Upper Paleolithic. The age of the lower

portion of the AT layer is ca 22 ka BP, and in the Gumma Prefecture, the Ag-KP deposits 1 m below the AT layer are dated to 32 ka BP (Matida, Arai, 1992). Judging from the stratigraphic position of the axes, they should be dated to the interval of 30 – 25 ka BP. However, this is still an open question. Archaeological materials of this age are rather rare in Japan. The question about the origins of flaked axes is also open. To resolve these problems new finds from mainland Eurasia are needed, but for the time being no information is available.

Another important issue is to understand why the ground-stone axes completely disappeared after the time of formation of the AT layer. It appears that the cause relates both to changes in tool use as well as to abrupt environmental changes. As a result of the Aira-Tanzawa explosion, a great amount of volcanic ash was ejected into the atmosphere, triggering climatic instability, a decrease in temperature, and environmental degradation. As a consequence, the environmental situation in the Far East radically changed. Several more strong eruptions took place at that time, but the spread of volcanic lava was restricted to the Kagoshima Bay area. The thickness of the pumice layer in the Kagoshima Prefecture near the epicenter of eruption is very great. Moreover, it has been shown that the AT deposits are also present several thousand kilometers away in the Russian Far East (Ibid.).

The sharp decrease in temperature entailed changes in the character of vegetation. Palynological analyses indicate that mixed forests (broad-leaved and coniferous) were replaced by cold steppes and fern brushwoods (Serizawa, 1982)

It appears that stone axes were mainly used for felling trees and wood processing (Sahara, 1994). As the arboreal vegetation became more and more scarce, the need for axes also decreased. The disappearance of forests and formation of steppes led to a change in the composition of hunted animals, and, as a consequence of this, hunting tools also changed. The AT layer that formed after the volcanic eruption contains increasing numbers of projectile points, which replaced knife-like tools.

2. In the deposits of the early stage of the Upper Paleolithic, which had formed prior to the deposition of the AT layer, ground-stone axes were often found in association with knife-like tools. The latter implements were most frequently represented by trapezoid forms, morphologically close to ground-stone axes. Such a situation has been recorded at the sites of Simofure-ushifuse (Gumma Prefecture), Hinatabayashi-B (Nagano Prefecture), Shimosato-motomura (Tokyo metropolitan area), Boyama, Deguchi-kanezuka, Minami-sarizuka-miyahara-1 (Chiba Prefecture), and some others. It is possible that the Early Upper Paleolithic tradition of manufacturing ground-stone axes was formed on the basis of trapezoid-shaped tools. As to the latter, the question of their origins has to be studied using materials from the Kirihara site in the Gumma Prefecture, dated to the period after the Akagi-yama eruption and the formation of the Ag-KP tephra layer (Aizawa, Sekiya, 1988).

3. Trapezoid tools and ground-stone axes have been found in ring-shaped accumulations, the purpose of which is very difficult to interpret. One of these objects might represent remains of a short-term dwelling, or perhaps of a permanent living structure (Kosuge, 2005). However, no post holes were found along the edges of these large (more than 10 m long) concentrations of stones. Their absence makes the acceptance of the hypothesis about the existence of permanent living structures rather problematic. Judging by the fact that all such accumulations contain many cores, blades, and hammerstones, and all the cores and blades can be refitted, one may conclude that these spots served as places where tools were manufactured.

4. Some of the ground-stone axes (like those from Iwajuku and Musashidai) have grinding in the middle part of the ventral face as well. This tells us that extensive grinding of tool surfaces may have occurred not only in the Neolithic, but also in the Paleolithic. The part of the surface that was ground depended on the tool function. The discovery of partly ground axes in one context with grinding stones probably testifies to the existence of a technological interconnection between these tools.

At the sites of Suzuki, Simofure-ushifuse, and Musashidai, ground-stone axes were found in association with blades amenable to refitting. The blades represent working edge resharpening products, and their presence points to the possibility of secondary use of the restored tools.

5. Tools very similar to the ground-stone axes from Japan were found at the site of Afontova Gora-2 (Krasnoyarsk, Russia) (Kato, 1971). The use-wear traces recorded on these tools may suggest that they were adzes for working wood. However, the finds from Afontova Gora differ from the Japanese ground-stone axes in the type of edge grinding. In addition, they were found in deposits dated to 20 ka BP. In any case, the Siberian finds demonstrate that the technology of ground-stone axe manufacture was also present in mainland Eurasia.

Of course, the questions of the origins of ground-stone axes, their functions, and the causes of their disappearance require further research.

References

Aizawa T., Sekiya A. 1988
Akagi-sanroku-no kyusekki. Tokyo: Kodansha.
Iwasaki T. 1986
Shimofure-ushifuse. Shibukawashi: Zaidan hojin gunma-ken maizo bunkazai chosa jigyodan.
Kato S. 1971
Manmosu hanta. Tokyo: Gakuseisha.
Kosuge M. 2005
Kanjo burokku-gun. Midorishi: Kasakeno-Iwajuku bunka shiryokan.
Machida H., Arai F. 1992
Kazanbai atorasu. Tokyo: Tokyo daigaku shuppankai.
Sahara M. 1994
Ono-no bunkashi. Tokyo: Tokyo daigaku shuppankai.
Serizawa Ch. 1982
Nihon kyusekki jidai. *Iwanami shinsho*, vol. 209: 141 – 145.
Sugihara S. 1956
Gunma-ken iwajuku hakken-no sekki bunka. Tokyo: Meiji daigaku.
Tateno T. 1980
Suzuki iseki III. Tokyo: Suzuki iseki keikokai..
Yokoyama Y. 1984
Musashidai iseki-I. Tokyo: Toritsu-fuchu-byoinnai iseki chosakai.

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OUT OF AFRICA AND INTO EURASIA WITH CONTROLLED USE OF FIRE: EVIDENCE FROM GESHER BENOT YA'AQOV, ISRAEL

Introduction

Evidence for controlled use of fire was recently reported from the Acheulian site of Gesher Benot Ya'aqov (Goren-Inbar et al., 2004). The geographical setting between Africa and Europe and the chronological placement of this evidence is viewed as an indication that the ability to use and control fire was a part of the hominid behavioral repertoire in the course of human dispersal from Africa into Eurasia. The potential role of fire in the process of Middle Pleistocene human diffusion, migration, and colonization is evaluated here through a systematic review of the early evidence of fire.

In this paper, we present the theoretical background and methodology applied to the study of fire use at Gesher Benot Ya'aqov (hereafter GBY). The Early Middle Pleistocene evidence from the site consists of burned flint artifacts, including a small-size fraction that was found spatially clustered, charcoal fragments, burned wood, fruit, and seeds (Ibid.). The identification of burned flint items was initially based on macroscopic signs of heat alteration and was later confirmed by thermoluminescence (TL) measurements (Alperson-Afil, Richter, Goren-Inbar, in press). In order to examine the cause of the burning (i.e., natural vs. anthropogenic fires), the spatial distribution of the burned and unburned flint microartifacts was examined.

We assume that natural wildfires result in extensive burning, while anthropogenic fires in the form of hearths result in spatially discernible clusters of burned material, specifically, small-sized material. We base this assumption on various ethnographic and archaeological observations of hearth-related activities and discard patterns.

Hearth-related spatial patterns. Human activities are spatially patterned, and the fact that humans tend to carry out a vast range of activities in close vicinity to hearths is widely documented. The hearth assembles the social group and is the area in which social interactions, tool production, food processing, food consumption, and ritual ceremonies are carried out (e.g., (Binford, 1983; Galanidou, 2000; Spurling, Hayden, 1984; Wadley, 2006; Yellen, 1977)). While a large range of activities (e.g., social interactions) leaves no tangible evidence for us to uncover, other actions (e.g., tool making and food processing) contribute directly to the formation of the archaeological record. The manufacturing of artifacts, one of the behaviors that Brooks and Yellen defined as principal "debris-generating" behaviors, is strongly associated with hearths (Brooks, Yellen, 1987: 82).

Hearths not only serve as spatial spots of accumulation but influence the distribution patterns of certain size groups within the assemblage. Binford (1978, 1983) suggested that when people work around a hearth, the formation of certain spatial patterns appears to be universal. More specifically, the distribution of debris often displays two concentric zones around the hearth: the drop zone in proximity to the hearth, where small fragments of bone/stone are left *in situ* (residual primary refuse in the terminology of Schiffer (1972, 1987)), and the toss zone, an area further away from the hearth to which the larger debris is tossed (secondary refuse in the terminology of Schiffer (1972)). Thus the area closest to the hearth is likely to display high quantities of small *in situ* refuse.

The fact that small items are left in their original location while large items tend to be removed was reported as early as 1961 in Green's pioneering study of discard patterns (Green, 1961: 91). Notwithstanding, spatial analysis studies often concentrate on the larger refuse and features, despite the fact that "…the data most likely to be informative…are very small refuse items, such as chipping debris, small bone fragments, and plant macrofossils, which will often be found in primary context" (O'Connell, 1987: 104).

Smaller refuse is more likely to be found *in situ* for several reasons: small items are less visible and are more likely to be missed during refuse clearance and preventive maintenance of the activity area (e.g., (DeBoer, 1983; Schiffer, 1987)); their small dimensions make them less hazardous (e.g., (Clark, 1991; Hayden, Cannon, 1983)); and they are more prone to trampling and thus penetrate deeper into the occupation surfaces (see (DeBoer, 1983) for a detailed discussion).

The fact that small refuse is more likely to be left *in situ* than large refuse is known as "Mckellar's principle" (first published in (Schiffer, 1976: 188)). Mckellar's work on the litter of the University of Arizona campus indicated that there is a critical size factor in refuse disposal patterns. She found that items above 9 cm were consistently tossed into trash cans, while smaller items were left behind as primary refuse (Ibid.; 1987: 62; Rathje, 1979: 10). Mckellar's principle has been confirmed in a variety of ethnoarchaeological settings (e.g., (Schiffer, 1987: 62 and references therein; Stevenson, 1991 and references therein)). However, while the general principle has been widely adopted, no conventional limit has been defined for the critical size factor. In other words, what is considered small? One extreme would be particles smaller than 1 mm (*microdebitage* in the terminology of Fladmark (1982), referring only to stone knapping products). Under a microscope, microdebitage can be further divided into *microflakes* and *microchunks* (Vance, 1987). A maximum size of 2 mm, *microartifacts* in the terminology of Stein (Dunnell, Stein, 1989; Stein, Teltser, 1989), referring to all archaeological residues, has also been suggested. These microartifacts have been found to be significant in the study of both natural (see (Dunnell, Stein, 1989)) and cultural (e.g., lithic manufacturing and discard (Hull, 1987); duration of occupation (Simms, 1988)) formation processes. Other studies set the limit at 2.5 mm (Metcalfe, Heath, 1990), 6 mm (Austin et al., 1999), 10 mm (Nadel, 2001), 25 mm (DeBoer, 1983) or 50 mm (O'Connell, 1987). Nevertheless, the various studies all share the view that small-dimensioned items are essential components in the reconstruction of site structure and are optimal indicators of activity areas (Cessford, 2003: 3; Hayden, Cannon, 1983: 134; Schiffer, 1987: 94; Simms, 1988: 208).

In conclusion, ethnographic observations have established the foundations of site structure reconstruction, which is based on the recognition that the association between features (i.e., hearths) and artifact distribution can provide the contextual framework of artifact concentrations (Simek, 1984). Consequently, in attempting to reconstruct the formation process of hearth-related spatial patterns, we can draw on the following assertions:

1) a wide range of activities is carried out in close proximity to hearths;

2) hearths are spatial spots of refuse accumulation;

3) small refuse is more likely to be left *in situ* than large refuse;

4) hearths are thus likely to display dense concentrations of small-sized refuse.

Archaeological evidence of similar hearth-related discard patterns has been reported as early as the Middle Paleolithic (Vaquero, Pasto, 2001) and from a variety of archaeological settings. These include open-air sites (e.g., (Goring-Morris, 1988; Hietala, 1983); see also Goring-Morris A.N. Prehistoric Investigations in the Western Negev. Pt. 1: The Shunera Dunes, Givat Hayil, Nahal Sekher and Hamifgash. Jerusalem: Qedem, Monographs of the Inst. of Archaeology (in prep.)), rockshelters, and cave sites (e.g., (Galanidou, 1997; Vaquero, Pasto, 2001)), in all of which the hearths are easily identifiable features.

Phantom hearths. Hearths are spatially bounded features. When uncovered in archaeological sites they often display distinctive characteristics of color, size, contour, depth, and the use of stones for construction. In addition, since they serve as focal points of activities, hearths display areas of refuse accumulation, specifically small refuse. These patterns are evident when we examine sites in which the hearths are well preserved. Here we are concerned with *phantom hearths* that display no directly observable features. Leroi-Gourhan's definition of *structures latentes* established the approach to such archaeological features, namely that these can be evident through observable patterns of the spatial distribution of artifacts (Leroi-Gourhan, Brezillon, 1972). Considering the hearth-related spatial patterning discussed above, we may assume that clusters of debris, specifically small burned debris, are indicators of hearths. If we pursue the location of the hearths, we should be able to trace it in the center of these concentrations. At Belvédère quarry (Netherlands), clusters of burned artifacts suggested the presence of a hearth in the center of such a concentration (Stapert, 1990). Similarly, the spatial analysis of flint microartifacts from GBY has traced clusters of small-sized burned items, interpreted here as remnants of hearths.

The evidence from Gesher Benot Ya'aqov

The 790,000-year-old Acheulian site of Gesher Benot Ya'aqov is located on the shores of the paleo-Lake Hula in the Levantine Corridor (Fig. 1). A 34 m depositional sequence was exposed in the study area. The sediments, documenting an oscillating paleo-lake, are considered to reflect global climatic changes and are assigned to OIS 18 – 20 (Feibel, 2001, 2004). The sequence is estimated to represent some 100,000 years of the freshwater lake. Thirteen archaeological horizons embedded within the sequence indicate that hominids repetitively occupied the lake margins (Goren-Inbar et al., 2000). Diverse evidence suggests that the Acheulian hominids hunted, processed meat, extracted marrow, quarried and transported different kinds of rock, skillfully produced stone tools, and gathered a vast range of plant food including seven types of nuts, the latter preserved due to the waterlogged environment (Goren-Inbar et al., 1994, 2002; Goren-Inbar, Saragusti, 1996; Goren-Inbar, Werker, Feibel, 2002).

Burned flint occurs in all the excavated archaeological horizons. In this study, we present results concerning burned flint items and their spatial distribution from two archaeological layers (V-5 and V-6), both excavated in Area C (see Fig. 1) and located some 13 m above the Brunhes-Matuyama chron boundary (Goren-Inbar et al., 2000), thus dated to the time of OIS 18 (Ibid.). These layers contain two types of sediments: coarse (coquina) in layer V-5 and fine (clay) in layer V-6; the shift between these sediment types indicates a change in the water level of the lake (Ibid.; Feibel, 2004). Layer V-5 (with an excavated volume of 2.25 m^3) and layer V-6 (with an excavated volume of 1.39 m^3) yielded flint assemblages that are large enough for a statistically valid lithic analysis (Table 1).

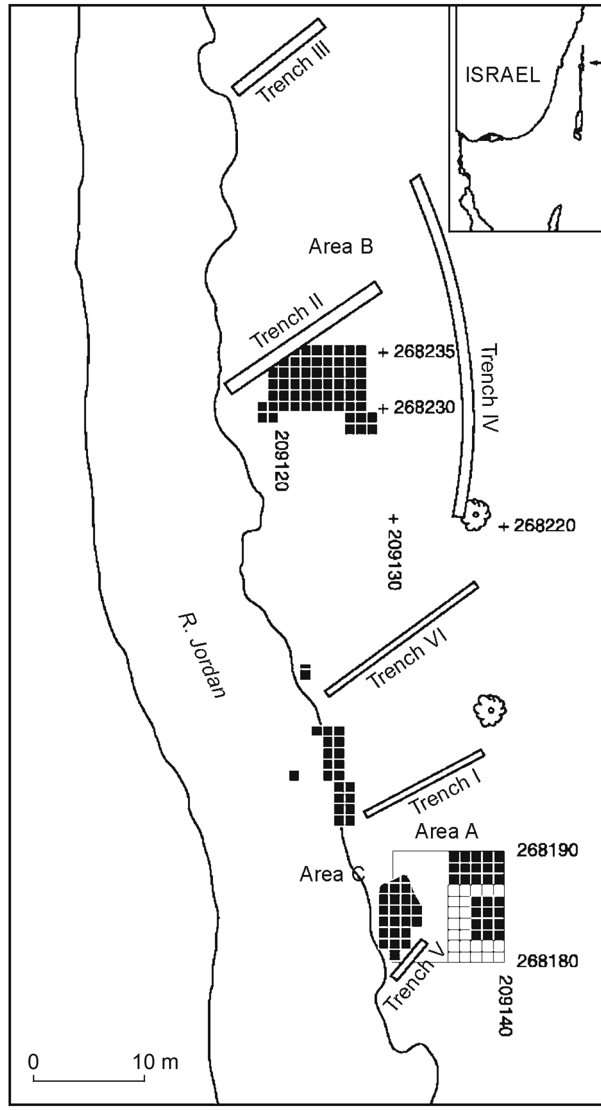

Fig. 1. Location map of Gesher Benot Ya'aqov and excavation areas.

Methodology

The excavation methodology at GBY was aimed at exposing the tectonically tilted occupation horizons along the strike and dip of each layer in order to obtain an optimal representation of the spatial organization of each horizon ("living floor"). Once exposed, the horizon was drawn and items were retrieved with a full spatial reference (X, Y and Z coordinates); these include mostly artifacts larger than 2 cm. Other materials were retrieved through excavation of 50 cm^2 quadrants to a depth of 5 cm and were thus given a more general spatial reference (X and Y are 50 cm^2 and Z is a range of heights). The entire excavated deposit of the two layers was wet-sieved during fieldwork and the sediments were bagged with their recorded spatial location.

Sorting of the sieved sediments of layers V-5 and V-6 yielded rich and varied assemblages (e.g., bones and teeth of micro-mammals, fish, and crabs; fruit, grains, and specks of charcoal). Most of the small-sized lithic items were retrieved through this procedure. These include all stone items (basalt, flint, and limestone) that range in size from 2 to 20 mm (hereafter microartifacts) (Fig. 2).

Burned flint items (artifacts and microartifacts) were observed during fieldwork and during the succeeding lithic analysis. The identification of burned flints was based on the presence of typical macrofractures (e.g., potlids), known to result from the exposure of flint to temperatures of approximately 350 – 500 °C (Fig. 3) (Purdy, 1975, 1982; Purdy, Brooks, 1971). TL analyses confirmed these observations and demonstrated that these damaged items were indeed heated in antiquity (Alperson-Afil, Richter, Goren-Inbar, in press). The bulk of the burned flints consists of microartifacts (see Table 1). Differentiation between natural items (e.g.,

Table 1. **Frequency of stone artifacts and microartifacts in Area C**

Layer	Artifacts			Microartifacts		
	Burned flint	Unburned flint	Basalt and limestone	Burned flint	Unburned flint	Basalt and limestone
V-5	1	312	86	550	30,058	5885
V-6	3	176	66	82	4415	2078

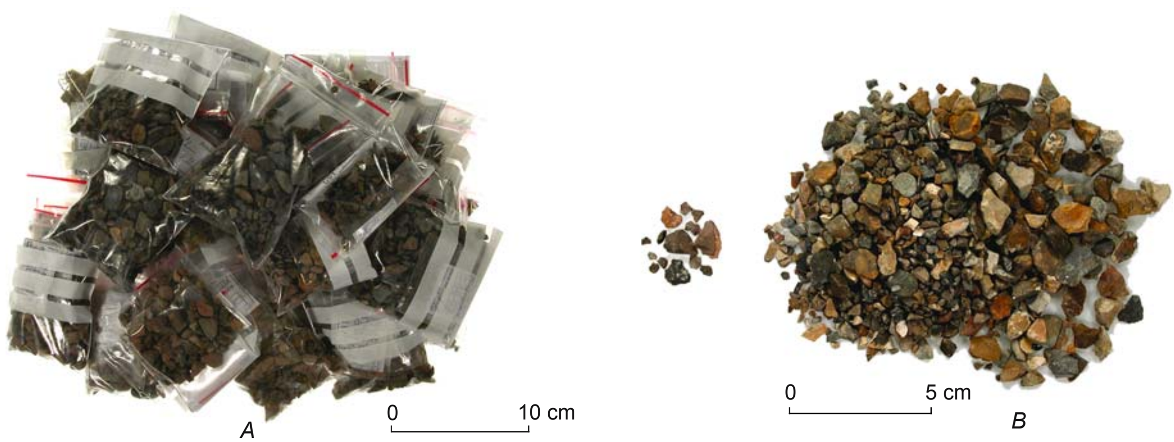

Fig. 2. Flint microartifacts that were extracted through sorting of the wet-sieved sediments; each plastic bag displays the content of a single sorted sediment sack (*A*); flint microartifacts that were sorted from a single sediment sack; photograph illustrates the ratio of burned items (on the left) to non-burned ones (on the right) (*B*).

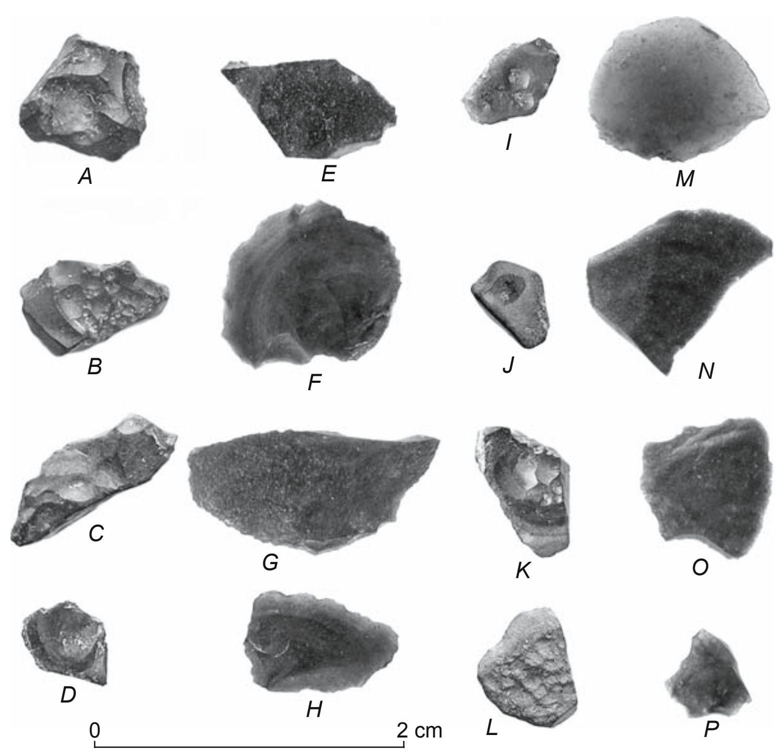

Fig. 3. Flint microartifacts from Area C at GBY. A – D: burned, from layer V-5; E – H: unburned, from layer V-5; I – L: burned, from layer V-6; M – P: unburned, from layer V-6.

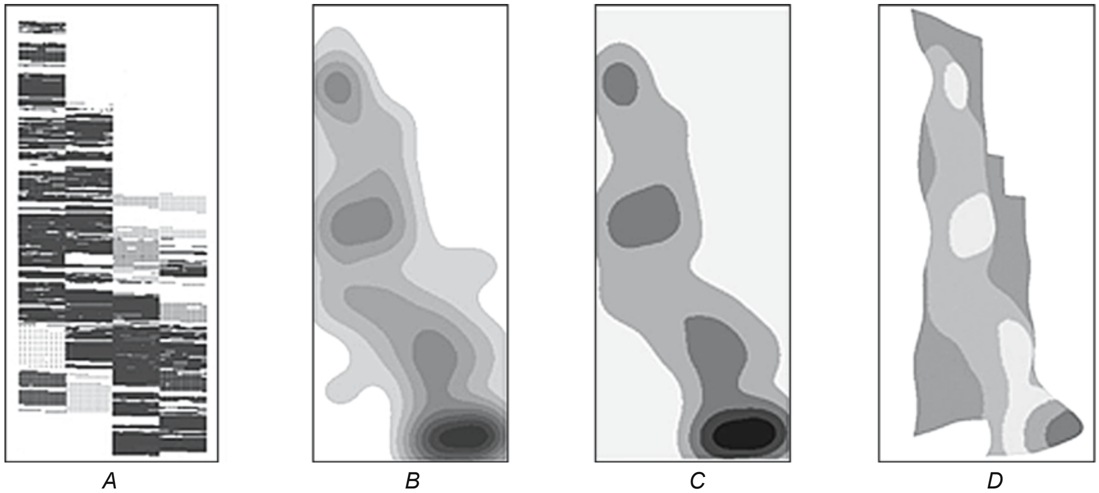

Fig. 4. The stages of building density maps, demonstrated on the assemblage of unburned flint microartifacts from layer V-5.
A – point-plotted distribution map; *B* – density map; *C* – standardized density map; *D* – standardized density map in which densities are represented as three-dimensional surfaces.

small-sized pebbles) and knapping debris was based on the presence of characteristic knapping features such as a ventral face, striking platform, etc.

Which circumstances could introduce burned material to the archaeological horizons? We have considered two possible scenarios: (1) natural fires occurred on the paleo-lake shores. In such a case, we would expect to find high frequencies of burned items, *scattered* all over the excavated area; (2) hominids carried out knapping activities near hearths, resulting in accumulations of small-sized debris in these areas, some/all of which was subjected to burning. In such a case, we would expect to find relatively low frequencies of burned items, densely *clustered*.

Since the charred botanical finds could not serve as a spatial indicator (because of their smaller specific gravity and the proximity of the occupation to water), spatial distribution was examined for the flint microartifacts in order to determine whether the burned items display clustering rather than sporadic distribution.

As most microartifacts are assigned a grid reference of sub-square precision (X and Y are 50 cm^2), their spatial plotting required us to assign each of these pieces a random reference point in their quadrant (with *Visual Basic* programming). Such a procedure, in which the spatial reference of excavated material is converted from a general quadrant area into point-plotted items, has been shown to provide reliable distribution patterns (Gilead, 2002). Using the ArcGIS 8.2 application (available in the GIS package), the flint microartifacts were point-plotted to form regular distribution maps (Fig. 4, *A*). Because of the large quantities of microartifacts, it was not possible to distinguish areas of high density within the general distribution pattern. Thus, the point-plotted distribution maps were converted into density maps (Fig. 4, *B*). In order to create a uniform scale (from 0 to 1) that will enable comparison between the different data sets (i.e., burned vs. unburned), the densities have been standardized by the maximum values of each data set (Fig. 4, *C*). Finally, in order to emphasize areas of high density, the density maps were converted into a three-dimensional representation in which the densities are depicted as three-dimensional surfaces (Fig. 4, *D*).

Results

A large quantity of flint microartifacts was retrieved from both layers. Nevertheless, the frequencies of *burned* items are low, reaching no more than 2 % of the total flint assemblage in each of the layers (see Table 1).

The density maps show that in layer V-5 the unburned flint microartifacts form a single cluster, located in the layer's southeastern area. The burned microartifacts were found in two clusters, one also in the southeast and the other in the northwest. Together, these two clusters contain more than 50 % of all the burned microartifacts in this layer (Fig. 5, *A*, *B*). In layer V-6, unburned flint microartifacts were found spread from the center of the excavated area to the northwest. More than 60 % of the burned microartifacts in this layer were found clustered in two concentrations, both located in the center of the excavated area (Fig. 5, *C*, *D*).

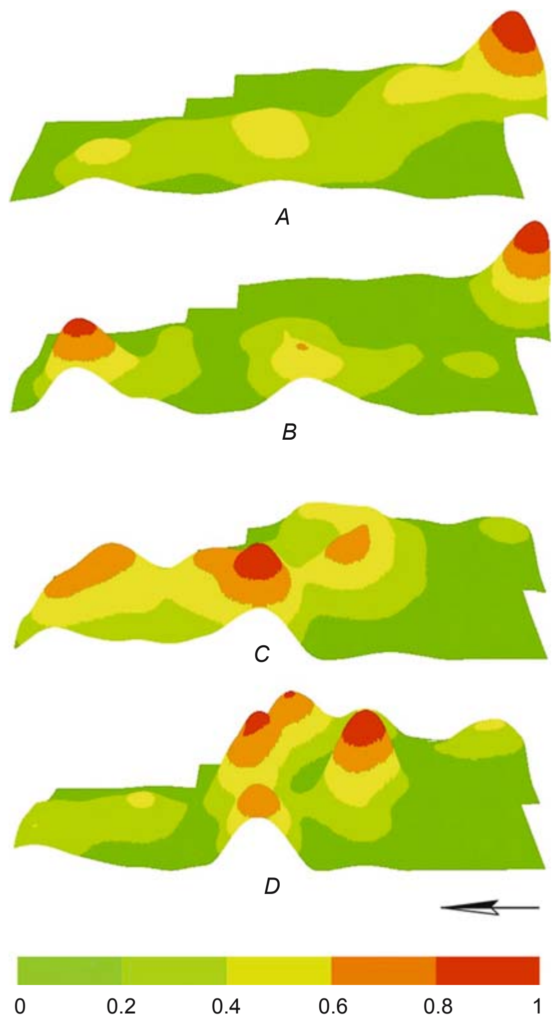

Fig. 5. Three-dimensional illustration of the relative densities of flint microartifacts in Area C (20 m^2) at GBY. *A* – layer V-5, unburned microartifacts; *B* – layer V-5, burned microartifacts; *C* – layer V-6, unburned microartifacts; *D* – layer V-6, burned microartifacts. Relative densities have been standardized by the maximum values of each data set. Densities are represented as surfaces.

These results indicate that the burned and unburned flint microartifacts are not distributed identically, and that their areas of distribution overlap only partially. Moreover, in those clusters where burned flint microartifacts occur, they outnumber the unburned ones, despite the greater overall quantities of the latter. Such multiple clustering suggests that the burning occurred in specific localities and that post-depositional processes (caused, for example, by water waves or currents) had a limited taphonomic effect on the original location of the microartifacts. Based on these results, we suggest that the clustering of the burned microartifacts indicates the original location of Acheulian hearths.

The origin of fire

The identification of burned flint microartifacts clearly attests to the presence of fire at GBY. As mentioned above, two alternative scenarios could have resulted in burned material at the site: natural fire and human controlled fire (i.e., hearths).

We considered three types of natural fire: peat fire, volcanic fire, and wildfire. The stratigraphic sequence rules out both peat and volcanic fires; although burned items appear throughout the Acheulian horizons, peat is present in a single thin stratum (stratigraphically much lower than layers V-5 and V-6), and there is no evidence of contemporaneous volcanic activity through the depositional sequence in the study area. The most probable type of natural fire in this region would be surface (Kimmins, 1997: 297) wildfire resulting from natural ignition and combustion.

Lightning is the major cause of wildfires in the Mediterranean zone (Whelan, 1995). In the present-day Hula Valley, lightning storms are most common from October to March (data from the Israel Meteorological Service); however, at that time of year (the rainy season), very few spontaneous fires occur (Ibid.). The Mediterranean wood species identified at the site (Goren-Inbar, Werker, Feibel, 2002), together with other paleobiological evidence (e.g., remains of mollusks, crabs, fish, and mammals), suggests that the seasonal climate pattern in the present-day Hula Valley resembles the pattern at the time of deposition. During a wildfire, the highest temperatures occur at the level of the grass canopy, and temperatures in such fires can reach 550 °C (Whelan, 1995), hot enough to damage flint. If surface wildfires were responsible for the burning of the organic and inorganic material, we would expect to find high frequencies of burned items. However, less than 2 % of the excavated flint pieces and wood fragments are burned (charcoal (Goren-Inbar et al., 2004); wood (Goren-Inbar, Werker, Feibel, 2002)). Furthermore, the GBY layers yielded large quantities of unburned wood, which was most likely driftwood (Ibid.) — an excellent fuel that would have fanned any wildfire. Yet another possibility is underground wildfires (such as burning roots and stumps). However, peak temperatures of fires occurring at 2.5 cm below the surface are less than 100 °C (Whelan, 1995: 16) and thus are unlikely to have damaged subsurface flint artifacts at GBY.

The paucity of burned items, their clustered distributions, and the fact that these are observed in two different occupation levels call for an interpretation other than naturally caused fire. Rather, they suggest that hominids were the agent responsible. Drawing on the vast ethnographic evidence, we interpret the presence of clustered burned flint microartifacts as an indication of hearths.

In conclusion, this study suggests that the Acheulian hominids who frequented the shores of the paleo-Lake Hula for thousands of years knew how to use fire and exercised that knowledge repeatedly throughout the archaeological sequence. In addition, the GBY evidence of fire use suggests that hearth-related social behavior may be of greater antiquity than is generally assumed.

Discussion

The study of burned flint microartifacts from GBY establishes a date of 790,000 years for the use and control of fire. However, the question of *when* man first obtained and controlled fire remains open. Attempts to evaluate this point in time are a fundamental archaeological challenge. Review of the archaeological data demonstrates that the early evidence is fragmentary and controversial. Commenting on James' (1989) review of the early indications of fire use, both Dennell (1989) and McGrew (1989) call attention to the fact that the evidence for fire is both direct and indirect; thus we should be cautious when using criteria of unequal value. However, it is our view that, given the antiquity of some of the evidence and its diverse nature, the use of a large range of criteria is essential when attempting to identify early use of fire and to construct a comprehensive description of the antiquity of control of fire, particularly since "if an incontestable hearth is required for proof, mastery of fire is documented only after 200 ka ago, at African, west Asian, and European cave sites"(Klein, 2000: 23 – 24).

Excavations of archaeological sites embedded in Pleistocene sediments have yielded various indications of fire. The following review attempts to assemble the evidence for the use of fire prior to the Middle Paleolithic. We propose to follow the evidence chronologically and geographically in order to trace the time span in which this technological invention emerged and spread, either as a consequence or as a driving force of human migration out of Africa and into Eurasia.

The African evidence

Large-scale excavations of Lower Pleistocene sites were undertaken at Koobi Fora (Kenya). Silty flood plain sediments dated to ca 1.5 Ma (Isaac, Harris, 1978) yielded several archaeological sites. Of these, the site of FxJj 20 contained two archaeological localities that are argued to present evidence for fire. At FxJj 20 East, four patches of sandy silts with presumably burned sediments were observed. Three of these displayed a slight reddish/orange color with some flecks of stronger red and the fourth consisted of a blackened zone showing an intense gray/black color, associated in part with calcification (Clark, Harris, 1985). Samples of these patches displayed thermal demagnetization, a strong indication of having been heated by fire to temperatures in the range of 200 – 400 °C (Ibid.). In addition, thermoluminescence (TL) analysis demonstrated that the reddish patches were indeed heated more recently than the surrounding tuffs (Rowlett, 2000: 200) and analysis of the phytoliths originating from the reddish patches displayed a heterogeneity of phytoliths, suggesting that these represent a hearth and not a burned stump (Ibid.; Rowlett, Davis, Graber, 1999).

Additional evidence for fire is found in some thermally altered lithic artifacts found at FxJj 20 East. These are black or reddish-orange items which are interpreted as being discolored due to exposure to fire (Clark, Harris, 1985). Artifacts modified on basalt and chert were found at some of these "fireplaces." The TL response of some of these pieces demonstrated that they were heated contemporaneously with the fireplace (Rowlett, 2000). It is interesting to note that the spatial distribution of the archaeological material demonstrated that the highest concentrations of lithics and bones are in vicinity to the patches of burned sediments (Clark, Harris, 1985).

Excavations at the site of FxJj 20 Main revealed two oxidized features; one of these was confirmed as representing the remnants of an ancient fireplace. These features contained fully oxidized sediments to a depth of at least 5 cm and exhibited magnetic susceptibility typical of fireplaces (Bellomo, 1994a). Thermal alternation was observed on 3 of the 335 stone artifacts recovered from the vicinity of the oxidized features at FxJj Main (Bellomo, 1994b).

Other evidence for fire derives from the site of Chesowanja (Kenya). The evidence was found in the locality of GnJi 1/6E, which underlies a basalt flow dated to 1.4 ± 0.07 Ma (Gowlett et al., 1981). The evidence consists of 40 pieces of burned clay, ranging in size from small flecks to 5 – 7 cm lumps (Ibid.). These were found intermingled with Oldowan stone tools and animal bones. Samples of these were examined through magnetic susceptibility, which concluded that they are the result of heating to 400 °C and that "...the Chesowanja clay was burned by a small, controlled fire" (Ibid.: 128). Clark and Harris (1985) describe some 51 reddish-brown clasts of clay from this site, of which the largest pieces were concentrated in an area of 3 m^2.

The site of Gadeb (Ethiopia) displays further possible evidence of burning. The site is embedded in a series of lacustrine and fluviolacustrine sediments of Plio-Pleistocene age in which the archaeological occurrences date between 1.5 and 0.7 Ma (Ibid.). Evidence of fire was found at the Acheulian site of Gadeb 8E in the form of weathered angular fragments of tuff with differential dark gray and red discoloration. These presumably burned rocks occurred singly, but a group of four such fragments were found distributed in one square meter (Ibid.). Ten of these rocks were subjected to paleomagnetic analysis and all were found to have a magnetization of thermal origin (Barbetti, 1986).

Excavations in the Middle Awash (Ethiopia) yielded several archaeological occurrences dating to 2.0 – 0.5 Ma, some with evidence for fire. In the vicinity of the Oldowan site of BOD-A4 and the Acheulian site of HAR-A3, clay samples were collected from a cone-shaped, reddish area ranging from 40 to 80 cm in diameter (Clark, Harris, 1985). On the basis of paleomagnetic analysis, clay samples from these two sites were interpreted as having been baked at temperatures of 600 °C or more (Barbetti, 1986). The evidence, however, is inconclusive as to whether these features are the result of fireplaces. It is interesting to note that although the clay patches were found in association with lithic artifacts and bones, none were found within these burned sediments. This is one of the reasons for the prevalent interpretation that these burned sediments are the result of burned tree stumps and that the burned clay is termite earth that was on the stump at the time when it was burned (Clark et al., 1984; Clark, Harris, 1985).

A hearth-like feature was observed during excavations at the Acheulian site of Olorgesailie (Kenya). The "hearth" was in the form of a depression filled with lithics and bones, but no charcoal was discovered in it (Isaac, 1977). Microscopic fragments of charcoal were later detected during the search for pollen grains. However, it was uncertain whether these are the result of human activity or wild bush fires (Ibid.).

Excavations at the South African cave site of Swartkrans unearthed a sequence of Early Stone Age occupations. In the Acheulian of Member 3, dated to 1.0 – 1.5 Ma, an assemblage of blackened bones was recovered (Brain, Sillen, 1988). Comparison of these bones with burned bones from experimental burning suggested that these are the result of intentional burning to various temperatures in the range of 300 – 500 °C, possibly for the purpose of cooking/roasting of meat (Brain, Sillen, 1988)*.

The waterlogged Acheulian occupation at Kalambo Falls (Zambia) yielded various burned plant materials (e.g., charred logs, charcoal, carbonized grass stems and plants). In addition, wooden implements which were presumably fire-hardened (James, 1989) and rare fire-fractured quartzite (Clark, Harris, 1985) were found.

A long sequence of burned cave deposits was unearthed at the South African site of Cave of Hearths. The exposure of the "basal hearth," in the third Acheulian horizon, uncovered an ash deposit, transformed into breccia, more than 1.3 m thick. Fragments of bones were found within the ashy sediments and were interpreted as follows: "They apparently chewed or broke animal bones into small pieces and threw them into the fire..." (Mason, 1969: 159). In addition, two handaxes from this area were reported to be fire-pitted (Oakley, 1954). Following an analysis of some samples from the basal hearth, Oakley (Ibid.) concluded that, unlike other hearths in the cave's sequence, the basal hearth was devoid of free carbon, suggesting that the sediments are not wood-ash but bat-guano, which might have been used as fuel for the hearth (Ibid.).

The Levantine evidence

Levantine Middle Paleolithic sites have produced several pioneering sediment studies which enable the identification of burned sediments and thus of ashes and hearths (Albert et al., 1999, 2000, 2003; Weiner, Goldberg, Bar-Yosef, 2002). However, such analyses are not available from Lower Paleolithic occupations, and the Levantine evidence is based mostly on the presence of burned lithics and bones.

In the 1.4 Ma old Acheulian site of 'Ubeidiya (Israel) evidence for fire is derived from several flint artifacts. Thirty-one burned flint artifacts, originating from 14 different archaeological horizons, were observed (Bar-Yosef, Goren-Inbar, 1993). However, "Such scanty evidence does not permit further speculation on the possibility that fire was used by the 'Ubeidiya hominids" (Bar-Yosef, Goren-Inbar, 1993: 191).

The Acheulian archaeological horizons at Latamne (Syria) revealed concentrations of limestone blocks and angular rubble of flint and limestone. Examination of the depositional environment concluded that it would have been impossible for these to have been deposited naturally at the site (Clark, 1966). Influenced by Stekelis's report of burned bones from Gesher Benot Ya'aqov (Stekelis, 1960), Clark suggested that "the rubble concentration at Latamne could be explained as having been used in the construction of stone 'ovens' for cooking meat and vegetable foods..." (1966: 219). Some of the limestone blocks exhibited fractures, reddening, and discoloration features, similar to those resulting from exposure to fire. One such piece of limestone rubble was examined by Oakley but tests for thermal alternation yielded negative results (Clark, 1968).

Excavations at the site of Bizat Ruhama (Israel) unearthed a possible concentration of burned bones. Although faunal remains were retrieved from various areas of the site, the bones differed in color and preservation, being fragile and whitish, in only one area. This feature, in addition to the presence of scant charcoal fragments in that area, suggested that the bones are burned (Ronen et al., 1998). Paleomagnetic measurements of the sediments suggested a date of ca 0.85 – 0.99 Ma for the cultural layer

* See also: Skinner A., Lloyd J., Brain C., Thackeray F. "Electron spin resonance and the first use of fire." Paper presented at the Paleoanthropology Society Annual Meeting. Montreal, 2004.

at Bizat Ruhama (Laukhin et al., 2001). Similar features were not encountered during the renewed excavations at the site nor other traces of burned materials (Zaidner, personal communication).

Excavations at Tabun Cave (Israel) yielded an extensive cultural sequence of Lower and Middle Paleolithic deposits. Evidence for the early use of fire can be found in the Acheulo-Yabrudian horizons (Ea–d), for which TL dates on burned flints suggested a date of 0.35 – 0.3 Ma ((Mercier et al., 1995); a somewhat older date, a combined ESR/U-series age of ca 0.39 Ma, has recently been proposed by Rink et al. (2004)). The TL dating provides the only reference for the presence of burned lithics in the Acheulian assemblages of Tabun. However, during excavation, faintly colored but well-defined hearths were observed throughout the Acheulian layers. The hearths of layer E differed from the surrounding sediments and were darker brown or yellow (Garrod, Bate, 1937). Some of these hearths appeared to be more intensive: "Scattered all over E were patches, more or less extensive, of white crumbly earth containing badly calcined flint, which presumably mark the place of particularly intensive fires" (Ibid.: 66).

Acheulo-Yabrudian deposits recently excavated at Qesem Cave (Israel) were dated by uranium isotopic series to a range of about 0.38 – 0.20 Ma (Barkai et al., 2003; Gopher et al., 2005). Evidence of fire includes burned bones, lithics, and sediments, and occurs throughout the 7.5 m deposit (Ibid.; Stiner, Barkai, Gopher, 2004). Recent excavations have documented that the upper half of the cave's sequence is comprised mainly of ash (Barkai, personal communication).

The presence of burned flints is not reported in publications of other Levantine Lower Paleolithic sites. However, a flake displaying potlidding is illustrated in Neuville's report of the Tayacian assemblage of E3 at Umm Qatafa (Israel) (Neuville, 1951: fig. 13). Burned flints, particularly small ones, are present at the site of Revadim Quarry (Israel) (personal observations), dated to ca 0.3 Ma (Marder et al., 1998).

The Asian evidence

The site of Zhoukoudian (China) has yielded what was long considered the earliest evidence for the use of fire. Major significance is granted to Locality 1, in which the remains of "Peking Man" and his related assemblages were supposedly embedded in layers of dark ashes dating to ca 0.6 – 0.3 Ma (Goldberg et al., 2001). These early indications of fire, particularly the 4 – 6 m accumulation of "ashes" in Layer 4 and the "hearth" of Layer 10, were extensively discussed and were for long interpreted as representing the remains of hearths constructed and used by man (e.g., (Breuil, 1932; Oakley, 1956, 1961; Stewart, 1956) and see (Goldberg et al., 2001: 518 – 520 and references therein)). Thermoluminescence (TL) analysis of fire-cracked hammerstones and burned hackberry seeds from Locality 1 suggested that these are "clearly heat crazed and carbonized respectively, so obviously they have been burnt somewhere at some time" (Rowlett, 2000: 207). In addition, sediments from Zhoukoudian were dated using the TL method and demonstrated that in Layer 10, in which burned items were found, the TL glow was lower than in sediments originating from layers in which no burned items were recorded (Ibid.).

However, the evidence from Zhoukoudian is currently controversial due to recent mineralogical analyses of the site's sediments. These suggest that no thick ashy accumulations or even ash remnants (siliceous aggregates) are present (Goldberg et al., 2001; Weiner et al., 1998). According to Goldberg et al. (2001), the dark "hearth" of Layer 10 is a deposit composed of finely laminated unburned organic material interbedded with silts, and the bulk of Layer 4 is bedded to laminated silts of loessic origin that were washed into the depression. During the renewed analysis of the "ashy" sediments, burned bones in association with lithic artifacts were found exclusively in the upper unit of Layer 10, thus suggesting that "this association of the burned bones and artifacts constitutes possible, but not conclusive evidence for fire use by humans at Locality 1" (Ibid.: 520). These burned bones were either black or turquoise-colored and were interpreted as "fossil bones that were somehow burned by natural processes" (Weiner et al., 1998: 252).

Charred wood remains were found at the site of Trinil (Java), for which potassium-argon dating suggested an age of 0.5 – 0.8 Ma and later a reading of 1.2 Ma (James, 1989 and references therein). Oakley suggested that these charred wood remains were the result of natural fires (1956: 40).

The site of Xihoudu (China) unearthed a large faunal assemblage together with some 30 lithic artifacts. Some of the bones were found to be black, gray and grayish-green and are regarded as burned on the basis of laboratory analysis (James, 1989). The faunal remains are considered to be some 1.0 Ma old and paleomagnetic readings suggested a date of 1.8 Ma (Ibid.; Pope, 1983).

A *Homo erectus* cranium with 20 stone tools was found at Gongwangling (China) (James, 1989). Magnetochronological studies dated the site to ca 1.2 Ma (Hyodo et al., 2002) and the presence of several charcoal flecks at the site is suggestive of burning (James, 1989).

The site of Yuanmou (China) unearthed two *Homo erectus* incisors as well as faunal and lithic material (Ibid.). Evidence for the use of fire is demonstrated by two of the mammal bones, which are dark-colored, and by the considerable amount of charcoal found at the site (Ibid.). Recent magnetochronological studies date these remains to 0.7 Ma (Hyodo et al., 2002). Pope (1983) mentions evidence of fire from the site of Lantian (China) at ca 0.78 Ma. However, the type of evidence is not reported from this site.

The European evidence

Several European sites have yielded fragmentary and controversial evidence of fire. Howell (1966) reported on some possibly burned flints from the site of Montiéres (France). The site, embedded in the Pleistocene sediments of the Somme Terrace, unearthed several worked stones, some of which had a "porcelainized aspect as if subjected to fire" (Ibid.: 91). Possible use of fire at the English sites of Swanscombe, Hoxne, and Marks Tey was implied by changes in pollen frequencies and the presence of charcoal fragments in the deposits. At Swanscombe, dated to ca 0.3 Ma, lumps of carbonized vegetable material were found. These were described by Oakley as charcoal resulting from "fires burnt on the banks of the river by Acheulian hunters" (1956: 41). Palynological studies of the Hoxne and Marks Tey deposits indicated a decrease in arboreal pollen and an increase in grasses in the Acheulian Layer. On the assumption that climatic changes cannot account for these shifts in vegetation, and based on a single piece of charcoal found at Hoxne, a suggestion was made that hominids induced forest fires for hunting purposes (James, 1989).

A recurrent difficulty when discussing early European sites is the classification of early "pebble industries" as of anthropogenic or natural origin (e.g., (Roebroeks, Kolfschoten, 1995a)). This is the case at the site of Blassac-les Battants (France), where faunal remains dating to 1.2 – 1.4 Ma were found in association with lithic objects (Raynal, Magoga, Bindon, 1995). Although some of these crystalline-rock items exhibit obvious thermal fractures, the entire "assemblage" is most likely naturally fractured (Ibid.). Similarly, the site of Přezletice (Czech Republic) revealed Pleistocene deposits dated paleomagnetically to the range of 0.59 – 0.89 Ma (Valoch, 1995). Charcoal remains, burned bones, burned stones, and the remains of a fireplace are reported from the site (Ibid.). However, the lithic artifacts of Přezletice display amorphous flaking properties that, in the opinion of some scholars, show no convincing traces of human interference (Roebroeks, Kolfschoten, 1995a).

A related problem occurs at the site of Šandalja Cave I (Croatia), where charcoal and burned bones were documented in Early Pleistocene breccia (Valoch, 1995). Only two stone items were found in association with these finds; an unmodified pebble and a flint chopper, which do not allow an unambiguous interpretation of the site (Ibid.). Valoch also reports on burned bones from Stránská Skála I (Czech Republic). The bones were found within the early Middle Pleistocene archaeological horizons and were chemically analyzed, suggesting that they were indeed burned to a temperature in the range of 200 – 500 °C (Ibid.).

Renewed archaeological investigations at Beeches Pit, Suffolk (England) have revealed varied evidence of burning for which TL dates suggested an age of 0.4 Ma (Gowlett et al., in press). This includes burned flints and two localized burned zones containing burned material that most likely represents remnants of hearths.

At the wooden-spears site of Schöningen (Germany), which is dated to ca 0.4 Ma, burned flints as well as hearths were found (Thieme, 1997; personal communication).

Substantial evidence of fire use is reported from the site of Vértesszöllös (Hungary). The site revealed the remains of two hominids (*Homo erectus* seu *sapiens palaeohungaricus* (Thoma, 1990) and ancient footprints of these were found on the living floor along with fireplaces, lithic artifacts, faunal, and botanical remains (Kretzoi, Dobosi, 1990). Th/U analyses of the travertine sediments of Vértesszöllös suggested an age of 0.35 Ma and ESR dating of the travertine yielded a similar age of 0.33 Ma (Pecsi, 1990). The documented fireplaces all contained fragmentary burned bones and no charcoal. Interestingly, the burned bones were laid in a radial fashion around the center of the fireplaces (Vertes, Dobosi, 1990). The presence of burned fragmentary bones and the lack of charcoal in these fireplaces led to the assumption that bones were used as fuel (Ibid.).

Such an interpretation was also suggested for the burned bones from La Cotte de St. Brelade in Jersey Island (English Channel). The site was dated to the range of 0.38 – 0.2 Ma (Huxtable, 1986) and revealed varied evidence for the use of fire. Indications of burning are reported from all occupation layers and include charcoal, burned bones, burned flint artifacts, and burned granite (Callow, Walton, Shell, 1986). In addition, several small patches of fire-reddened earth were observed and identified as remnants of hearths (Ibid.). The high frequencies of burned bones and the predominance of these over wood charcoal suggested that bones were used as fuel (Ibid.).

Evidence for fire is recorded from the Spanish site of Torralba, dated to ca 0.3 – 0.35 Ma. The excavations revealed an area of over 30 m^2 containing the semiarticulated remains of the left side of a large elephant with only four retouched flakes in association with it (Howell, 1966). An area to the southeast yielded other remains of the same individual, in addition to remains of bovids. In that area, several patches of charcoal were observed (Ibid.), suggesting that the processing of the elephant's meat involved the use of fire. In total, some 232 pieces of charcoal are known from Torralba, in addition to hundreds of near-microscopic pieces (Freeman, 1975). The unique conditions of preservation allowed the conservation not only of charcoal but of some 76 wooden fragments and 31 casts of decayed large wooden objects, some with deliberate cultural alteration (Ibid.). One of these wooden objects is a 12 cm long trapezoidal-shaped block with a darkened coloration suggestive of burning (Howell, 1966).

At Cantabria, the early Middle Pleistocene site of San Quirce revealed an abundant lithic industry without faunal remains. The lithic material was found "clustered spatially and in association with ash and a possible hearth" (Raposo, Santonja, 1995: 10). A more convincing hearth is reported from the Middle Pleistocene site of Solana del Zamborino (Granada). The hearth is defined by "a circle of five quartzite pebbles, with an impressive amount of charcoal and ash in the middle" (Ibid.: 19).

The site of Terra Amata in Nice (France) exposed what is acknowledged to demonstrate the most ancient example of built structures with interior hearths. TL dates suggest an age of 0.25 – 0.2 Ma and correlation of the geological sequence with isotopic stage 9 suggests a date of 0.33 Ma (Villa, 1983); additional TL dates gave an age of 0.38 Ma (Scarre, 1998). The hearths were found in the center of huts from which only the postholes remained, and were identified as areas of reddened sand, about 30 cm wide, with traces of charcoal and reddened pebbles. In some cases, a small pile of pebbles was found in vicinity to the hearth, supposedly to protect the fire from drafts (Villa, 1983). Concentrations of charcoal as well as burned flints, burned mussel shells (Ibid.), and burned bones (Villa, 2001) were also observed.

A similar association between hearths and dwelling structures is reported from the 0.3 Ma old site of Bilzingsleben (Germany) where the foundations of three dwelling structures with hearths in front of them were observed (Mania, 1995). Charcoal, burned stones, and burned bones are also reported (Villa, 2001). Similarly, at Azych Cave (Caucasus), two Acheulian layers were exposed within the Middle Pleistocene deposits (Ljubin, Bosinski, 1995). A total of four hearths were found, one of these located inside a limestone dwelling feature (Ibid.).

Fire and human dispersals

Researchers have invested great efforts in recognizing archaeologically the occurrence of fire and determining the initial stages of human control over fire. The evidence for the early use of fire is based on highly variable criteria for the identification of fire. Likewise, a large diversity of phenomena is used to determine man's use of fire: burned items (lithics, bones, wood, and shells), burned sediments, ashes, and charcoal.

Taken together, the various lines of evidence suggest that initial controlled use of fire may have occurred in Africa some 1.5 Ma ago. *Homo erectus* (*sensu lato*) was

Table 2. **Chronological and geographical distribution of the major possible indications of fire (after (Oakley, 1956))**

Date, Ma BP	Africa	Levant	Asia	Europe
1.5	^+Koobi Fora ^Gadeb ^Chesowanja	+Ubeidiya	#Xihoudu	
	^Middle Awash #Swartkrans		*Gongwangling	
1.0	~Kalambo Falls ^+Cave of Hearths	#Bizat Ruhama		
		+~*Gesher Benot Ya'aqov +Latamne	#*Yuanmou ~Trinil	
				^+#*Přezletice
0.5			^#+Zhoukoudian	^+Schöningen ^+Beeches Pit #*Šandalja Cave #Stránská Skála ^Azych Cave
0.35		^+Tabun Cave ^+#Qesem Cave +Revadim Quarry		# Vértesszöllös ^+#*La Cotte ~*Torralba *-Terra Amata ^+#*Bilzingsleben

Note: + burned stones; # burned bones; ~ burned wood;^ burned sediments; - burned shells; * charcoal.

most likely our first ancestor to overcome the fear of fire and to "domesticate" it for his needs. It is at this time, ca 1.5 Ma ago, that *Homo erectus* started to explore new territories and the human diffusion out of Africa began.

The chronological and geographical distribution of the earliest evidence for fire (Table 2) suggests that it could have been a stimulating tool during this stage of human dispersal.

The date of ca 1.8 Ma that is generally suggested for the first dispersals out of Africa and into Eurasia is also the baseline date of the so-called "*long chronology*" (see (Dennell, 2003 and references therein)). Dennell (Ibid.) conducted a thorough review of the indications for human presence outside East Africa during the Early Pleistocene. His review integrated evidence from North Africa, southern Asia and Europe and concluded that during the Early Pleistocene the colonizing abilities of *Homo erectus* were very limited and that "it was probably not until the Middle Pleistocene that hominids began habitually to utilize latitudes up to 45 – 50° N, which happen to include most of Europe" (Ibid.: 435).

The age and character of the earliest occupation of Europe are questions that have been the subject of intensive discussion and debate (e.g., (Roebroeks, Kolfschoten, 1995b); see (Dennell, 2003; Roebroeks, 2001 and references therein)). There is, however, general agreement that the substantial settlement of Europe, in the form of continuous presence of hominids, occurred some 0.5 Ma ago (Dennell, 2003; Roebroeks, 2001). In this framework of "*short chronology*," the few sites predating 500 ka (e.g., Atapuerca (Falgueres et al., 1999; Parés, Pérez-González, 1999); Fuente Nueva-3 and Barranco Leyn (Oms et al., 2000)) are viewed as marginal, intermittent incursions. Roebroeks stresses that "the absence of Lower and early Middle Pleistocene sites north of the Pyrenees and Alps suggests that even if hominids were around the Mediterranean perimeter from the late Lower Pleistocene onwards, it required significant changes in their behaviour to take them north…" (2001: 454).

Review of the early European evidence of fire use indicates that the ability to control and maintain fire might well be the behavioral change that enabled the colonization of these northern parts of Europe, as suggested by Villa (1994, 2001). "Absence or non systematic use of fire may be one of the reasons why the settlement of Europe took a rather long time" (Villa, 2001: 4). Thus, the earlier incursions lacked the technological ability to make fire that would have enabled a more continuous settlement, such as the one evident in the geographical and chronological extent of archaeological sites in Europe from 0.5 Ma onwards.

The use of fire conferred various advantages for humans and, once "domesticated," fire enabled protection from predators, warmth and light, and the exploitation of a new range of foods. Thus we can assert quite confidently that it was fire that enabled the colonization of new niches and that "with the possession of means of making fire at will man could freely leave his early circumscribed seat and successfully spread to other environments and eventually populate the earth" (Hough, 1916: 257).

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References

Albert R.M., Bar-Yosef O., Meignen L., Weiner S. 2003
Quantitative phytolith study of hearths from the Natufian and Middle Paleolithic levels of Hayonim Cave (Galilee, Israel). *Journal of Archaeological Science*, vol. 30: 461 – 480.

Albert R.M., Lavi O., Estroff L., Weiner S., Tsatskin A., Ronen A., Lev-Yadun S. 1999
Mode of occupation of Tabun Cave, Mt. Carmel, Israel during the Mousterian period: A study of the sediments and phytoliths. *Journal of Archaeological Science*, vol. 26: 1249 – 1260.

Albert R.M., Weiner S., Bar-Yosef O., Meignen L. 2000
Phytoliths in the Middle Paleolithic deposits of Kebara Cave, Mt. Carmel, Israel: Study of the plant materials used for fuel and other purposes. *Journal of Archaeological Science*, vol. 27: 931 – 947.

Alperson-Afil N., Richter D., Goren-Inbar N. (in press)
Phantom hearths and controlled use of fire at Gesher Benot Ya'aqov, Israel. *Journal of Anthropological Archaeology*.

Austin L.A., Bergman C.A., Roberts M.B., Wilhelmsen K.H. 1999
Archaeology of excavated areas. In *Boxgrove: A Middle Pleistocene Hominid Site at Eartham Quarry, Boxgrove, West Sussex*. London: English Heritage, pp. 312 – 377.

Barbetti M. 1986
Traces of fire in the archaeological record before one million years ago? *Journal of Human Evolution*, vol. 15: 771 – 781.

Barkai R., Gopher A., Lauritzen S.E., Frumkin A. 2003
Uranium series dates from Qesem Cave, Israel, and the end of the Lower Paleolithic. *Nature*, vol. 423: 977 – 979.

Bar-Yosef O., Goren-Inbar N. 1993
The Lithic Assemblages of 'Ubeidiya: A Lower Paleolithic Site in the Jordan Valley. Jerusalem: Inst. of Archaeology Hebrew Univ.

Bellomo R.V. 1994a

Early Pleistocene fire technology in Northern Kenya. In *Society Culture and Technology in Africa.* Philadelphia: Univ. of Pennsylvania, pp. 17 – 28.

Bellomo R.V. 1994b

Methods of determining early hominid behavioral activities associated with the controlled use of fire at FxJj 20 Main, Koobi Fora, Kenya. *Journal of Human Evolution*, vol. 27: 173 – 195.

Binford L.R. 1978

Dimensional analysis of behavior and site structure: Learning from an Eskimo hunting stand. *American Antiquity*, vol. 43: 330 – 361.

Binford L.R. 1983

In Pursuit of the Past: Decoding the Archaeological Record. London: Thames and Hudson.

Brain C.K., Sillen A. 1988

Evidence from the Swartkrans Cave for the earliest use of fire. *Nature*, vol. 336: 464 – 466.

Breuil H. 1932

Le feu et l'industrie de pierre et d'os dans le gisement du 'Sinanthropus' a Chou Kou Tien. *L'Anthropologie*, vol. 42: 1 – 17.

Brooks A.S., Yellen J.E. 1987

The preservation of activity areas in the archaeological record: Ethnoarchaeological and archaeological work in Northwest Ngamiland, Botswana. In *Method and Theory for Activity Area Research: An Ethnoarchaeological Approach.* New York: Columbia Univ. Press, pp. 63 – 106.

Callow P., Walton D., Shell C.A. 1986

The use of fire at La Cotte de St. Brelade. In *La Cotte de St. Brelade 1961 – 1978. Excavations by C.B.M. McBurney.* Norwich: Geo Books, pp. 193 – 195.

Cessford C. 2003

Microartifactual floor patterning: The case at Catalhoyuk. *Assemblage*, vol. 7: 1 – 13. http://www.shef.ac.uk/assem/issue7/cessford.html.

Clark J.D. 1966

Acheulian occupation sites in the Middle East and Africa: A study in cultural variability. In *Recent Studies in Paleoanthropology.* Wisconsin: American Anthropological Association, pp. 202 – 229.

Clark J.D. 1968

The Middle Acheulian occupation site at Latamne Northern Syria (second paper): Further excavations (1965) – general results, definition and interpretation. *QUATERNARIA*, vol. 10: 1 – 71.

Clark J.E. 1991

Flintknapping and debitage disposal among the Lacandon Maya of Chiapas, Mexico. In *The Ethnoarchaeology of Refuse Disposal.* Arizona: Arizona State Univ., pp. 63 – 78.

Clark J.D., Asfaw B., Assefa G.,
Harris J.W.K., Kurashina H., Walter R.C.,
White T.D., Williams M.A.J. 1984

Palaeoanthropological discoveries in the Middle Awash Valley, Ethiopia. *Nature*, vol. 307: 423 – 428.

Clark J.D., Harris J.W.K. 1985

Fire and its roles in early hominid lifeways. *The African Archaeological Review*, vol. 3: 3 – 27.

DeBoer W.R. 1983

The archaeological record as preserved death assemblage. In *Archaeological Hammers and Theories.* New York: Academic Press, pp. 19 – 36.

Dennell R.W. 1989

Comments on "Hominid use of fire in the Lower and Middle Pleistocene: Review of the evidence" (James, S.R). *Current Anthropology*, vol. 30: 11 – 13.

Dennell R.W. 2003

Dispersal and colonization, long and short chronologies: How continuous is the Early Pleistocene record for hominids outside East Africa? *Journal of Human Evolution*, vol. 45: 421 – 440.

Dunnell R.C., Stein J.K. 1989

Theoretical issues in the interpretation of microartifacts. *Geoarchaeology*, vol. 4: 31 – 42.

Falgueres C., Bahain J.-J., Yokoyama Y.,
Arsuaga J.L., Bermudez de Castro J.M.,
Carbonell E., Bischoff J.L., Dolo J.-M. 1999

Earliest humans in Europe: The age of TD6 Gran Dolina, Atapuerca, Spain. *Journal of Human Evolution*, vol. 37: 343 – 352.

Feibel C.S. 2001

Archaeological sediments in lake margin environments. In *Sediments in Archaeological Contexts.* Salt Lake City: Univ. of Utah Press, pp. 127 – 148.

Feibel C.S. 2004

Quaternary lake margins of the Levant Rift Valley. In *Human Paleoecology in the Levantine Corridor.* Oxford: Oxbow Books, pp. 21 – 36.

Fladmark K.R. 1982

Microdebitage analysis: Initial considerations. *Journal of Archaeological Science*, vol. 9: 205 – 220.

Freeman L.G. 1975

Acheulean sites and stratigraphy in Iberia and the Magreb. In *After the Australopithecines. Stratigraphy, Ecology, and Culture Change in the Middle Pleistocene.* Hague: Mouton Publishers, pp. 661 – 743.

Galanidou N. 1997

'Home is where the hearth is': The spatial organization of the Upper Paleolithic rockshelter occupations at Klithi and Kastritsa in Northwest Greece. Oxford: British Archaeological Reports. (Int. Ser.; N 687).

Galanidou N. 2000

Patterns in caves: Foragers, horticulturists, and the use of space. *Journal of Anthropological Archaeology*, vol. 19: 243 – 275.

Garrod D.A.E., Bate D.M.A. 1937

The Stone Age of Mount Carmel. London: Clarendon Press.

Gilead I. 2002

Too many notes? Virtual recording of artifacts provenance. In *Virtual Archaeology.* Arezzo: British Archaeological Reports, pp. pp. 41 – 43. (Int. Ser.; N 1075),

Goldberg P., Weiner S., Bar-Yosef O.,
Xu Q., Liu J. 2001

Site formation processes at Zhoukoudian, China. *Journal of Human Evolution*, vol. 41: 483 – 530.

Gopher A., Barkai R., Shimelmitz R., Khalaily M.,
Lemorini C., Hershkovitz I., Stiner M. 2005

Qesem Cave: An Amudian site in Central Israel. *Journal of the Israel Prehistoric Society*, vol. 35: 69 – 92.

Goren-Inbar N., Alperson N., Kislev M.E., Simchoni O.,
Melamed Y., Ben-Nun A., Werker E. 2004

Evidence of hominin control of fire at Gesher Benot Ya'aqov, Israel. *Science*, vol. 304: 725 – 727.

Goren-Inbar N., Feibel C.S., Verosub K.L., Melamed Y., Kislev M.E., Tchernov E., Saragusti I. 2000

Pleistocene milestones on the out-of-Africa corridor at Gesher Benot Ya'aqov, Israel. *Science*, vol. 289: 944 – 947.

Goren-Inbar N., Lister A., Werker E., Chech M. 1994

A butchered elephant skull and associated artifacts from the Acheulian site of Gesher Benot Ya'aqov, Israel. *Paléorient*, vol. 20: 99 – 112.

Goren-Inbar N., Saragusti I. 1996

An Acheulian biface assemblage from the site of Gesher Benot Ya'aqov, Israel: Indications of African affinities. *Journal of Field Archaeology*, vol. 23: 15 – 30.

Goren-Inbar N., Sharon G., Melamed Y., Kislev M. 2002

Nuts, nut cracking, and pitted stones at Gesher Benot Ya'aqov, Israel. *PNAS*, vol. 99: 2455 – 2460.

Goren-Inbar N., Werker E., Feibel C.S. 2002

The Acheulian Site of Gesher Benot Ya'aqov: The Wood Assemblage. Oxford: Oxbow Books.

Goring-Morris A.N. 1988

Trends in spatial organization of terminal Pleistocene hunter-gatherer occupations as viewed from the Negev and Sinai. *Paléorient*, vol. 14: 231 – 244.

Gowlett J.A.J., Hallos J., Hounsell S., Brant V., Debenham N.C. (in press)

Beeches Pit – archaeology, assemblage dynamics and early fire history of a Middle Pleistocene site in East Anglia, UK. *Journal of Eurasian Prehistory.*

Gowlett J.A.J., Harris J.W.K., Walton D., Wood B.A. 1981

Early archaeological sites, hominid remains and traces of fire from Chesowanja, Kenya. *Nature*, vol. 294: 125 – 129.

Green H.J.M. 1961

An analysis of archaeological rubbish deposits. *Archaeological News Letter*, vol. 7: 91 – 93.

Hayden B., Cannon A. 1983

Where the garbage goes: Refuse disposal in the Maya highlands. *Journal of Anthropological Archaeology*, vol. 2: 117 – 163.

Hietala H. 1983

Boker Tachtit: Spatial distributions. In *Prehistory and Paleoenvironments in the Central Negev, Israel.* Dallas: Southern Methodist Univ., p. 191 – 202.

Hough W. 1916

The distribution of man in relation to the invention of fire-making methods. *American Anthropologist*, vol. 18: 257 – 263.

Howell F.C. 1966

Observations on the earlier phases of the European Lower Paleolithic. In *Recent Studies in Paleoanthropology.* Wisconsin: American Anthropological Association, pp. 88 – 201.

Hull K.L. 1987

Identification of cultural site formation processes through microdebitage analysis. *American Antiquity*, vol. 52: 772 – 783.

Huxtable J. 1986

The Thermoluminescence dates. In *La Cotte de St. Brelade 1961 – 1978. Excavations by C.B.M. McBurney.* Norwich: Geo Books, pp. 145 – 149.

Hyodo M., Nakaya H., Urabe A., Saegusa H., Shunrong X., Jiyun Y., Xuepin J. 2002

Paleomagnetic dates of hominid remains from Yuanmou, China, and other Asian sites. *Journal of Human Evolution*, vol. 43: 27 – 41.

Isaac G.L. 1977

Olorgesailie: Archeological Studies of a Middle Pleistocene Lake Basin in Kenya. Chicago: Univ. of Chicago Press.

Isaac G.L., Harris J.W.K. 1978

Archaeology. In *Koobi Fora Research Project*, vol 1. Oxford: Clarendon Press, pp. 64 – 85.

James S.R. 1989

Hominid use of fire in the Lower and Middle Pleistocene. *Current Anthropology*, vol. 30: 1 – 26.

Kimmins J.P. 1997

Forest Ecology. New Jersey: Prentice Hall.

Klein R.G. 2000

Archeology and the evolution of human behavior. *Evolutionary Anthropology*, vol. 9: 17 – 36.

Kretzoi M., Dobosi V.T. (eds.) 1990

Vértesszöllös Site, Man and Culture. Budapest: Akademiai Kiado.

Laukhin S.A., Ronen A., Pospelova G.A., Sharonova Z.V., Ranov V.A., Burdukiewicz J.M., Volgina V.A., Tsatskin A. 2001

New data on the geology and geochronology of the Lower Paleolithic site Bizat Ruhama in the Southern Levant. *Paléorient*, vol. 27: 69 – 80.

Leroi-Gourhan A., Brezillon M. 1972

Fouilles de Pincevent: Essai d'Analyse Ethnographique d'un Habitat Magdalenien. Paris: Editions du C.N.R.S.

Ljubin V.P., Bosinski G. 1995

The earliest occupation of the Caucasus region. In *The Earliest Occupation of Europe.* Leiden: Univ. of Leiden, pp. 207 – 253.

Mania D. 1995

The earliest occupation of Europe: The Elbe-Saale region (Germany). In *The Earliest Occupation of Europe.* Leiden: Univ. of Leiden, pp. 85 – 101.

Marder O., Khalaily H., Rabinovich R., Gvirtzman G., Wieder M., Porat N., Ron H., Benkirer R., Saragusti I. 1998

The Lower Paleolithic Site of Revadim quarry: Preliminary finds. *Journal of the Israel Prehistoric Society*, vol. 28: 21 – 53.

Mason R. 1969

Prehistory of the Transvaal. Johannesburg: Witwatersrand Univ. Press.

McGrew W.C. 1989

Comments on "Hominid use of fire in the Lower and Middle Pleistocene: Review of the evidence" (James, S.R). *Current Anthropology*, vol. 30: 16 – 17.

Mercier N., Valladas H., Valladas G., Reyss J.-L., Jelink A., Meignen L., Joron J.-L. 1995

TL dates of burnt flints from Jelinek's excavations at Tabun and their implications. *Journal of Archaeological Science*, vol. 22: 495 – 509.

Metcalfe D., Heath K.M. 1990

Microrefuse and site structure: The hearths and floors of the Heartbreak Hotel. *American Antiquity*, vol. 55: 781 – 796.

Nadel D. 2001
Indoor/outdoor flint knapping and minute debitage remains: The evidence from the Ohalo II submerged camp (19.5 KY, Jordan Valley). *Lithic Technology*, vol. 26: 118 – 137.
Neuville R. 1951
Le Paléolithique et le Mésolithique du Desert de Judée. Paris: Masson et C[IE].
Oakley K.P. 1954
Evidence of fire in South African cave deposits. *Nature*, vol. 174: 261 – 262.
Oakley K.P. 1956
Fire as Paleolithic tool and weapon. *Proceedings of the Prehistoric Society*, vol. 21: 36 – 48.
Oakley K.P. 1961
On man's use of fire, with comments on tool-making and hunting. In *Social Life of Early Man.* Chicago: Aldine, pp. 176 – 193.
O'Connell J.F. 1987
Alyawara site structure and its archaeological implications. *American Antiquity*, vol. 52: 74 – 108.
Oms O., Parés J.M., Martínez-Navarro B., Agustí J., Toro I., Martínez-Fernández G., Turq A. 2000
Early human occupation of Western Europe: Paleomagnetic dates for two Paleolithic sites in Spain. *PNAS*, vol. 97: 10666 – 10670.
Parés J.M., Pérez-González A. 1999
Magnetochronology and stratigraphy at Gran Dolina section, Atapuerca (Burgos, Spain). *Journal of Human Evolution*, vol. 37: 325 – 342.
Pecsi M. 1990
Geomorphological position and absolute age of the Vértesszöllös Lower Paleolithic site. In *Vértesszöllös Site, Man and Culture.* Budapest: Akademiai Kiado, pp. 27 – 41.
Pope G.G. 1983
Evidence on the Age of the Asian Hominidae. *PNAS*, vol. 80: 4988 – 4992.
Purdy B.A. 1975
Fractures for the archaeologist. In *Lithic Technology: Making and Using Stone Tools.* Paris: Mouton Publishers, pp. 133 – 141.
Purdy B.A. 1982
Pyrotechnology: Prehistoric application to chert materials in North America. In *Early Pyrotechnology: The Evolution of the First Fire-Using Industries.* Washington: Smithsonian Institution Press, pp. 31 – 44.
Purdy B.A., Brooks H.K. 1971
Thermal alternation of silica minerals: An archeological approach. *Science*, vol. 173: 322 – 325.
Raposo L., Santonja M. 1995
The earliest occupation of Europe: The Iberian peninsula. In *The Earliest Occupation of Europe.* Leiden: Univ. of Leiden, pp. 7 – 25.
Rathje W.L. 1979
Modern material culture studies. *Advances in Archaeological Method and Theory*, vol. 2: 1 – 37
Raynal L.-P., Magoga L., Bindon P. 1995
Thephrofacts and the first human occupation of the French Massif Central. In *The Earliest Occupation of Europe.* Leiden: Univ. of Leiden, pp. 129 – 146.
Rink W.J., Schwarcz H.P., Ronen A., Tsatskin A. 2004
Confirmation of a near 400 ka age for the Yabrudian industry at Tabun Cave, Israel. *Journal of Archaeological Science*, vol. 31: 15 – 20.
Roebroeks W. 2001
Hominid behaviour and the earliest occupation of Europe: An exploration. *Journal of Human Evolution*, vol. 41: 437 – 461.
Roebroeks W., Kolfschoten T. van. 1995a
The earliest occupation of Europe: A reappraisal of artefactual and chronological evidence. In *The Earliest Occupation of Europe.* Leiden: Univ. of Leiden, pp. 297 – 315.
Roebroeks W., Kolfschoten T. van. (eds.) 1995b
The Earliest Occupation of Europe. Leiden: Univ. of Leiden.
Ronen A., Burdukiewicz J.M., Laukhin S.A., Winter Y., Tsatskin A., Dayan T., Kulikov O.A., Vlasov V.K., Semenov V.V. 1998
The Lower Paleolithic site Bizat Ruhama in the Northern Negev, Israel: Preliminary report, 1996 excavations. *Archäologisches Korrespondenzblatt*, vol. 28: 163 – 173.
Rowlett R.M. 2000
Fire control by *Homo erectus* in East Africa and Asia. *ACTA ANTHROPOLOGICA SINICA*, vol. 19: 198 – 208.
Rowlett R.M., Davis M.G., Graber R.B. 1999
Friendly fire. *Discovering Archaeology*, vol. 1: 82 – 89.
Scarre C. 1998
Exploring Prehistoric Europe. Oxford: Oxford Univ. Press.
Schiffer M.B. 1972
Archaeological context and systemic context. *American Antiquity*, vol. 37: 156 – 165.
Schiffer M.B. 1976
Behavioral Archeology. New York: Academic Press.
Schiffer M.B. 1987
Formation Processes of the Archaeological Record. Albuquerque: Univ. of New Mexico Press.
Simek J.F. 1984
Integrating pattern and context in spatial archaeology. *Journal of Archaeological Science*, vol. 11: 405 – 420.
Simms S.R. 1988
The archaeological structure of a Bedouin camp. *Journal of Archaeological Science*, vol. 15: 197 – 211.
Spurling B., Hayden B. 1984
Ethnoarchaeology and intrasite spatial analysis: A case study from the Australian Western desert. In *Intrasite Spatial Analysis in Archaeology.* Cambridge: Cambridge Univ. Press, pp. 224 – 241.
Stapert D. 1990
Middle Paleolithic dwellings: Fact or fiction? Some applications of the ring and sector method. *Palaeohistoria*, vol. 32: 1 – 19.
Stein J.K., Teltser P.A. 1989
Size distributions of artifact classes: Combining macro-and-micro-fractions. *Geoarchaeology*, vol. 4: 1 – 30.
Stekelis M. 1960
The Paleolithic deposits of Jisr Banat Yakub. *Bulletin of the Research Council of Israel. Geo-Sciences 9G*, vol. 2/3: 61 – 90.

Stevenson M.G. 1991
Beyond the formation of hearth-associated artifact assemblages. In *The Interpretation of Archaeological Spatial Patterning*. New York: Plenum Press, pp. 269 – 299.
Stewart O.C. 1956
Fire as the first great force employed by man. In *Man's Role in Changing the Face of the Earth*. Chicago: Univ. of Chicago Press, pp. 115 – 133.
Stiner M.C., Barkai R., Gopher A. 2004
The Acheulo-Yabrudian faunas from Qesem Cave (Israel): Preliminary results. In *69th Annual Meeting of the Paleoanthropology Society and Society for American Archaeology. March 30 – April 4*. Montreal.
Thieme H. 1997
Lower Paleolithic hunting spears from Germany. *Nature*, vol. 385: 807 – 810.
Thoma A. 1990
Human tooth and bone remains from Vértesszöllös. In *Vértesszöllös Site, Man and Culture*. Budapest: Akademiai Kiado, pp. 253 – 262.
Valoch K. 1995
The earliest occupation of Europe: Eastern Central and Southeastern Europe. In *The Earliest Occupation of Europe*. Leiden: Univ. of Leiden, pp. 67 – 84.
Vance E.D. 1987
Microdebitage and archaeological activity analysis. *Archaeology*, vol. 40: 58 – 59.
Vaquero M., Pasto I. 2001
The definition of spatial units in Middle Paleolithic sites: The hearth-related assemblages. *Journal of Archaeological Science*, vol. 28: 1209 – 1220.
Vertes L., Dobosi V.T. 1990
Fireplaces of the settlement. In *Vértesszöllös Site, Man and Culture*. Budapest: Akademiai Kiado, pp. 519 – 521.
Villa P. 1983
Terra Amata and the Middle Pleistocene Archaeological Record of Southern France. San Diego: Univ. of California Press.
Villa P. 1994
Europe: Lower and Middle Pleistocene archaeology. In *History of Humanity. Vol. 1: Prehistory and the Beginnings of Civilization*. London: Routledge, pp. 44 – 61.
Villa P. 2001
Fire and fireplaces in the Middle and Upper Pleistocene of Western Europe. Paper presented at the XIVth UISPP Congress. Liege.
Wadley L. 2006
The use of space in the late Middle Stone Age of Rose Cottage Cave, South Africa. In *Transitions Before the Transitions: Evolution and Stability in the Middle Paleolithic and Middle Stone Age*. New York: Springer Science+Business Media, Inc., pp. 279 – 294.
Weiner S., Goldberg P., Bar-Yosef O. 2002
Three-dimensional distribution of minerals in the sediments of Hayonim Cave, Israel: Diagenetic processes and archaeological implications. *Journal of Archaeological Science*, vol. 29: 1289 – 1308.
Weiner S., Xu Q., Goldberg P., Liu J., Bar-Yosef O. 1998
Evidence for the use of fire at Zhoukoudian, China. *Science*, vol. 281: 251 – 253.
Whelan R.J. 1995
The Ecology of Fire. Cambridge: Cambridge Univ. Press.
Yellen J.E. 1977
Archaeological Approaches to the Present: Models for Reconstructing the Past. New York: Academic Press.

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WEAPONS OF THE GORNY ALTAI NOMADS IN THE HUNNU AGE

Introduction

The study of weapons used by the Gorny Altai nomads when Central Asia was controlled by the Hunnu empire began rather recently, thanks to excavations conducted in the 1980s and 1990s at Ust-Edigan, Chendek, and Sary-Bel (Hudiakov et al., 1990; Soyenov, Ebel, 1992; Hudiakov, 1998; Soyenov, 1999). The most detailed studies concerned weapons from Ust-Edigan (Hudiakov, Moroz, 1990; Hudiakov, 1997). At present, we can continue this work by analyzing new finds from the 2002 – 2003 excavations at the Yaloman II funerary complex in the Ongudai Region of the Altai Republic (Tishkin, Gorbunov, 2002, 2003). Two chronological groups were separated at that site: western, including 24 objects (2nd century BC – 1st century AD), and central, including four later objects (second half of the 4th – first half of the 5th century AD). So far, these chronological estimates are supported only by a small series of radiocarbon dates and by archaeological finds (Tishkin, Gorbunov, 2003: 493; Tishkin, 2004: 297). In terms of burial rite and finds, the early (western) group resembles sites such as Ust-Edigan, Sary-Bel, Chendek (eastern group), and Pazyryk (mounds 23, 24, and 42). These sites were attributed to the Ust-Edigan stage of the Bulan-Koba culture of Gorny Altai (Tishkin, Gorbunov, 2005: 329).

In the western group of Yaloman II, weapons were found in five mounds (23a, 48, 57, 61, and 62). They include weapons of the projectile type (bow and arrow), those of hand-to-hand combat (dagger and model of pickaxe), and armor plates.

Bows

Remains of composite bows were found in three burials. In mound 23a, they include a set of six horn side plates: two pairs of end plates and a pair of middle plates (Fig. 1, *1 – 6*). The distance between the end plates was 154 cm, which should be regarded as an estimate of the total bow length, apparently without string. The upper end plates are narrow and gently curved. They have rounded heads and arcuate notches for the string; the tips have decomposed. The heads of the lower end plates are missing, and the tips are pointed. The insides of the plates are completely hatched; the outsides are partly hatched. The middle plates, too, are fragmentary, but their principal features can be reconstructed. These plates are segment-shaped, with straight bases and pointed tips. They are about 20 cm long, and 2.6 – 2.8 cm wide; their insides are hatched.

In mound 62, a set of six side plates was found (two pairs of end plates and a pair of middle plates), and two fragments of the wooden bow (Fig. 2). The distance between end plates was 110 cm, and they lay nearly perpendicular to the middle part of the bow, possibly indicating that the bow was strung. The end plates are incomplete: mostly their pointed tips are present. However, the 32 cm long wooden part of the bow's upper horn is nearly intact. Judging from its parameters, the end plates had wide, pointed heads with trapezoid notches for the string. They were additionally fastened to the bow with three wooden pegs. The middle plates are segment-shaped, well

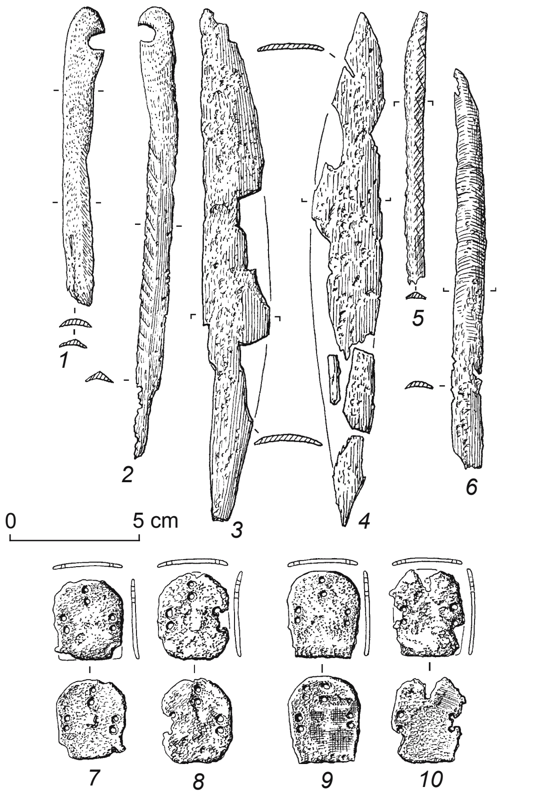

Fig. 1. Weapons from Yaloman II mounds 23a (*1 – 6*), 57 (*7, 8*), and 61 (*9, 10*).
1 – 6 – horn; *7, 10* – iron, bronze; *8, 9* – iron.

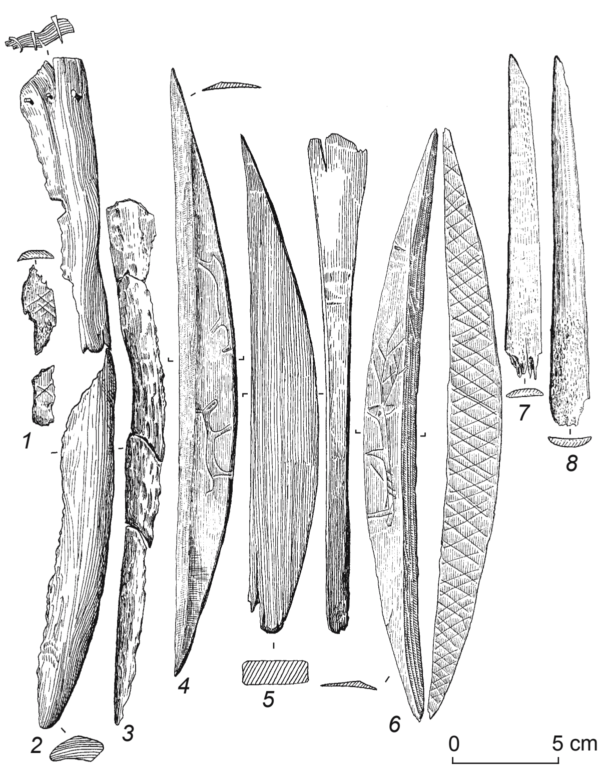

Fig. 2. Weapons from Yaloman II mound 62.
1, 3, 4, 6 – 8 – horn; *2, 5* – wood.

Fig. 3. Central plates from the bow.

Fig. 4. Representations of plates from the bow.

polished, and have straight bases and pointed tips (Fig. 3). Their insides are covered with incisions that form a widely-spaced oblique hatching. On the outsides, only the areas adjoining the bases are finely hatched. In the central unhatched part, representations of animals are engraved (Fig. 4). The plates are 28.3 – 29 cm long and are 2.6 – 2.8 cm at their widest. The grip of the bow is mostly preserved. Judging by the wooden parts, the main part of the bow consisted of three separate elements: the grip (with shoulders) and two horns, fastened with glue and strips perpendicular to the shoulders.

In mound 48, only fragments of two horn side plates remained from the bow: a middle one and a lower one (Fig. 5, *2, 3*). Their dimensions are apparently the same as those of the better-preserved specimens described above.

Composite bows from early mounds of Yaloman II are of a well-known type. They have six side plates (two pairs of end plates and a pair of central ones). Bows with similar details were found at Ust-Edigan and Sary-Bel (Hudiakov, 1997: 28; Soyenov, 1999: fig. 6, 8, 14). Certain bows from Ust-Edigan, Chendek, and Pazyryk had an additional seventh plate attached to the backside of the grip (Hudiakov, 1997: 29; Soienov, Ebel, 1992: fig. 22; Sorokin, 1977: fig. 10). Composite bows with six or seven plates, arranged likewise, were first used by the Hunnu in the 3rd century BC and later by many Eurasian peoples (Hudiakov, 1993: 121 – 122). The shape of the early Bulan-Koba plates is precisely the same as in Hunnu specimens (Konovalov, 1976: pl. III – V; Tseveendorj, 1985: 79; Hudiakov, Tseveendorj, 1990: fig. 1 – 4; Davydova, 1996: pl. 12, *3, 4*; 52, *4, 5*; 84, *10, 11*; Minyaev, 1998: pl. 57, *1*; 63, *1*; Erdenebaatar, Turbat, Hudiakov, 2003: fig. 1 – 12). The end plates are narrow, gently curved, and have rounded, pointed, or truncated heads; the central side plates are segment-shaped with straight or concave bases, and those on the backsides of the grips are narrow and are shorter than the lateral ones, and have somewhat widened tips. Based on these parallels, plates of the Ust-Edigan stage apparently date from the 3rd and 2nd centuries BC to the 1st century AD, when Hunnu bows were most widely distributed, although similar bows were used until the late 5th century.

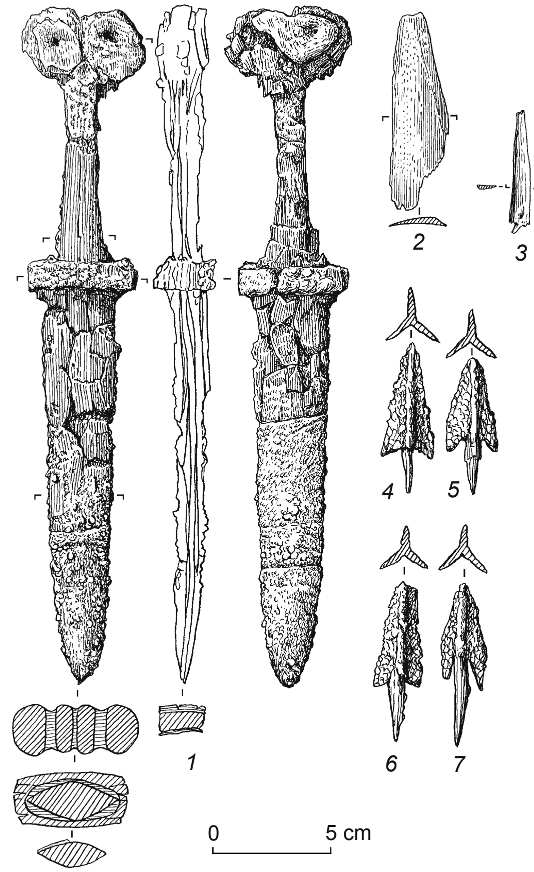

Fig. 5. Weapons from Yaloman II mound 48.
1, 4 – 7 – iron; *2, 3* – horn.

Arrows

Battle arrowheads were found in two graves. Four of them are from mound 48. They all are iron, tanged, trilobate and triangular in profile with barb-like shoulders directed backward (Fig. 5, *4 – 7*; 6). Their total length is 6 – 7 cm; the length without tang is 4 – 5 cm, and the maximal width is 2.0 – 2.2 cm. In mound 62, an iron arrowhead with a wooden shaft was found (Fig. 7, *2*; 8). Oxidation is present on another of the arrows. The preserved specimen resembles those described above: total length 5.2 cm, length without tang 4.3 cm, greatest width 2.6 cm. The shafts are missing; their length is 37.5 – 54.0 cm, with a thickness up to 1 cm (Fig. 7, *4*). A small fragment of shaft has a notch for the string (Fig. 7, *3*). Arrowheads with barb-like shoulders, resembling those from Yaloman, were found at Ust-Edigan and Sary-Bel (Hudiakov, 1997: fig. *2, 8, 9, 11, 13*; Soyenov, 1999: fig. 15, *1 – 4)*. Other arrowheads from Ust-Edigan are trilobate and triangular in profile, with straight shoulders and a hexagonal section. One specimen is of the armor-piercing type, with a tetrahedral (diamond-shaped) section and triangular in profile (Hudiakov, 1997: fig. 1, *9*; 2, *10, 12, 14*).

Fig. 6. Iron dagger and arrowheads.

Iron trilobate arrowheads, triangular in profile, were widely used by many peoples of Eurasia, both nomadic and sedentary, from ca 300 BC on (Khazanov, 1971: 36 – 37). Specimens geographically closest to those from

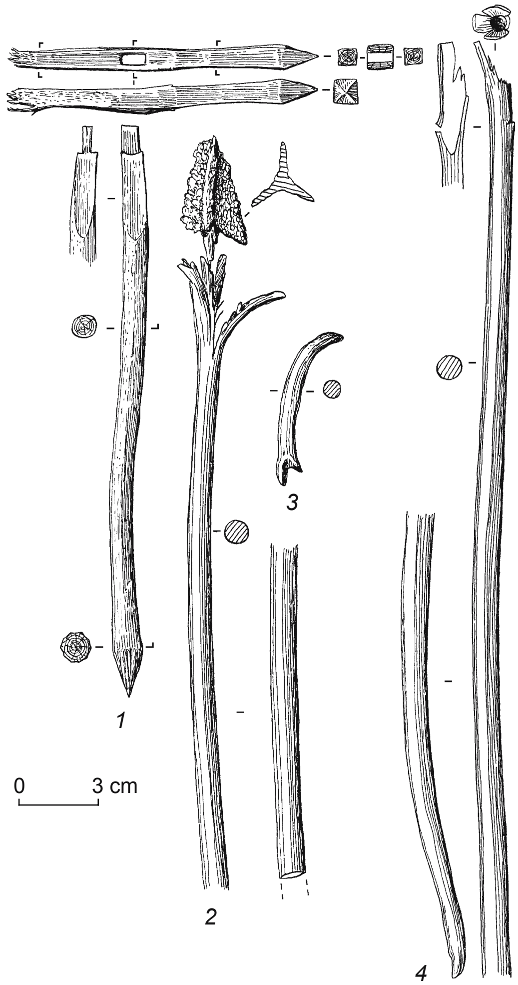

Fig. 7. Weapons from Yaloman II mound 62.
1, 3, 4 – wood; *2* – iron, wood.

Fig. 8. Model of pickaxe, arrowhead, and wooden parts of the bow.

Bulan-Koba are arrowheads of Kamenskaia culture, the forest-steppe Altai, dating from the 3rd – 2nd century BC (Mogilnikov, 1997: fig. 46, *1, 2*) and those of Tes stage of the Tagar culture, Minusinsk Basin, 2nd – 1st century BC (Hudiakov, 1986: fig. 16, *1, 2*). Arrowheads with a triangular profile and straight base were in use in later periods. Especially noteworthy are triangular arrowheads with barbs. They are identical to Hunnu specimens dating from the 2nd century BC – 1st century AD (Konovalov, 1976: pl. I, *8, 9*; Minyaev, 1998: pl. 30, *1, 5*). The latter do not occur after the 1st century AD, at least not in eastern Central Asia. Arrowheads with a hexagonal section were used by the Hunnu in the 2nd century BC – 1st century AD and by the Sarmatians in the 1st century BC – 1st century AD (Hudiakov, 1986: fig. 5, *1*; Khazanov, 1971: pl. XIX, *32*). They occur in later periods as well. The closest parallels to the armor-piercing arrowhead described by us are the Hunnu specimens (Hudiakov, 1986: fig. 6, *1, 22*).

Dagger

The dagger from mound 48 is made of iron. It has a keel-shaped blade and a lense-shaped section. The tang has a volute-shaped top. A straight bar-like guard is set on its base (Fig. 5, *1*; 6). Present on the blade is wooden decay from the sheath, and on the tang is wooden lining from the hilt. The dagger's total length is 17 cm, its maximal width 3 cm and thickness 1.8 cm; the length of tang is 12 cm, its average width 1.4 cm, and thickness 0.8 cm; the length of the guard is 4.8 cm, its width is 2.4 cm and its height is 1.2 cm. A similar dagger was found at Sary-Bel (Soyenov, 1999: fig. 13, *6*). Such daggers originated from those of the Scythian period. Their closest parallels come from 3rd century BC – 1st/2nd centuries AD Bactrian (Yuechi-Kushan) assemblages and from 1st century BC – 1st/2nd centuries AD burials associated with the Sargat culture (Pogodin, 1998: fig. 2, *2*; Litvinsky, 2001: 244 – 248; pl. 58, *1 – 3*; 61, *12, 13*). At Ust-Edigan, daggers of a different type were found (without guard or top) (Hudiakov, 1997: fig. 1, *13*; 3). In the east, these daggers were used by the Hunnu in 2nd century BC – 1st century AD, and in the west, by the Sarmatians in the 1st century BC – 1st century AD (Khazanov, 1971: 20 – 21, pl. X, *1 – 3*; XI, *4*; Davydova, 1996: pl. 9, *5*).

Pickaxe

In mound 62, a wooden model of a pickaxe was found. It consists of the pickaxe proper and a helve (Fig. 7, *1*; 8). The pickaxe has a rather high butt, an indistinct rectangular socket, and a slightly concave pyramidal pick widening toward the end. The length of the pickaxe is 12 cm; dimensions of the socket, 0.4 – 0.9 cm; maximal width of the striker, 1 cm. The helve is cylindrical with a conical tip. Its base is truncated and shaped as a projection with shoulders for helving. Its length is 22 cm; mean thickness, 1 cm. There is no doubt that the Yaloman model is votive. In all its features, it replicates actual battle pickaxes of the Scythian period. In Altai, the latest among such pickaxes were found in burials dating from the 3rd – 2nd centuries BC (Mogilnikov, 1997: 51, fig. 42; Kocheyev, 1999: 75, fig. 4).

Sword

The early nomads of Bulan-Koba used another weapon in addition to the close-combat weapons described above. At Ust-Edigan, a fragment of a double-edged sword was found. It has no guard, and straight shoulders mark the transition from the blade, which is lense-shaped in section, to the tang. The tip of the tang is widened and rounded (Hudiakov, 1997: fig. 1, *14*). The specimen is paralleled by 1st – 5th-century AD Sarmatian and western Central Asian daggers (Khazanov, 1971: 17 – 21, pl. XII, *1, 3*; Kozhomberdyev, Hudiakov, 1987: fig. 7, *1*; Levina, 1996: fig. 85, *1*). In eastern Central Asia, they might have appeared in the 2nd century BC or even earlier (Kozhomberdyev, Hudiakov, 1987: 89). An indication of this may be a fragment of a double-edged blade and hilt from Dyrestui burial ground (Minyaev, 1998: pl. 30, *13, 14*).

Plate-armors

Two pairs of iron armor plates were found in mounds 57 and 61 (Fig. 1, *7 – 10*; 9). They are oval-rectangular, and each has six holes for attaching two pairs of side plates and a pair of upper central plates. The length of the plates is 3.1 – 3.3 cm, their width is 2.7 – 2.8 cm, and thickness 1.5 mm. Similar plates were found in late 3rd century BC – 1st-century AD Hunnu burials, and in those associated with the Amur tribes and Xianbi and dating from the 2nd – 3rd century AD (Davydova, 1995: pl. 95, *10, 19*; 104, *1, 2*; Rets, Yui Su-hua, 1999: fig, 3, *3*; Derevianko, 1987: pl. VII, *2, 3, 8*; VIII, *1 – 3*; Gorbunov, 2005, 2005: fig. 1, *1*). Two plates from Yaloman were lined on the inside with bronze. Analysis of the bronze indicated that it was of Chinese, Trans-Baikalian, or Ordosian origin (Tishkin, Khavrin, 2004: 305); possibly the first Bulan-Koba armors were imported. Interestingly, details of armor were found in rich female burials. They might have been ritual and served apotropaic or other purposes.

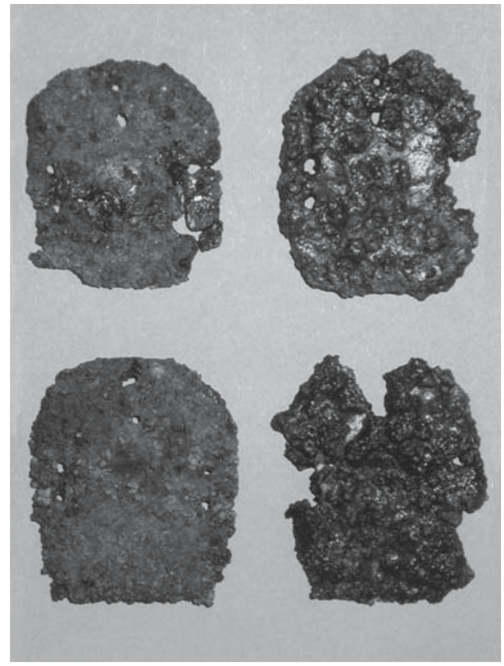

Fig. 9. Armor plates.

General characteristics of weapons

Knowledge gained from newly-discovered and previously-known weapons of the Bulan culture's Ust-Edigan stage permit a description of the weaponry of the Gorny Altai nomads of the Hunnu age. There were two types of composite bows, four types of arrowheads, and two types of daggers; swords, pickaxes, and armors were uniform (Fig. 10). While numerous categories of weapons were used, typological diversity was minor. Weapons are few, which is possibly explained by peculiarities of the funerary tradition. Bows are the most frequent category (18 specimens), followed by arrowheads (17), daggers (7), and armor plates (4). Other weapons so far are represented by isolated specimens. No more than three categories of weapons combine in a single grave. Combinations include bow, arrows, and dagger; bow, arrows, and sword; and bow, arrows, and pickaxe.

Arrows, which were of a simple type (three specimens) and of an armor-piercing type (one specimen) were evidently used to attack lightly-armed enemies (Hudiakov, 1997: 31). Large powerful bows suggest that the bowshot was maximal (Hudiakov, 1993: 111). The

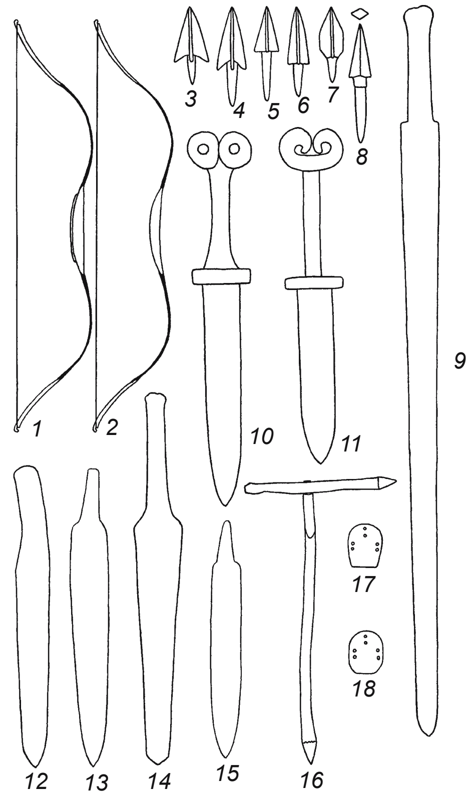

Fig. 10. Weapons of Bulan-Koba culture Ust-Edigan stage, Gorny Altai (2nd century BC – 1st century AD). Distribution of types according to sites: Ust-Edigan – *1 – 9*, *12 – 15*; Chendek – *1*; Pazyryk – *1*; Yaloman II – *2 – 4*, *10*, *16 – 18*; Sary-Bel – *2 – 4*, *11*.

most efficient close-combat weapons were swords and pickaxes, mostly especially against armored warriors; daggers played a less important role.

Based on the weapons alone, it is hard to speak of types of troops; however, judging from representations, at least two types can be established: lightly armored cavalry and infantry (Gorbunov, 2003: 90, fig. 34, *1*). Based on plates from armor, there middle-armed cavalry existed as well. The principal tactic was shooting arrows at the enemy from a large distance, but close combat, in which most likely cavalry was engaged, was also possible.

Conclusions

Weapons used at the Ust-Edigan stage were mostly influenced by the Hunnu tradition. They included composite bows, trilobate hexagonal and anti-armor arrowheads, daggers without guards or tops, and plate armor. Certain weapons may have been received from Hunnu proper, as evidenced by armor plates. The influence of Sarmatian and western Central Asian (early Kushan) traditions should also be considered, as exemplified by daggers with guards and tops, and possibly by the sword. Trilobate triangular arrowheads and possibly the model of a pickaxe likely derived from the preceding Scythian epoch.

References

Davydova A.V. 1995
Ivolginskiy arkheologicheskiy kompleks. Vol. 1: Ivolginskoe gorodische. St. Petersburg: Fond “AziatIKA”. (Arkheologicheskie pamyatniki syunnu; iss. 1).

Davydova A.V. 1996
Ivolginskiy arkheologicheskiy kompleks. Vol. 2: Ivolginskiy mogilnik. St. Petersburg: Tsentr “Peterburgskoe vostokovedenie”. (Arkheologicheskie pamyatniki syunnu; iss. 2).

Derevianko E.I. 1987
Ocherki voennogo dela plemen Priamuriya. Novosibirsk: Nauka.

Erdenebaatar D., Turbat C., Hudiakov Y.S. 2003
Hunnskoe oruzhie distantsionnogo boya iz mogilnika Egin-Gol v Severnoi Mongolii. *Vestnik Novosibisk. Gos. Univ.*, vol. 3: 43 – 53.

Gorbunov V.V. 2003
Voennoe delo naseleniya Altaya v III – XIV vv. Pt. 1: Oboronitelnoe vooruzhenie (dospekh). Barnaul: Izd. Altai. Gos. Univ.

Gorbunov V.V. 2005
Syanbiiskii dospekh. In *Voennoe delo nomadov Tsentralnoi Azii v syanbiiskuyu epokhu*. Novosibirsk: Izd. Novosib. Gos. Univ., pp. 220 – 223.

Hudiakov Y.S. 1986
Vooruzhenie srednevekovykh kochevnikov Yuzhnoi Sibiri i Tsentralnoi Azii. Novosibirsk: Nauka.

Hudiakov Y.S. 1993
Evolyutsiya slozhnosostavnogo luka u kochevnikov Tsentralnoi Azii. In *Voennoe delo naseleniya yuga Sibiri i Dalnego Vostoka*. Novosibirsk: Izd. IAE SO RAN, pp. 107 – 148.

Hudiakov Y.S. 1997
Vooruzhenie kochevnikov Gornogo Altaya hunnskogo vremeni (po materialam raskopok mogilnika Ust-Edigan). In *Izvestiya Laboratorii arkheologii*, N 2. Gorno-Altaisk: Gorno-Altaisk. Gos. Univ., pp. 28 – 36.

Hudiakov Y.S. 1998
Problema genezisa kultury hunnskogo vremeni v Gornom Altae. In *Drevnosti Altaya: Izvestiya Laboratorii arkheologii*, N 3. Gorno-Altaisk: Izd. Gorno-Altaisk. Gos. Univ., pp. 97 – 112.

Hudiakov Y.S., Moroz M.V. 1990
Kollektsiya oruzhiya iz mogilnika Ust-Edigan. In *Arkheologicheskie issledovaniya na Katuni*. Novosibirsk: Nauka, pp. 177 – 185.

Hudiakov Y.S., Skobelev S.G., Moroz M.V. 1990
Arkheologicheskie issledovaniya v dolinakh rek Oroktoi i Edigan v 1988 godu. In *Arkheologicheskie issledovaniya na Katuni*. Novosibirsk: Nauka, pp. 95 – 150.

Hudiakov Y.S., Tseveendorj D. 1990
Novye nakhodki hunnskikh lukov v Gobiiskom Altae. In *Arkheologicheskie, etnograficheskie i antropologicheskie issledovaniya v Mongolii*. Novosibirsk: Nauka, pp. 126 – 132.
Khazanov A.M. 1971
Ocherki voennogo dela sarmatov. Moscow: Nauka.
Kocheyev V.A. 1999
Boevoe oruzhie pazyryktsev. In *Drevnosti Altaya: Izvestiya Laboratorii arkheologii*, N 4. Gorno-Altaisk: Izd. Gorno-Altaisk. Gos. Univ., pp. 74 – 82.
Konovalov P.B. 1976
Hunnu v Zabaikalie (pogrebalnye pamyatniki). Ulan-Ude: Buryat. kn. izd.
Kozhomberdiev I.K., Hudiakov Y.S. 1987
Kompleks vooruzheniya kenkolskogo voina. In *Voennoe delo drevnego naseleniya Severnoi Azii*. Novosibirsk: Nauka, pp. 75 – 106.
Levina L.M. 1996
Etnokulturnaya istoriya Vostochnogo Priaraliya. I tysyacheletie do n.e. – I tysyacheletie n.e. Moscow: Vostochnaya literatura.
Litvinsky B.A. 2001
Khram Oksa v Baktrii (Yuzhnyi Tadzhikistan): Baktriiskoe vooruzhenie v drevnevostochnom i grecheskom kontekste, vol. 2. Moscow: Vostochnaya literatura.
Minyaev S.S. 1998
Dyrestuiskiy mogilnik. St. Petersburg: Fond "AziatIKA". (Arkheologicheskie pamyatniki syunnu; iss. 3).
Mogilnikov V.A. 1997
Naselenie Verkhnego Priobiya v seredine – vtoroi polovine I tysyacheletiya do n.e. Moscow: IA RAN; Puschinskiy nauch. tsentr RAN.
Pogodin L.I. 1998
Vooruzhenie naseleniya Zapadnoi Sibiri rannego zheleznogo veka. Omsk: Omsk. Gos. Univ.
Rets K.I., Yui Su-hua. 1999
K voprosu o zaschitnom vooruzhenii hunnov i syanbi. In *Evraziya: Kulturnoe nasledie drevnikh tsivilizatsii. Gorizonty Evrazii*, iss. 2. Novosibirsk: Izd. Novosibirsk. Gos. Univ., pp. 42 – 55.
Sorokin S.S. 1977
Pogrebeniya epokhi velikogo pereseleniya narodov v raione Pazyryka. *Arkheologicheskiy sbornik Gosudarstvennogo Ermitazha*, iss. 18: 57 – 67.
Soyenov V.I. 1999
Raskopki na mogilnike Sary-Bel. In *Drevnosti Altaya: Izvestiya Laboratorii arkheologii*, N 4. Gorno-Altaisk: Izd. Gorno-Altaisk. Gos. Univ., pp. 134 – 152.
Soyenov V.I., Ebel A.V. 1992
Kurgany gunno-sarmatskoi epokhi na Verkhnei Katuni. Gorno-Altaisk: Izd. Gorno-Altaisk. Gos. Ped. Inst.
Tishkin A.A. 2004
O neobkhodimosti mezhdistsiplinarnogo izucheniya materialov gunno-sarmatskogo vremeni Gornogo Altaya. In *Kompleksnye issledovaniya drevnikh i traditsionnykh obschestv Evrazii*. Barnaul: Izd. Alati. Gos. Univ., pp. 296 – 300.
Tishkin A.A., Gorbunov V.V. 2002
Issledovaniya pamyatnikov rannego zheleznogo veka i srednevekoviya v Lesostepnom i Gornom Altae. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy*, vol. 8. Novosibirsk: Izd. IAE SO RAN, pp. 456 – 461.
Tishkin A.A., Gorbunov V.V. 2003
Issledovaniya pogrebalno-pominalnykh pamyatnikov kochevnikov v Tsentralnom Altae. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 9, pt. 1. Novosibirsk: Izd. IAE SO RAN, pp. 488 – 493.
Tishkin A.A., Gorbunov V.V. 2005
Predmetnyi kompleks iz pamyatnika Yaloman-II na Altae kak otrazhenie vliyaniya materialnoi kultury hunnu. In *Sotsiogenez v Severnoi Azii*. Irkutsk: Izd. Irkutsk. Gos. Tekh. Univ., pp. 327 – 333.
Tishkin A.A., Khavrin S.V. 2004
Predvaritelnye rezultaty spektralnogo analiza izdelii iz pamyatnika gunno-sarmatskogo vremeni Yaloman-II (Gornyi Altai). In *Kompleksnye issledovaniya drevnikh i traditsionnykh obschestv Evrazii*. Barnaul: Izd. Altai. Gos. Univ., pp. 300 – 306.
Tseveendorj D. 1985
Novye dannye po arkheologii hunnu (po materialam raskopok 1972 – 1977 gg.). In *Drevnie kultury Mongolii*. Novosibirsk: Nauka, pp. 51 – 87.

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PREHISTORIC AND MEDIEVAL FORTIFICATIONS IN THE ZERKALNAYA (TADUSHI) RIVER BASIN*

Introduction

Fortified settlements and forts in Primorye (Maritime region, the Russian Far East) have long attracted attention not only because of impressive stone and earthen ramparts of various shapes and sizes, but also due to their function. First, fortifications built by the natives interested their close and distant neighbors – precisely those against which these constructions were erected. Chinese sources contain voluminous evidence concerning the construction of fortifications by Far Eastern tribes and states. In addition to recording the geography of a neighboring region and its forts, arms, passes, and roads, the Chinese gathered information concerning the daily life, customs, traditions, and population sizes of the region's "barbarian" tribes. Based on these records, maps were drawn and dynastic chronicles were composed. Thanks to translations by N.Y. Bichurin, V.P. Vasiliev, V. Gorsky, G.M. Rozov, and N.V. Kuehner of Chinese chronicles dealing with "eastern aliens," we know that the medieval Tungus-Manchurian tribes (Mohe, Bohai, and Jurchen) had built an intricate network of fortifications (Bichurin, 1950: 69, 111; Vasiliev, 1857: 198 – 199).

The written data were supported by archaeological studies. More than 150 diverse fortifications (fortified settlements, fortresses, and ramparts) have been discovered in Primorye. Previously, all of them were believed to be medieval and associated with the Tungus-Manchurian states such as Bohai (AD 698 – 926), Jin (1115 – 1234), and Eastern Xia (1217 – 1234). It was believed that fortified settlements and fortresses were mostly situated in the southern regions of Primorye. However, V.K. Arseniev's field dairy, currently on deposit in the Archive of the Society for Study of the Amur Territory, as well as results of archaeological investigations carried out in the mountain taiga zone of northeastern Primorye in 1973 – 1975 and 1996 – 2005, provide more information (Arseniev, 2002). A survey of the basins of 18 rivers (Zerkalnaya, Rudnaya, Lidovka, Brusilovka, Kedrovka, Dzhigitovka, Serebrianka, Taezhnaya, Pervaya Utesnaya, Malaya Kema, Kema, Amgu, Zhivopisnaya, Sobolevka, Kuznetsovka, Burlivaya, Peia, and Samarga) in the northeastern and eastern regions of Primorye has revealed the existence of 60 fortification sites. The oldest fortifications were built as early as the 1st millennium BC during the Metal Age, i.e., one thousand years earlier than it was previously believed. One of the areas where these sites are concentrated is the Zerkalnaya River basin (the Tadushi River prior to 1972), where twelve assorted fortifications were discovered including forts, fortresses, natural defensive features, and ramparts (Fig. 1). Their chronology, types, cultural attribution, origin, and role in the entire Primorye fortification network will be addressed in the present article.

Prehistoric and medieval fortifications in the Zerkalnaya (Tadushi) basin

The Zerkalnaya is a large river flowing along the Tadushi depression nearing the western slopes of the Sikhote-Alin. The Zerkalnaya is 82 km long; its declension is 420 m. The topography of the region is mountainous; the elevation of

* Supported by the Russian Foundation for Humanities (Project N 04-01-00374a).

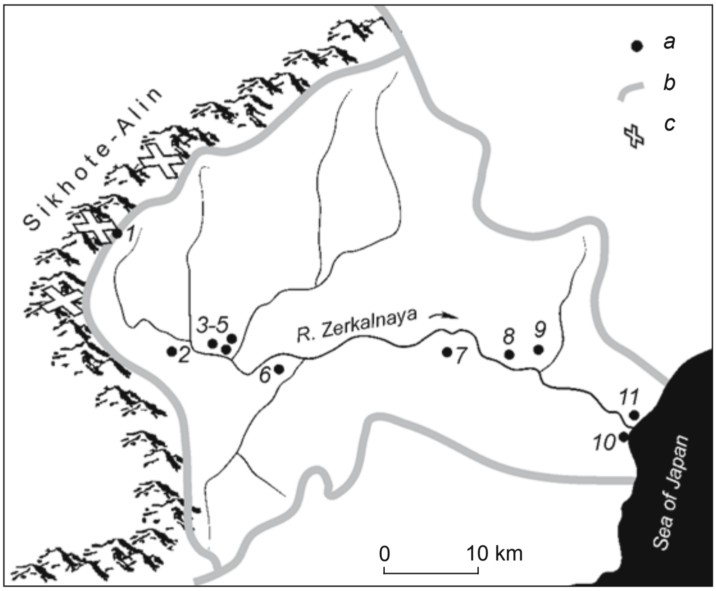

Fig. 1. Map showing the location of fortification sites in the Zerkalnaya (Tadushi) River basin.
1 – Venyukov; *2* – Dersu Cliff; *3* – *5* – Gornorechenskoe-1 – 3; *6* –Xibaigou; *7* – Sadovy Klyuch; *8* – Bogopol; *9* – rampart on the Zerkalnaya; *10* –Ust-Zerkalnoe; *11* – rampart in the Shiroky ravine.
a – fortified settlement; *b* – watershed; *c* – mountain pass.

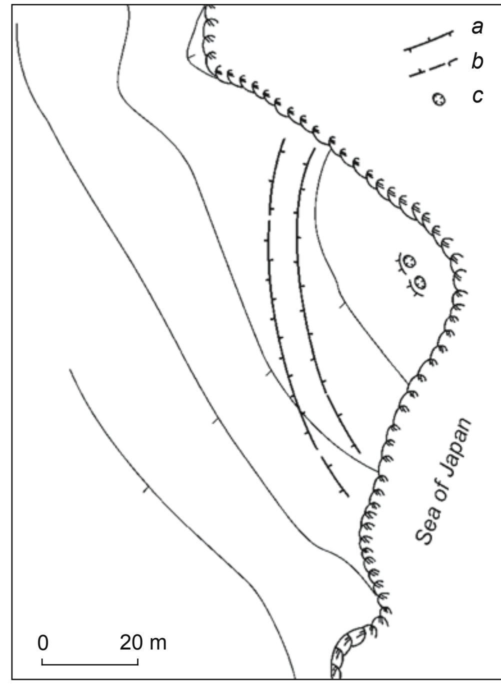

Fig. 2. Plan of the Ust-Zerkalnoe fortified settlement.
a – rampart; *b* – destroyed sections of the rampart; *c* – hollow.

the highest peaks in the upper reaches is 600 –1300 m, and 250 – 400 m of those in the lower reaches. The river valley is moderately meandering, and the mean width of the river is 1 – 2.8 km; at points of confluence with tributaries, the river is up to 3.6 km wide. Banks are steep and cut by water gaps. The major left tributaries are the Kavalerovka and Vysokogorskaya; the right tributaries are the Ustinovka (Xibaigou) and Sadovaya. The river flows into Zerkalnaya Bay in the Sea of Japan. The river mouth forms a wide liman separated from the sea by a sand bank. The Zerkalnaya connects the western and eastern portions of the Sikhote-Alin mountain range. The river is suitable for human habitation over the whole of its course.

The Metal Ages

A.P. Okladnikov (1963: 5 – 27) reported ancient fortifications in Primorye in the 1960s. He described an archaeological site with a rampart on the Peschanny Peninsula. A few years later, D.L. Brodiansky (1965: 56 – 58) published a paper on a fortified settlement of the shell midden culture on the Petrov Peninsula. In 1973, a rampart was recorded from the Kedrovka site attributable to the Early Iron Age*. The following year, a site with a rampart dating from the Metal Age was discovered on the Kudia Hill by V.I. Diakov*. However, at that time, archaeologists of the Far East viewed the evidence with skepticism. It has taken 30 years and a considerable array of new data to render indubitable to everyone the existence not only of medieval fortifications but of prehistoric ones as well.

The fortification site at Ust-Zerkalnoe was discovered by the Amur-Primorye Archaeological Expedition in the Zerkalnaya River basin. It is situated on the top of a cliff 1 km south of the mouth of the river (Fig. 1, *10*; 2)**. The eastern face of the cliff is rocky and descends abruptly into the Sea of Japan; the western slope is steep. On the top of the cliff are two lines of semi-circular ramparts

* **Diakova O.V.** Results of archaeological survey conducted in 1973 in the Dalnegorsky and Terneisky regions of the Maritime Territory. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 4984. P. 17.

* **Diakov V.I., Diakova O.V.** Archaeological investigations carried out in 1974 in the Dalnegorsky and Terneisky regions of the Maritime Territory and in the Khabarovsk Region of the Khabarovsk Territory. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 5274. P. 8.

** **Diakova O.V.** Report on excavations conducted by the Amur-Primorye Archaeological Expedition in 2002 at Kunalieskoye and Krasnoe Ozero and on reconnaissance in the Kavalerovsky, Dalnegorsky, and Terneisky regions of the Maritime Territory. Archives of the Institute of History, Archaeology, and Ethnography, Far Eastern Branch of the Russian Academy of Sciences. F. 1, Inv. 2, D. 557. P. 17.

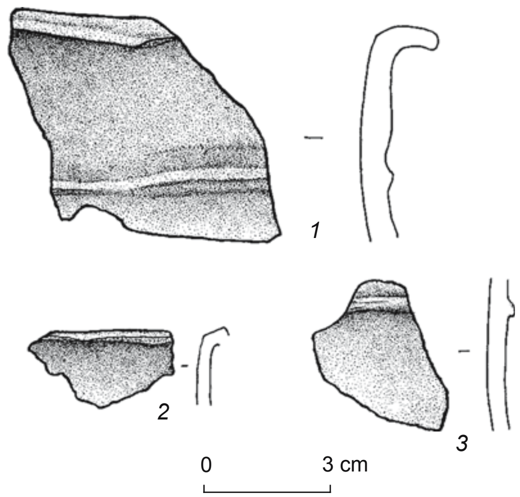

Fig. 3. Ceramics of the Lidovka culture (Kunalei group). Ust-Zerkalnoe.

consisting of stones and sandy clay. The interior wall is 70 m long; the exterior one is 80 m. The height of the interior face of the ramparts does not exceed 1 m, while the lower border of exterior face of the wall actually incorporates the hill's slope. There are two terrace-shaped platforms with two ovoid depressions (3 by 1.5 m) on the flat top of the cliff. This prehistoric fortification was damaged by more recent military facilities. The total area of the site is 0.15 hectare. It contains one cultural horizon and displays the following stratigraphic sequence: (1) sod, 0.7 – 10 cm thick; (2) humus-containing soil, 15 – 20 cm thick; (3) light brown loam (culture-bearing horizon), 20 – 30 cm thick; and (4) rock debris (bedrock).

The layer of light brown loam yielded hand-made ceramic ware attributable to the Kunalei variant of the Lidovka culture (Fig. 3) and one blank for a stone cylinder-shaped bead.

The Ust-Zerkalnoe fortified settlement belongs to the promontory type; its other classification features are as follows. The fortress is small, with semi-circular outlines, and is protected by a rampart made of stones and filling; no terraces were arranged, there is no inner regular town and redoubt, and the ramparts lack towers. The site is a guard fortress protecting the passage to the Zerkalnaya Bay and the river valley.

The promontory type of fortresses is the most ancient type in the Russian Far East. Such fortifications represent enclosures constructed at the narrowest portion of a promontory, at the edge where three sides are steep and abruptly descending to water. Fortifications of this type were widely used by various peoples all over Eurasia, including Primorye and the Amur basin during the Metal and Middle Ages.

There are nine fortified settlements of the Lidovka culture located in northeastern Primorye (Ust-Zerkalnoe, Mys [Promontory] Strashnyi, Dubrovinskoe, Ust-Belembe, Kemskoe-Skalistoe, Utesnoe, Mys [Promontory] Alexandra, Dedushkin Klyuch, and Kudia). All these sites are situated close to the mouth of rivers flowing into bays along the Sea of Japan. Archaeological materials from these sites suggest their attribution to the terminal stage of the Lidovka culture, i.e., at the end of the 1st millennium BC. At that time, the situation on the Sea of Japan and on the eastern slopes of the Sikhote-Alin was not quiet and called for fortification constructions. Apparently, enemies were awaited from the sea. In the second half of the 1st millennium BC only the Yankovsky people, the sole known tribe of Primorye sea foragers, were capable of attacking the Lidovka tribes. The Yankovsky tribes moved from south to north along the seashore and confronted the Lidovka population. Available archaeological evidence shows that these contacts did not always end with fighting. For instance, materials from settlements of Blagodatnoe-3 and Novogordeevskoe as well as those from the fortified site of Kunalei suggest assimilation processes that were reflected in pottery showing both the Lidovka and Yankovsky features.

The Middle Ages

In the Russian Far East, four archaeological cultures are attributed to the medieval period: Mohe, Bohai, and cultures of the Primorye and the Amur Jurchen. In Primorye, sites associated with the former three cultures were found. The culture of the Primorye Jurchen is represented by sites dating from the Jin period (1115 – 1234) and those of the Eastern Xia (1217 – 1234).

In the Zerkalnaya basin, archaeological sites attributable to the Mohe, Bohai, and Jurchen (Eastern Xia State) have been located. Only bearers of the latter two cultures built fortifications.

The Bohai culture. The Bohai state was established in 698 by the Tungus-Manchurian Mohe. This state occupied a vast territory including a part of Primorye, North Korea, and Northeast China (Manchuria). Apart from the eponymic people, the Bohai state included Koguryo, Paleo-Asiatic speakers, and Chinese.

Three types of Bohai fortified settlements have been recognized in the Zerkalnaya basin: the promontory, the valley, and the mountain types.

Promontory type. This type is represented by Gornorechenskoe-1 – 3 (see Fig. 1, *3 – 5*). These fortified settlements are situated on promontories protruding into the river. Fortifications of this type are further subdivided into two variants: with arcuate and closed ramparts. Gornorechenskoe-1 and 2 illustrate the first variant.

Gornorechenskoe-1 is situated on a 20 m high rocky promontory in the center of the village of Gornorechensk

(Fig. 4). In plan the settlement is semi-circular, with one stone and earth rampart up to 1.5 m high, 3 m wide at the bottom, and a ditch up to 1 m deep and 1.5 – 2 m wide. The rampart surrounds the site on its northern, western, and southern sides. The east is protected by a nearly vertical rocky precipice. The western portion of the rampart has a two-meter wide gate opening. The gate is simple, without any special structures. The area of the site is 0.25 hectare. The southwestern part of the wall shows stonework consisting of rough rock fragments and round pebbles. The ground inside the fortification is rather flat, no terraces were made, and no features of an inner town or dwelling constructions are visible on the surface. The site contains two cultural layers. Cleaning of the precipitous side of the site revealed the following stratigraphic sequence: (1) a layer of modern soil and vegetation; (2) brown loam; and (3) rocks. The lowermost portion of the brown loam layer contains flakes of white tuff typical of Mesolithic assemblages in the Zerkalnaya basin. The layer contemporaneous with the medieval period lacked any archaeological remains*.

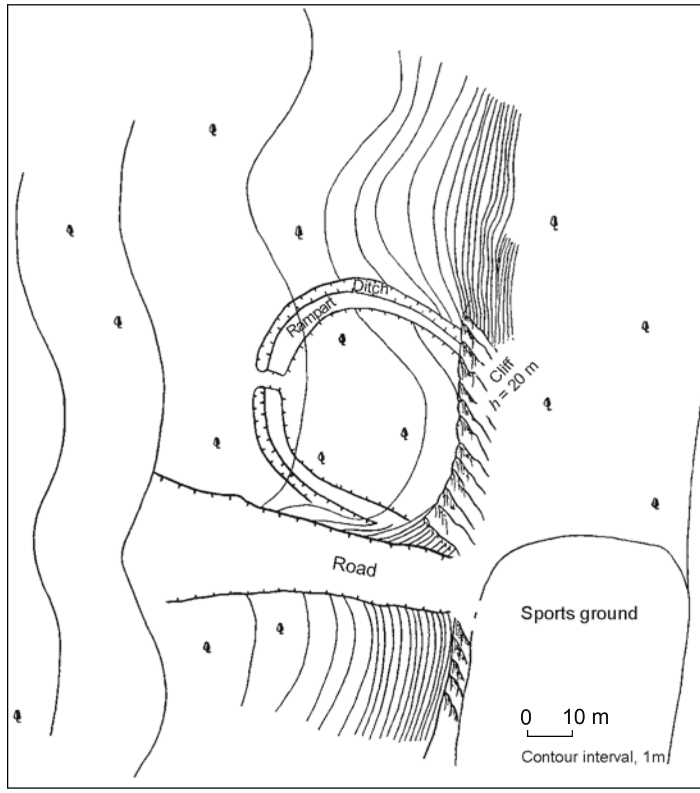

Fig. 4. Plan of the Gornorechenskoe-1 fortified settlement.

Gornorechenskoe-2 is situated on a promontory-like margin of a hill, 3 km east of the village of Gornorechensk, on the left bank of the Vysokogorskaya River. The northern side of the site is protected by three lines of ramparts forming a semi-circle; the southern side is a rocky precipice. The ramparts are up to 3 m high and built of pebbles and rough large cobbles. The north-northeastern section of the walls shows breaches (two-meter wide) for gates. That is, each rampart consists of two parts; their exterior length is 150 and 120 m, respectively; the interior length is 120 and 100; the mean lengths are 120 and 110 m. The total area of the site does not exceed 0.4 hectare. The interior surface is flat, lacking any terraces or remains of an inner town, although dwelling pits are visible. Archaeological remains recovered from this site consist of ceramics of the Bohai culture (Medvedev, 1969a: 237; 1969b)**. At present, this fortified settlement is completely destroyed.

The fortified settlement of Gornorechenskoe-1 and 2 are of the promontory type, semi-circular in shape, simple in plan, non-terraced, without an inner town and redoubt, small, with stone ramparts lacking towers, and with simple gates. Functionally, they can be defined as dwelling fortifications.

Gornorechenskoe-3 is a fortification on a promontory with a closed rampart (Fig. 5). It is situated in the eastern portion of Gornorechensk, on a high promontory with a flat top. Remains of a severely eroded stone rampart (diameter of stones varies from 5 to 45 cm) and a ditch can be traced along the margin of the hill. The rampart is 3 – 3.5 m wide and 0.5 m high. The outlines of the rampart resemble an irregular polygon, 49.5 m long along the north-south line and 43 m long along the east-west line*.

The site comprises two cultural layers. The lower layer of greenish loam contained Mesolithic artifacts.

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* **Boldin V.I., Nikitin Y.G.** Archaeological investigations carried out in the Kavalerovsky and Chuguevsky regions of the Maritime Territory in 1996. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 20547; **Okladnikov A.P.** Report on the investigations conducted by the Far Eastern Archaeological Expedition in 1960. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 2120; **Diakova O.V.** Report on the investigations conducted by the Amur-Primorye Archaeological Expedition in 2002. P. 17.

** See also: **Galaktionov O.S.** Report on archaeological survey in the Maritime Territory in 1986. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 11516; **Boldin V.I., Nikitin Y.G.** Archaeological investigations carried out in the Kavalerovsky and Chuguevsky regions of the Maritime Territory in 1996. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 20547.

* **Boldin V.I., Nikitin Y.G.** Archaeological investigations carried out in the Kavalerovsky and Chuguevsky regions of the Maritime Territory in 1996. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 20547; **Diakova O.V.** Report on the investigations conducted by the Amur-Primorye Archaeological Expedition in 2002. P. 17.

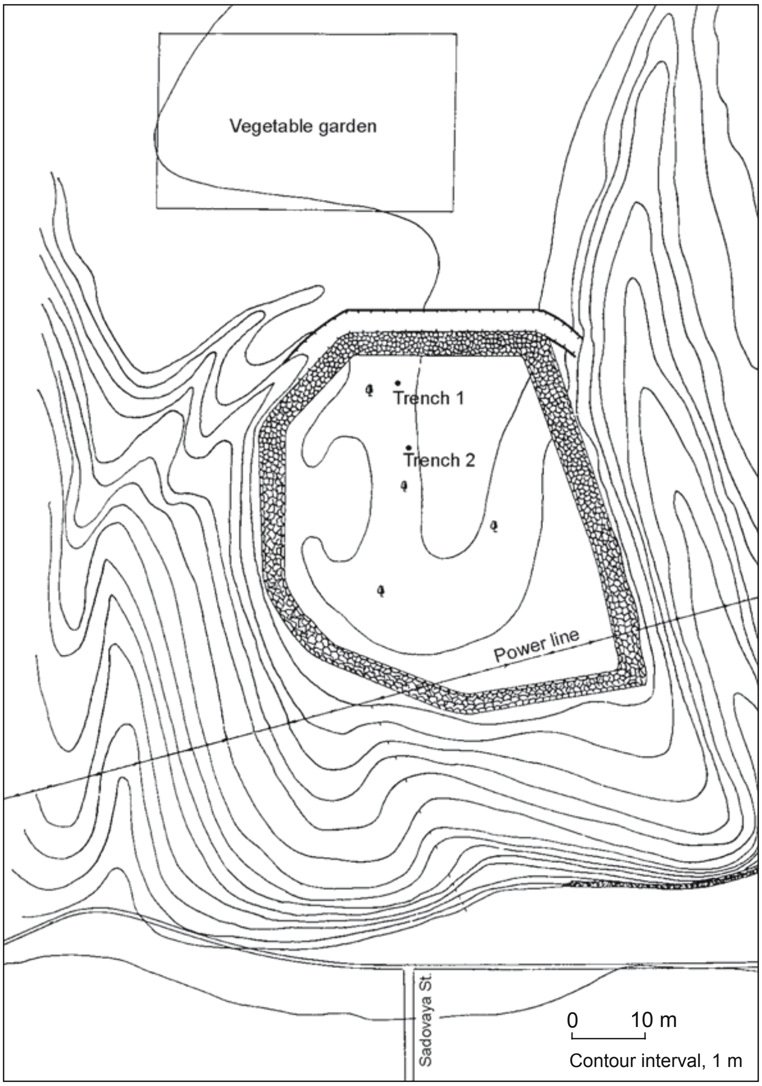

Fig. 5. Plan of the Gornorechenskoe-3 fortress.

The upper layer of sod and modern soil is attributable to the Middle Ages, i.e., to the period of the fortress's construction. The fortress had indeed been constructed, but apparently no permanent population had been housed within it. No diagnostic datable materials have been revealed from this layer.

Gornorechenskoe-3 can be classified as the fortress of the promontory type; it is of polygonal shape and surrounded by a closed rampart made of stones. The site is small-sized, simple in plan, non-terraced, without an inner town and redoubt. Fortifications have neither towers nor gates. Functionally, it can be defined as a defensive watch fortification.

Analysis of the fortified settlements on promontories revealed their heterogeneity and various origins. Fortifications with arcuate ramparts blocking the promontory in its narrowest place – in the Zerkalnaya basin – appeared as early as the 1st millennium, in the Metal Age. Similar fortresses have been identified within the Mohe culture. Many Mohe fortifications show an additional rampart protecting the gate. Mohe promontory fortresses existed for a considerably long period: from the first centuries AD to the 8th and 9th centuries. More sophisticated promontory fortresses with arcuate ramparts existed in the Bohai culture as a result of the assimilation of Mohe tribes by the inhabitants of the Bohai State. Hence archaeological remains (especially pottery) from Bohai fortresses demonstrate basic features typical of the Mohe culture.

Promontory fortified settlements with closed ramparts are analogous to rectangular valley fortresses. They even retain additional walls that were used by the Bohai population as drainage constructions in valleys. Construction of fortresses on promontories was a response to the instability generated by the collapse of the Bohai State in the 9th century.

Valley type. Fortified settlements of this type are located in river valleys, mostly on flat elevated floodplains that are not submerged by water. There are two fortresses of this type in the Zerkalnaya basin: Sadovy Klyuch and Bogopol (see Fig. 1, *7*, *8*).

Valley fortifications were built in areas suitable for agriculture, often in swampy areas located within the middle and lower reaches of a river and close to its mouth. With respect to shape, the fortresses are subdivided into squares (rectangles) and polygons. Sadovy Klyuch is a rectangular fortress. It is located 2 km south of the village of Suvorovo, on the right bank of the Sadovaya River, a tributary of the Zerkalnaya (Fig. 6). This square-shaped fortress is oriented with its corners to the cardinal points. Each side is 100 m long; the total area is 1 hectare. The rampart height does not exceed 1 m. The ramparts are made of stones and soil. There is a two-meter wide gate in the middle of the northeastern wall. Ceramic ware was collected from the surface (Gladyshev, 1986)*.

* See also: **Silantiev G.L.** On archaeological survey in the Kavalerovsky, Partizansky, and Shkotovsky regions of the Maritime Territory in 1980. Archives of the Institute of History, Archaeology, and Ethnography, Far Eastern Branch of the Russian Academy of Sciences. F. 1, Inv. 2, N 83; **Boldin V.I., Nikitin Y.G.** Archaeological investigations carried out in the Kavalerovsky and Chuguevsky regions of the

The fortified settlement of Sadovy Klyuch is a square-shaped, small-sized valley fortification without towers. It is planigraphically simple, non-terraced, with ramparts made of stones and soil. Functionally, it is a dwelling and defensive settlement of the Bohai period.

Bogopol is an example of a polygonal valley fortified settlement (Fig. 7). It is situated in the suburbs of the town of Bogopol, on the left bank of the Zerkalnaya. The fortress is trapezoidal in plan and surrounded by two lines of ramparts (exterior and interior) and by ditches. The fortress is oriented according to cardinal points. The ramparts are 0.7 – 1.5 m high, from 1 to 1.5 m wide at the top and from 3 to 5 m at the bottom. The ditches are 1 – 1.5 m deep and 1.5 – 3 m wide. The walls are made of soil and rock debris (diameters vary from 10 to 40 – 50 cm). The ramparts were erected on a manner of stone basement. The arrangement of stones on the outside of the rampart apparently attests to a loose coating. The western rampart has a two-meter gap in the place of the former gates. The remaining part of the western interior rampart is 20 m long, and that of the exterior rampart is 30 m long; the northern interior and exterior ramparts are 45 and 75 m long; the length of the eastern interior rampart is 55 m. The surface of the interior area of the fortress was made level with soil. In the center, there are two depressions (4 by 5 m) created by dwellings. The total area of the fortress is 0.2 hectare. Archaeological remains collected from the site mostly contain ceramics of the Bohai type (Fig. 7).

The site has been classified as a small valley fortress of trapezoid form, without towers. It is planigraphically simple, non-terraced, without traces of an inner town. Ramparts made of rock debris and soil are faced with stones. Functionally, is can be classified as dwelling and defensive.

Pottery serves as the major cultural indicator. Pottery mostly of the Bohai type, such as Bohai pots, has been recovered suggesting attribution of the site to the Bohai culture. In general, the ceramic complex from square-shaped fortresses is well-correlated chronologically with the period of the Bohai State, i.e., can be dated to the 7th – 10th centuries.

Valley fortification apparently evidence high skills, which the Primorye natives had scarcely yet developed by that time, because all known fortifications dated to from the late 1st millennium BC – 1st millennium AD are of the simplest (promontory) type. A square plan had always

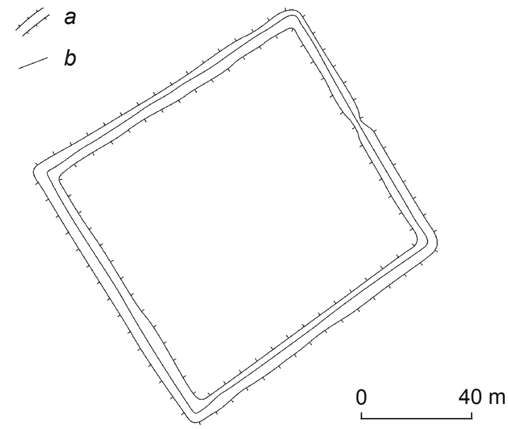

Fig. 6. Plan of the rampart at the Sadovy Klyuch fortified settlement.
a – outlines of the blurred rampart; *b* – ridge of the rampart.

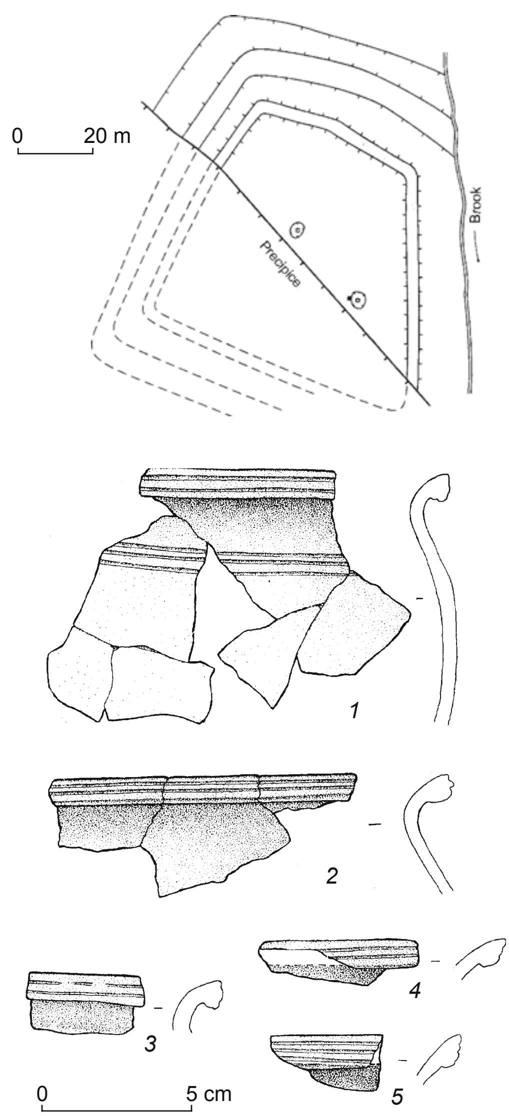

Fig. 7. Plan of the fortification and ceramics. Bogopol fortified settlement.

Maritime Territory in 1996. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 20547; **Diakova O.V.** Investigations conducted in the Maritime Territory by the Amur-Primorye Archaeological Expedition in 2003. Archives of the Institute of History, Archaeology, and Ethnography, Far Eastern Branch of the Russian Academy of Sciences. F. 1, Inv. 2, D. 558. P. 21.

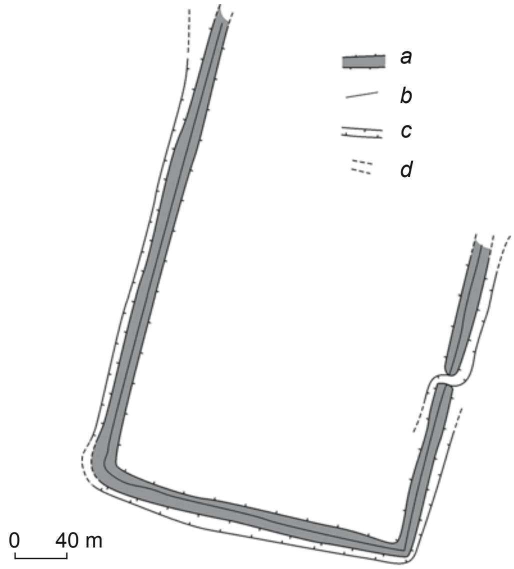

Fig. 8. Plan of the Venyukov fortification.
a – rampart; *b* – ridge of the rampart; *c* – ditch; *d* – destroyed sections.

been a typical feature of Chinese valley fortifications in the past. The Chinese used to build square-shaped houses and palaces. They believed that the earth is also square-shaped. In the Russian Far East, such fortresses appeared after the Bohai State had been established (698 – 926). Available written sources hold that this state was arranged in accordance with the Chinese system of territorial administration in the first half of the 9th century. It is likely that the Bohai population borrowed the square-shaped fortresses from the Chinese at approximately same time. The Bohai State was subdivided into provinces, districts, and prefectures. In "barbarian" provinces, including Primorye, "suppression districts" responsible for maintaining order were established.

The valley topography of square-shaped fortifications lacking towers as well as the comparatively small proportion of weaponry within archaeological assemblages, together with stratigraphic data and the spatial distribution of artifacts attest to the mostly peaceful occupation of the northeastern Primorye by the Bohai State. Available data also suggest that Bohai did not have any strong enemies. Fortified settlements were built and used as administrative headquarters. The size of a particular settlement seems to have depended on its status.

Mountain type. Fortifications located on the highest elevations and providing for control over the surrounding area belong to this type. Such fortifications were important strategic points and were built for the purpose of repelling enemy attacks. According to microtopographic features, Bohai fortified settlements can be subdivided into two subtypes: (1) erected on mountain passes and (2) natural fortifications on cliffs. The Venyukov fortified settlement in the Zerkalnaya basin belongs to the first type. It was erected at the strategically important crossroads ensuring control over migration from one river basin to another (see Fig. 1, *1*) (Venyukov, 1970: 117). The site is located on the Venyukov mountain pass, 12 km northwest of the village of Kavalerovo. Remains of ramparts surround the settlement on three sides, resembling an open-ended rectangle (Fig. 8). Its western section is 344 m long; the length of the eastern section is 198 m, and that of the southern section is 244 m. The height of the inside of the rampart is 0.7 – 1.8 m; its outside is 1.3 – 2 m high. A waterlogged ditch from 3 to 7 m wide is situated outside the rampart. A five-meter wide gap left from the gates is located in the middle portion of the eastern section of the rampart. The interior surface of the site is comparatively flat. The total area of the fortress is 8 hectares (Ibid.: 235)*.

V.K. Arseniev wrote that there was a fortress on top of the Sikhote-Alin ridge on the way from the Fudzina to the Tadushi rivers. The fortress was large and at that time located at some distance from the southern path and a sanctuary. Apparently, a road ran there formerly and, possibly, close to the fortress blocking the mountain pass on either side**. Arseniev located the mountain sanctuary on top of a hill, north of the fortress situated near the Zerkalnaya (Tadushi) River. The Venyukov fortified settlement represents the mountain type. It is small, rectangular in shape, planigraphically simple, non-terraced, without traces of an inner town and redoubts. The ramparts are made of soil; towers are absent. Functionally, it was a fort for defense and observation.

The natural fortified site of Dersu Cliff (see Fig. 1, *2*) is situated in the northern portion of Kavalerovo, on a 98 m high cliff on the right bank of the Zerkalnaya. The site is located on a hilltop surrounded by natural cliffs. The legend holds that the first meeting of Arseniev and Dersu Uzala occurred on this cliff***. The Dersu Cliff was most likely used as a guard and observation station in this portion of the Zerkalnaya valley during the Bohai period.

The Primorye Jurchen culture of the Eastern Xia State (1217 – 1234). The Eastern Xia emerged during the troublesome times of the collapse of the Jin Empire (1115 – 1234) and the establishment of Mongolian rule

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* See also: **Arseniev V.K.** Notes of a journey of 1907. Archives of PFRGO-OIAK. F. 14. Inv. 1. D. 8; **Galaktionov O.S.** Report on archaeological survey in the Maritime Territory in 1983. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 10177. P. 87; **Diakova O.V.** Report on the investigations conducted by the Amur-Primorye Archaeological Expedition in 2002. P. 17.

** **Arseniev V.K.** Notes of a journey of 1907.

*** **Diakova O.V.** Report on the investigations conducted by the Amur-Primorye Archaeological Expedition in 2002. P. 27.

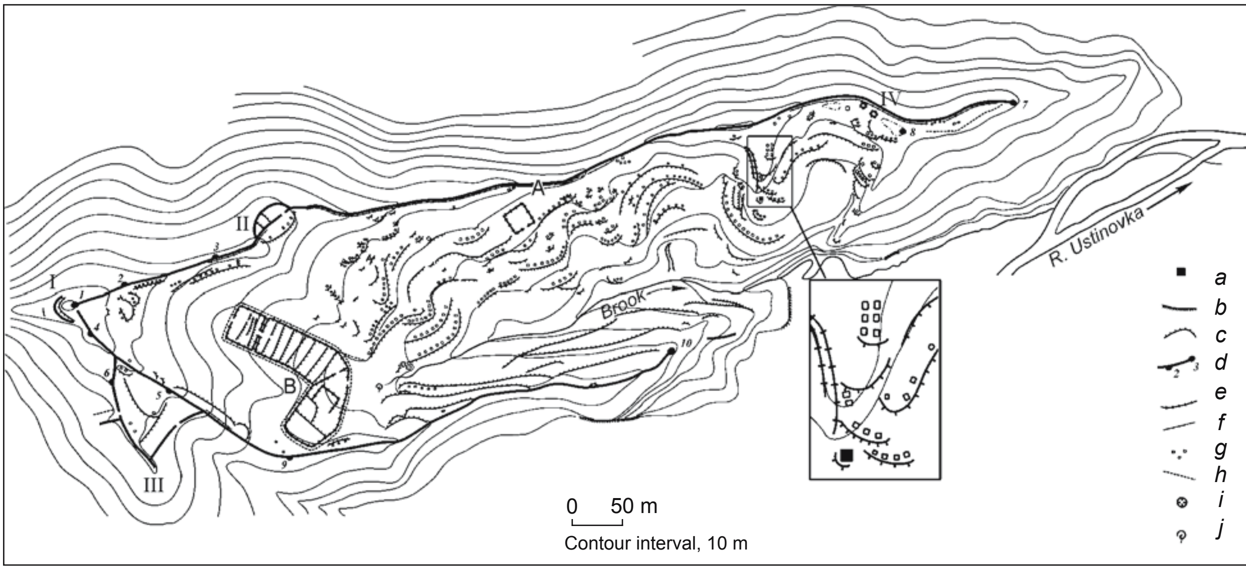

Fig. 9. Plan of the Xibaigou fortified settlement.
I – IV – fortifications; A – redoubt; B – inner town.
a – homestead; *b* – cliffs; *c* – terraces; *d* – rampart with towers (enumerated); *e* – embankment; *f* – ditch; *g* – hollows; *h* – ancient road; *i* – well; *j* – spring.

over the Far East. Archaeological sites illustrating that period consist of mountain fortresses with discontinuous ramparts on the slopes of the Sikhote-Alin. There are about 30 such sites in Primorye, one of which has been located in the Zerkalnaya basin.

The Xibaigou fortified settlement is located 2 km south of the village of Ustinovka, at the edge of a mountain ridge separating the Zerkalnaya River and its right tributary, the Ustinovka (Xibaigou) River (see Fig. 1, *6*) (Tatarnikov, 2001; Diakova, 2005: 24 – 31)*.

The site shows the strict spatial organization of the interior and exterior areas traditional for the Eastern Xia state in Primorye (Fig. 9). Xibaigou is located in the water gap from where the spring runs into a clear and cold brook. The site is surrounded by a rampart running along the hilltops. The rampart can be conventionally subdivided into the northern (1005 m), southern (410 m), and western (271 m) sections. The total length of the rampart is 1686 m. The habitation area was situated in the water gap. Dwellings were built on terraces constructed on the slopes. At Xibaigou, such terraces are considerably high (3, 5, 8 m) due to the steep slopes of surrounding hills. Terraces were constructed in the following way: (1) a plane terrace was cut in the slope and leveled; (2) a special basement was constructed of backed loam; (3) interchanging layers of muddy and loose soil overlie the basement. Sizes of such terraces vary across the site; some have space enough for one dwelling, others for several houses. Houses were of the standard type with П- and Г-shaped systems of heating canals (*kang*). Written sources from the 16th century hold that Jurchen military officers and their families lived in such terraced settlements in water gaps.

The inner town is located close to the ridge running along the western rampart. It consists of several rectangular areas. These areas were constructed employing the same strategy as described above, followed by the laying of building foundations. Inside the town, colonnaded palace-like houses were situated. The corners of such houses were oriented to the cardinal points. Chronicles from the 16th century hold that the interior town of the first Manchurian capital was populated exclusively by the members of the emperor's family. The Xibaigou settlement most likely was the headquarters of local government.

A redoubt was located close to the northern rampart. It is square-shaped, with corners oriented according to the cardinal points; the sides are 19 – 20 m long and the total area is 0.04 ha. The rampart was made with interchanging layers of muddy and loose soil (*hantu* technology). The gate opening is 2 to 3 m wide and has a wooden platform (a watch-box). There were two to three houses with П- and Г-shaped *kang* canals inside the redoubt. Functionally, this settlement can be determined as a military station. Fortification features include earthen ramparts (*hantu* technology), an additional gate wall of

* See also: **Diakova O.V.** Report on the investigations conducted by the Amur-Primorye Archaeological Expedition in the Maritime Territory (Kavalerovsky region) in 2005. Archives of the Institute of History, Archaeology, and Ethnography, Far Eastern Branch of the Russian Academy of Sciences. F. 1, Inv. 2, D. 601. P. 5 – 11.

the *zahaba* type, towers, stone throwing areas, guard houses located along the ramparts, and stone depots on and close to the rampart.

The Xibaigou fortified settlement can be classified as a large mountain fortress with discontinuous walls. In plan, the site is terraced, with an inner town and redoubt. Ramparts are composed of interchanging earthen layers; the corners are faced with stones. Fortification features include towers equipped with stone throwing stations and stone depots. The settlement functioned as a military and an administration headquarters.

These features together with pottery, mostly vessels of vase shapes, ironware and coins suggest attribution of Xibaigou to the Jurchen culture of the Eastern Xia State period (1217 – 1234). The clear outlines of the settlement and the absence of evidence of reconstruction suggests a short construction period for this site and an existence for the site of not more than 20 – 25 years in duration. Clear construction patterns of fortification features and houses attest to traditions other than the Tungus-Manchurian and Paleo-Asiatic. Apparently, construction was directed by Chinese specialists. The work was carried out by soldiers and the local population. It was likely a compulsory duty for local people. Only the military detachment was able to abandon town quickly and in proper order. It seems that the local people were also forced to build and maintain roads. The Jurchens of Eastern Xia invaded the territory populated by the related Tungus-Manchurian tribes and seemed to have maintained friendly relations with them. Their major enemies were Jurchen from the Jin Empire and the Mongols who possessed all possible weaponry of that time including battering rams, fire balls, and stone-shooting cannons as well as well-equipped detachments of horsemen, together with rich experience in conquering and controlling conquered territories.

The origins of Jurchen fortified mountain settlements located on slopes of water gaps is clear, and have the same syncretic features of traditional constructions of such settlements.

Topographic features of the Russian Primorye have much in common with the topography of the northeastern parts of Korea and China. Apparently, similar landscapes predetermined the principles of choosing a place for the construction of fortresses by the population of these regions. Thus the Koguryo people and the Jurchen of the Eastern Xia alike regarded steep mountain slopes, on the banks of a big river serving as a major transportation route and principal natural obstacle limiting an enemy's mobility, as the best place for constructing a fortress. Jurchen tribes maintaining close contacts with the Korean people borrowed the Koguryo fortification traditions.

Other features were borrowed from the Chinese including the layout of fortified settlements, their major features being separate zones for the inner town, redoubt and habitation area, the orientation of the houses with their corners to cardinal points, and the building of terraces through the employment of *hantu* technology.

Fortification features and their construction technology attest to the employment of different traditions. For instance, building layered earthen walls through use of *hantu* technology, which implies beginning with the corners, as well as layouts of houses and other buildings attest to Chinese origin; these traditions have been known in China since the 4th century BC (Nosov, 2001: 27). According to Chinese traditions, the Jurchen people located stone-throwing areas on defensive walls and erected towers at the corners. Such traditions were recorded in China as early as the 6th century BC. On the other hand, discontinuous walls that were thrown up of earth along the highest areas of the hills clearly represent the local tradition of construction of promontory fortresses that was practiced during the Metal Ages and the early medieval period (the Mohe culture).

In sum, the construction of mountain fortresses on steep hills aggregated those features of the Korean, Chinese, and Tungus-Manchurian traditions of house- and fortification-building that were the most secure and the most easily adapted to military needs.

Separate ramparts. A fortification rampart has been located on the left bank of the Zerkalnaya, 3 km from the village of Zerkalnaya (see Fig. 1, *9*). This earthen wall is 50 m long and 0.5 – 0.7 m high. It was discovered by Z.V. Andreeva in 1961*.

Another protective wall has been located in the ravine eroded by the Shiroky creek running to the Sea of Japan (see Fig. 1, *11*). This site is situated outside the Zerkalnaya basin; however, it is located close to its mouth. The wall was thrown up of earth. It crosses the ravine in its narrowest portion and has a gate in the middle. Neither of the ramparts yields diagnostic material. They were most likely built in the Middle Ages**. The function of this object was to defend the entryway to the Shiroky ravine.

Conclusions

1. Since the remote past, the Zerkalnaya (Tadushi) basin has connected the eastern and the western slopes

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* **Andreeva Z.V.** Report on the 1961 survey in Chuguevsky and Kavalerovsky regions of the Maritime Territory. Archives of the Institute of Archaeology, Russian Academy of Sciences. P-1. N 2391.

** **Silantiev G.L.** Report on the 1980 archaeological survey of medieval sites in the Kavalerovsky, Chuguevsky, and Shkotovsky regions (Maritime Territory). Archives of the Institute of History, Archaeology, and Ethnography, Far Eastern Branch of the Russian Academy of Sciences. F. 12, Inv. 2, D. 83.601.

of the Sikhote-Alin range and has been an important transportation route, along which were situated eleven fortifications serving various purposes. The total length of the route was 60 – 80 km.

The Venyukov fortress controlled the route running from the western slopes of the Sikhote-Alin to the eastern slopes, where the road ran along the Zerkalnaya River. In the lower reaches of the Zerkalnaya, the road branched in three directions: northern, eastern, and southeastern. The northern branch led from the Zerkalnaya valley across the Tetuhe pass and along the Monastyrka valley to the Rudnaya basin. The eastern route reached the mouth of the Zerkalnaya and Zerkalnaya Bay on the Sea of Japan. A retaining wall was constructed to control the estuary. The southeastern route linked the upper reaches of the rivers Brusilovka and Sadovy Klyuch. All the three routes formed the Zerkalnaya transportation net.

2. Ust-Zerkalnoe is the oldest fortress in the Zerkalnaya valley. This fortress of the promontory type was built in the 1st millennium BC by people associated with the Kunalei group of the Lidovka culture. It protected the entrance to the bay. In the Zerkalnaya valley itself, nine sites associated with the Lidovka culture were discovered, attesting to a comparatively high population density in the past. Promontory fortresses were evidently constructed by native tribes.

3. Early medieval fortresses include six Bohai sites falling into three types: promontory (Gornorechenskoe-1 – 3), valley (Sadovy Klyuch, Bogopol), and mountain type (Dersu Cliff). Ethno-political and military processes of the late 1st millennium BC contributed to the instability in the region, resulting in the replacement of valley fortifications by those of the promontory type, which met the defense requirements of that period.

4. The Jurchen fortified settlements of the Eastern Xia period (1217 – 1234) are the most late-day of the ancient settlements in Primorye. One of them is Xibaigou, which combines the Koguryo and Chinese traditions of fortification.

Generally, the chronological subdivision of fortifications in the Zerkalnaya basin correlates with the chronological scheme of Primorye cultures.

References

Arseniev V.K. 2002
Putevoi dnevnik 1906 goda. *Zapiski OIAK* (Vladivostok), vol. 36, iss. 1: 49–50.

Bichurin N.Y. 1950
Sobranie svedenii o narodakh, obitavshih v Srednei Azii v drevnie vremena, vol. 2. Moscow, Leningrad: Izd. AN SSSR, pp. 326.

Brodiansky D.L. 1965
Ukreplennoe poselenie kultury rakovinnyh kuch na ostrove Petrova. In *VIII konferentsia molodyh uchenyh Dalnego Vostoka. Sektsia obscestv. nauk*. Vladivostok: n.p., pp. 56 – 58.

Diakova O.V. 2005
Drevnie i srednevekovye gorodischa i kreposti Dalnego Vostoka (Severo-Vostochnoe Primore). Vladivostok: Izd. Dalnevost. Gos. Techn. Univ.

Gladyshev S.A. 1986
Arkheologicheskie razvedki v doline r. Zerkalnoi (Yuzhnoe Primore). In *Problemy arkheologii Severnoi i Vostochnoi Azii: Sbornik nauch. trudov*. Novosibirsk: IIFF SO AN SSSR, pp. 89 – 90, 94 – 95.

Medvedev V.E. 1969a
Gorodischa v dolinakh rek Kentsuhe i Tadushi. In *Arkheologicheskiye otkrytiya 1968 g.* Moscow: n.p., p. 237.

Medvedev V.E. 1969b
Srednevekovoe gorodische Kentsuhe II na r. Tadushi. In *Izvestiya Sibirskogo otdeleniya AN SSSR*. N 1: Ser. obschestv. nauk, iss. 3: 37.

Nosov K.S. 2001
Zamki i kreposti Indii, Kitaya, Yaponii. Moscow: Reittar.

Okladnikov A.P. 1963
Drevnee poselenie na poluostrove Peschanom u Vladivostoka. Moscow, Leningrad: Izd. AN SSR.

Tatarnikov V.A. 2001
Kraevedcheskii klub “Tetuhe” g. Dalnegorska i novye otkrytia v arkheologii Severo-Vostochnogo Primoria. In *Tetuhinskie chteniya: Tezisy dokl. nauch.-prakt. konferentsii, 21 – 22 noyabria 2001 g.*. Dalnegorsk: n.p., pp. 4 – 5.

Vasiliev V.P. 1857
Istoriya i drevnosti vostochnoi chasti Srednei Azii ot X do XIII veka. St. Petersburg: [Tip. Panteleevyh].

Venyukov M.I. 1970
Puteshestvie po Primoriyu, Kitayu i Yaponii. Khabarovsk: Khabarovsk kn. izd.

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POTTERY FROM THE EASTERN VARIATION OF THE ITKUL CULTURE (Based on Finds from the Yurtobor Archaeological Microregion in the Lower Pritobolie)

Introduction

The Lower Pritobolie region includes the basin of the Lower Tobol River together with its left (Iset, Tura and Pyshma, Tavda) and right (Tap, Yurga) tributaries. The area lies within the boundaries of the northern forest-steppe and south-taiga zones. The Tobol, Iset, Tura and Pyshma, and Tavda originate in the Ural Mountains. In the Tyumen Region, these rivers acquire the characteristics of flat country with slow flow and a meandering bed. Their wide (up to several kilometers) flood plains with numerous lakes and mort-lakes are accompanied by stretches of sand terrace with pine forests and large marshy areas (Pomus, 1956: 585 – 586; Fiziko-geographicheskoe raionirovanie…, 1973: 151; Bakulin, Kozin, 1996: 50).

Until recently, the lands of the Lower Pritobolie have remained a blank spot on the map of the Late Bronze – Early Iron Age cultures of Western Siberia. At the beginning of the 1990s, several fortified settlements with circular layout were found in the Yarkovo District of the Tyumen Region at the confluence of the Tobol and Tap rivers (Yurtobor archaeological microregion) (Zakh, 1995). The sites are situated within a 1.5 – 2 km section of a long sand promontory with dune hills (Fig. 1). In 1991 and 2001 – 2004, excavations were carried out on the Vak-Kur-2, Karagai-Aul-1, and Karagai-Aul-4 settlements (Zakh, Zimina, 1999; Zimina, 2002, 2004a, b). The characteristics of the pottery and various other artifacts which were found and a series of radiocarbon measurements (Table 1) allow for the dating of these fortified settlements to the transition from the Bronze to Iron Age and the beginning of the Early Iron Age.

The excavated settlements have been attributed to the Itkul culture, which was identified after the materials of Trans-Uralian sites (Salnikov, 1962; Beltikova, 1977). Regional peculiarities of the Pritobolie assemblages have enabled us to single out a local, Eastern variation of this culture and divide it into three phases (Fig. 2), referred to as the Itkul, Karagai-Aul, and Vak-Kur (Zakh, Zimina, 2004). The Eastern variation of the Itkul culture existed in the Lower Pritobolie from the late 8th / early 7th centuries to the late 6th century BC (Table 1).

The Itkul stage is represented by the Karagai-Aul-4 site. This is a single-ground settlement of oval shape (160 by 110 m). In the course of excavations, exposing an area 390 m^2, two buildings and a small fortifications section were examined. The cultural layer proved rather poor in finds. It contained endscrapers for working hides made of ceramic fragments, in one case of green schist, a fragment of a small clay article (a mould?), and approximately 1500 pottery shards representing at least 36 vessels (based on the number of necks).

The Karagai-Aul stage is represented by the Karagai-Aul-1settlement which has two adjacent grounds of oval (Karagai-Aul-1/A) and round (Karagai-Aul-1/B) shape with closed, circular layout, fortified with ramparts and ditches.

The ground of Karagai-Aul-1/A (250 by 164 m) is encircled with a weakly expressed rampart and a ditch. In

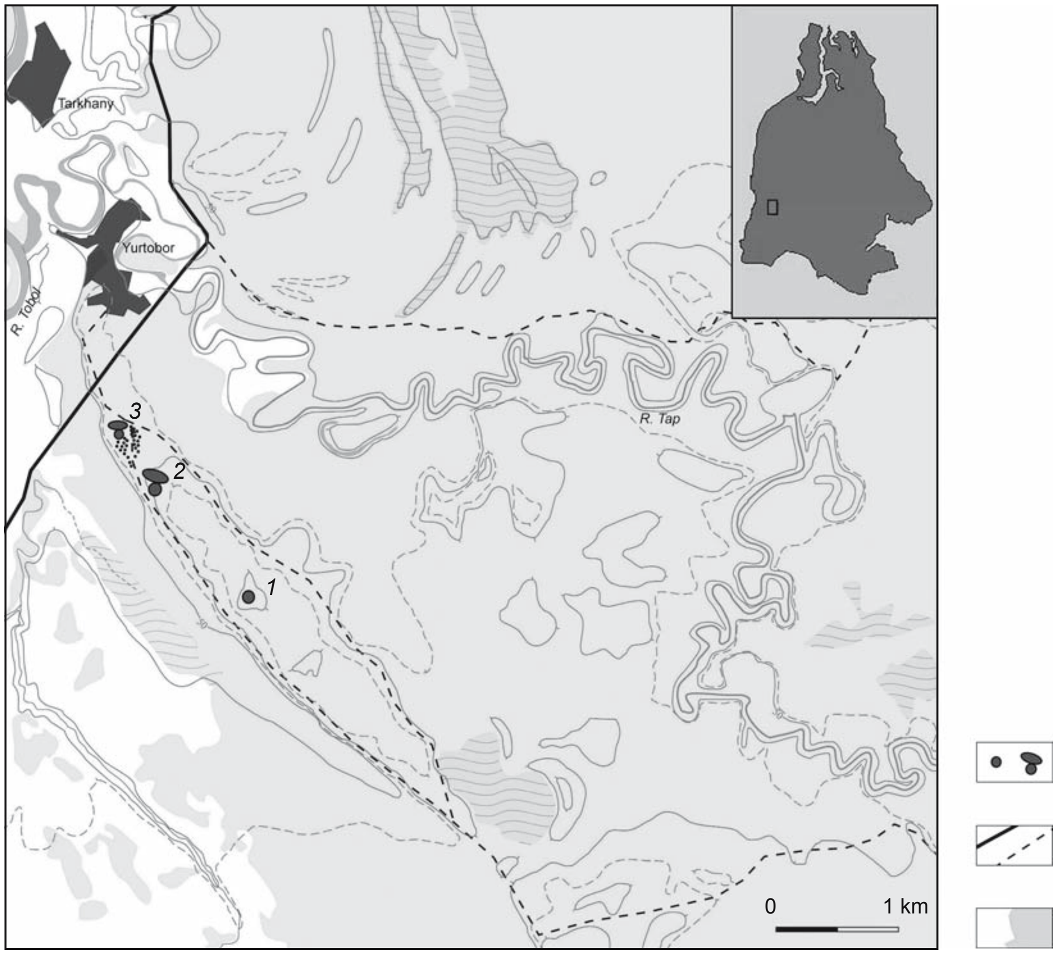

Fig. 1. Map showing the distribution of the sites representing the Eastern local variation of the Itkul culture in the Yurtobor archaeological microregion.
1 – Karagai-Aul-4; *2* – Karagai-Aul-1; *3* – Vak-Kur -*2*.
a – settlements; *b* – roads; *c* – forest.

the northeastern and northwestern parts of the settlement, two entrances were recorded, 3 and 4 m wide, respectively. Situated along the edge of the oval ground are 44 above-ground dwellings. No buildings have been recorded in the central part. Two excavation trenches (total area 281 m^2) exposed small sections of fortification and an inter-dwelling space. One dwelling was completely exposed, the other only partly. On completion the excavated dwelling yielded approximately 1000 shards of pottery representing at least 30 vessels (based on the number of necks), fragments of a crucible and ceramic endscrapers. The cultural layer of the partly excavated dwelling contained several ceramic endscrapers, fragments of a probable crucible, and 325 shards of pottery representing at least 12 vessels (based on the number of necks).

The ground of Karagai-Aul-1/B (diameter about 170 m) is surrounded by two ramparts with a ditch running between them. The remains of 43 above-ground structures have been recorded along the inner circle and in the central part of the ground. The excavation area (256 m^2) exposed a building at the edge of a ridge-like elevation, part of an inter-dwelling space on the slope of a hollow, and part of the fortification system. The cultural layer gave the following finds: a bronze perforator (awl), clay spindles (both intact and fragmented), approximately 100 ceramic endscrapers made from fragments of the walls of vessels, fragments of a crucible (?) and drops of bronze, an endscraper on a flake of gray schist which had been used to work hides, a grinding stone of quartzite pebble, and over 8000 shards of pottery representing at least 151 vessels (based on the number of necks).

The Vak-Kur stage is represented by the Vak-Kur-2 site which includes two fortified grounds of oval (Vak-Kur-2/A) and round (Vak-Kur-2/B) shape, and the Vak-Kur-2 settlement (unfortified). The ground of Vak-Kur-2/A (160 by 100 m) is surrounded by a ditch encircling 42 above-ground dwellings. The ground of Vak-Kur-2/B

Table 1. **Radiocarbon dates of sites in the Yurtobor archaeological microregion**

Site	Object	Laboratory code	Absolute date, BP	Calibrated date, BC	
				± 1ð	± 2ð
Karagai-Aul-4	Structure 1	SOAN-5316	2630 ± 30	822–796	840–760
		SOAN-5318	2750 ± 45	970–960 930–830	1000 810
		SOAN-5314	2785 ± 25	1000–985 975–950 945–895	1000 890 880–830
	Structure 2	SOAN-5320	2595 ± 30	806–766	830–760 690–660 610–590
	Rampart	SOAN-5321	2625 ± 75	900–750 690–660 620–590 580–560	1000 400
Karagai-Aul-1/A	Structure 2	SOAN-2925	2840 ± 30	1040–1030 1020–920	1130 900
	Inter-dwelling space	SOAN-4615	2635 ± 35	825–796	900–870 840–760
	»	SOAN-4616	2695 ± 75	920–790	1050 750
	Rampart	SOAN-4617	2625 ± 65	900–760 680–660 610–590	930–740 730–520
Karagai-Aul-1/B	Structure 1	SOAN-4614	2745 ± 30	910–830	980–950 940–820
		SOAN-4613	2830 ± 25	1005–965 960–925	1050 900
Vak-Kur-2/B	Structure 1	SOAN-5838	2420 ± 75	760–680 670–640 590–580 550–400	780–390
		SOAN-5836	2415 ± 30	760–740 540–530 520–400	760–680 670 640 550 390
	Rampart	SOAN-5840	2770 ± 75	1000–830	1130 800
		SOAN-5841	2510 ± 80	800–520	800–400
Vak-Kur-2 (settlement)	Structure 1	SOAN-4611	2460 ± 65	760–680 670–630 600–570 560–480 470–410	780–400
		SOAN-4608	2505 ± 60	790–750 730–520	800–480 470–410
		SOAN-4610	2575 ± 40	810–760 690–660 620–590 580–560	830–750 700–540
		SOAN-4609	2685 ± 60	900–800	1000 760
	Structure 2	SOAN-4612	2255 ± 30	390–350 290–230 220–210	400–340 330–200

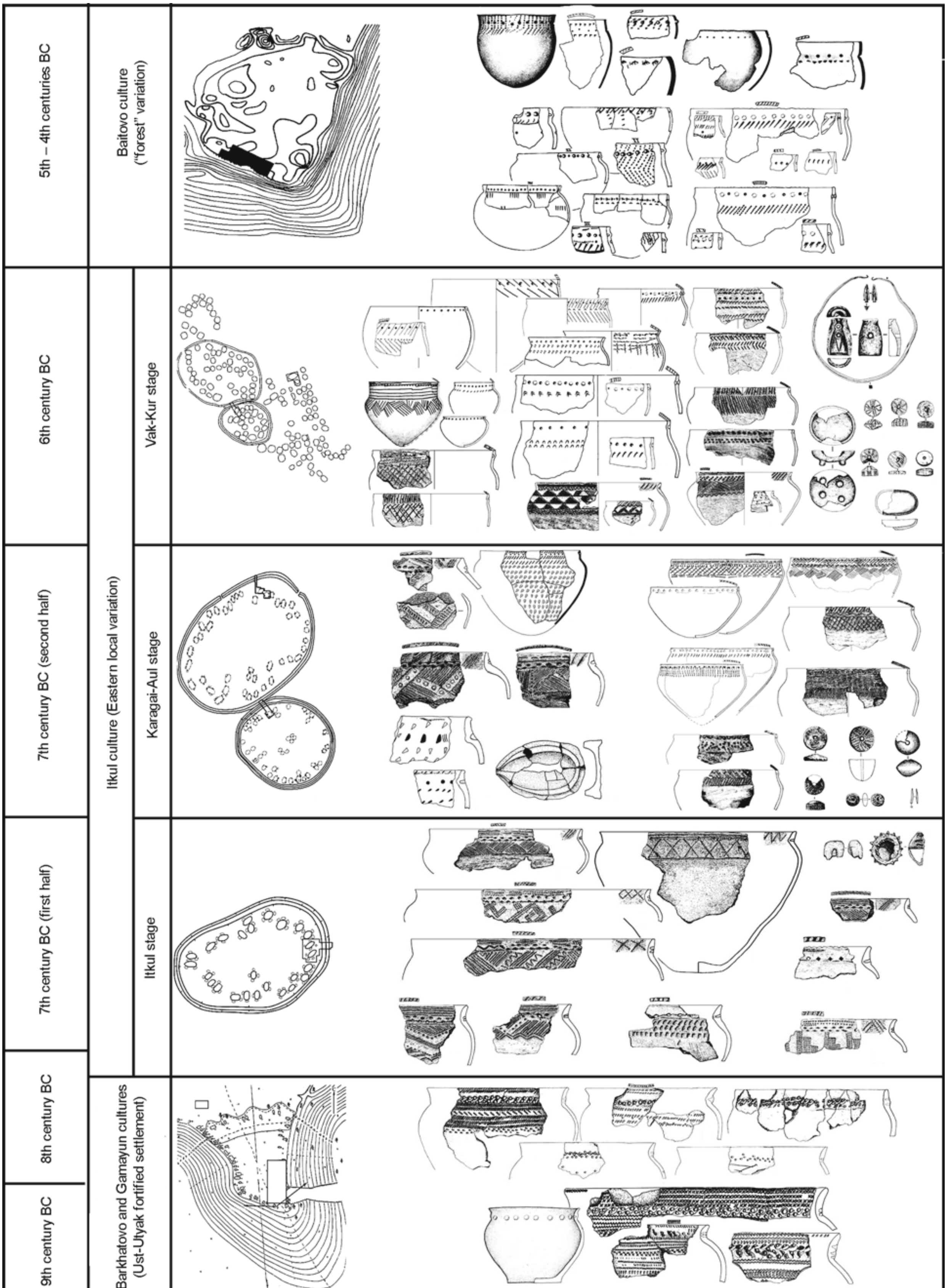

Fig. 2. Scheme showing the development of the Eastern local variation of the Itkul culture.

(diameter approximately 80 m) is bordered by a rampart and a ditch. It encompasses 21 above-ground structures. The remains of 82 more above-ground buildings were identified beyond the borders of the two fortified grounds.

One building (on the ground of Vak-Kur-2/B) and a section of the defensive belts of both grounds (ditches and a rampart-like elevation between them) were investigated in the fortified part of the site. The excavated area reached 217 m^2. At the settlement of Vak-Kur-2, the excavation area (372 m^2) exposed the remains of two dwellings.

The finds from the dwelling in the fortified part of the site include: clay spindles, a bone spindle, approximately 50 endscrapers made from ceramic fragments, a clay bead, a clay cup (“thimble”), a crucible (?) fragment, several fragments of unidentifiable artifacts and approximately 7000 ceramic fragments. Approximately 100 vessels were identified; 68 of them proffered statistical data.

The collection obtained from the dwellings in the unfortified part of the site (the settlement itself) includes objects made of bronze (an arrowhead, fragments of small plates), stone (a mould part, a flint blade, a schist flake, a grinding stone of aleurolite, an abrasive on a pebble), clay (an altar, a fragment of an oval dish, spindles, a small “counter”, a small ball, a fragment of an object resembling either a vessel handle or a part of an animal head image, approximately 100 endscrapers made of vessel walls), as well as over 6000 pottery fragments representing at least 127 vessels.

Description of pottery assemblages

Ceramics from Karagai-Aul-4. Petrographic analysis of ceramic samples has shown that the vessels are made of loams composed of montmorillonite and hydromica with an admixture of powdered clastic quartzofel-spathic material. Cement constitutes from 70 to 88 % of the section area. Several types of clay paste have been distinguished: clay + natural detritus + grog + organic matter (?); clay + detritus + grog; clay + sand + grog; clay + natural detritus + organic matter. Grog is present in almost all samples, but in small amounts: from single grains to 12 % of the section area. The size of grain ranges from 0.1 – 1.5 mm. The presence of talc represents a specific feature of the clay pastes from Karagai-Aul-4 is (Table 2) being absent in only two of 12 samples (Fig. 3, *4, 5*).

Vessel bases are made of scrap-like pieces of clay and the walls have been created in the coil-and-shape method using long ropes of clay which are then coiled around on top of themselves to form the desired shape. Most of these vessels are pots with a short body, wide neck and convex shoulders. The low straight (46.7 %) or slightly bent

Table 2. **Results of the petrograpnic analysis of pottery samples from the stratified settlements of the Lower Pritobolie**

Section number (sample number)	Cement, % of section area	Composition of clay paste	Sand			Grog		Volume of pores, %
			% of section area	Predominant size, mm	Composition	%	Size, mm	
1	2	3	4	5	6	7	8	9
KA4-1 (KA4/03)	72–75	C+D+G+O?	25	0.05–0.25	Fs and Q grains; less – muskovite and talc plates, grains of hornblende, E	2–3	0.1–0.6	–
KA4-2 (KA4/03/49)	70–75	C+D+G+O?	25–30	0.05–0.25	Fs and Q grains; less – hornblende, tourmaline, muskovite and talc plates, fragments of siliceous rocks	Solitory	0.2	–
KA4-3 (KA4/03/19)	75–80	C+D+G	20–25	0.05–0.25	Fs and Q grains; less – hornblende, E, muskovite plates, fragments of siliceous rocks	1–3	?	–
KA4-4 (KA4/03/146)	75–80	C+D+G	20–25	0.05–0.5 0.1–0.2	Fs and Q grains; less – hornblende, E, muskovite and talc plates	Solitory	0.25–0.8	–
KA4-5 (KA4/03/18)	83–88	C+Fs+G	5–7	0.05–0.25	Grains of Fs and Q	7–10	0.1–1.7	–
KA4-6A (KA4/03)	73–80	C+D+G+O?	10–15	0.05–0.2	Grains of Fs and Q; rare grains of hornblende, plates of muskovite and talc	10–12	0.1–2.0	–

Table 2 continued

1	2	3	4	5	6	7	8	9
KA4-6B (KA4/03/??)	80–85	C+D+G	10–13	0.05–0.2	Grains of Fs and Q; rare plates of black mica, colorless mica, fragments of siliceous rocks	5–7	0.1–1.0	–
KA4-7 (KA4/03/123)	80–85	C+D+G	15–20	0.05–0.5 0.1–0.2	Grains of Fs and Q; rare grains of hornblende, E, plates of muscovite and talc	1–2	0.1–1.0	–
KA4-8 (KA4/03/46)	85	C+D+G+O?	15	0.05–0.25	Grains of Fs and Q; rare grains of hornblende, E, clinopyroxene, plates of muskovite and talc	Solitory	0.3–1.5	5–7
KA4-9 (KA4/03/84)	80	C+D+O?	20	0.05–0.15	Grains of Fs and Q; less – fragments of siliceous rocks, plates of black mica, muskovite, talc	–	–	7
KA4-10 (KA4/03/43)	80–85	C+D+G+O?	15–20	0.05–0.25	Grains of Fs and Q, less – hornblende, plates of black mica, muskovite, talc, fragments of siliceous rocks	Solitory	0.25–0.6	–
KA4-11 (KA4/03/122)	75–80	C+D+G	20–25	0.05–0.25	Grains of Fs and Q; less – hornblende, plates of black mica, muskovite, talc, fragments of siliceous rocks	Solitory	0.5	–
KA-3 (KA1/4)	58–63	C+Fs+G	27–32	0.08–1.25 0.1–0.25 and 0.5	Q (sometimes decadent); less – Fs; rare – fragments of acid effusives, siliceous and micaceous fragments; solitary – M, E	7	0.2–0.7	2–3
KA-8 (KA1/35)	57–62	C+Fs+G	32–35	0.05–0.25 0.08–0.2	Q followed by Fs; rare – siliceous fragments, solitary – M, E	3–5	0.3–1.25	3
KA-10 (KA1/30)	63–68	C+Fs+G	25–30	0.08–0.3 0.1–0.25	Q (sometimes crushed, decadent), followed by Fs; rare – siliceous and micaceous fragments, solitary – M, E	5	0.4–1.0	3
KA-11 (KA1/34)	63–68	C+Fs+G	25–30	0.05–0.25 0.05–0.15	Q followed by Fs; rare – acid effusives, clayey and siliceous fragments; solitary – M, E	5	0.2–0.9	2
KA-15 (KA1/?)	55–60	C+Fs+G	30–35	0.05–0.35 0.08–0.2	Q followed by Fs; rare – acid effusives, siliceous fragments; solitary – M, E	8–10	0.2–1.6	2
KA-18 (KA1/ov-02/50)	60–68	C+D+G	18–23	0.08–0.25 0.08–0.15	Q followed by Fs; rare – acid effusives, siliceous fragments; solitary – M, E , ore mineral, anatase	12–15	0.25–3.0	2
KA-19 (KA1/ov-02/50)	68–73	C+Fs+G	20–23	0.05–0.25 0.08–0.15	Q (somwtimes decadent) followed by Fs (often fissured); less frequently– acid effusives, clayey and siliceous fragments; solitary – M, E, zoisite, small carbonaceous fragments	5–7	0.3–0.75	1–2
KA-20 (KA1/ov-02/21)	50–55	C+Fs+G	35–37	0.05–0.35 0.1–0.3	Q followed by Fs; rare – siliceous fragments, microquartzite; solitary – M, hornblende, ore mineral	8–10	0.5–1.2	2
KA-22 (KA1/ov-02)	62–68	C+Fs+G	20–25	0.08–0.25 0.08–0.15	Q followed by Fs; rare – acid effusives, siliceous fragments; solitary – M, E , anatase, ore mineral	8–10	0.25–0.8	2–3

Table 2 continued

1	2	3	4	5	6	7	8	9
KA1-2 (KA1/ circ/431)	65–68	C+Fs+G	30–35	0.05–0.25 0.1–0.2	Q, much less frequent – Fs; rare – siliceous fragments; solitary – M, E	Solitory	0.5–0.8	2
KA1-3 (KA1/ circ/430)	60–65	C+Fs+G	27–32	0.05–0.3 0.1–0.2	Q followed by Fs; rare – micaceous-siliceous fragments, fragments of acid effusives, microquartzites, solitary – M, E, zoisite, sphene	5	0.25–0.4	2–3
KA1-4 (KA1/ circ/361)	73–78	C+D +G?	22–27	0.05–4.0 0.1–0.3 and > 1	Q (often decadent) and Fs, microquartzites, big fragments of fibrous talc aggregate	Solitory	?	–
KA1-5 (KA1/ circ/381)	68–72	C+Fs+G	23–27	0.05–0.25 0.1–0.2	Q followed by Fs; rare – siliceous fragments, solitary – M, E, hornblende	2–3	?	–
KA1-7 (KA1/ circ/381)	63–65	C+Fs+G	20–25	0.05–0.3 0.1–0.2	Q followed by Fs; rare – fragments of acid effusives, siliceous and micaceous fragments, solitary – M, E, zoisite, amphibole	8–10	0.25–1.0	2
KA1-8 (KA1/ circ/381)	55–60	C+Fs+G	27–32	0.08–0.25	Q followed by Fs; rare – siliceous fragments (sometimes xhlorizated), fragments of acid effusives, solitary – M, E, hornblende	10–12	0.2–1.2	2
KA1-9 (KA1/circ/ 381)	58–65	C+Fs+G	30–35	0.08–0.5 0.15–0.2	Q (sometimes in crushed, decadent fragments) followed by Fs; rare – micaceous-siliceous fragments, fragments of acid effusives, microquartzites; solitary – M, E, zoisite, hornblende, ore mineral	3–5	0.4–1.0	2
VK-2, (VK/200)	55–60	C+Fs+G	30–35	0.05–0.3 0.1–0.2	Q (often fissured) followed by Fs; rare - – micaceous-siliceous and clayey-siliceous fragments, fragments of acid effusives; solitary – M, E	5–7	0.2–0.8	2–3
VK-5, (VK/188)	60–65	C+Fs+G	25–30	0.05–0.3 0.08–0.25	Q followed by Fs, less frequently - siliceous and clayey-siliceous fragments; solitary – M, E	8–10	0.2–0.5	1
VK-7, (VK/200, 300)	68	C+Fs+G	23–27	0.08–0.3 0.1–0.2	Q followed by Fs (often fissured); less frequently - micaceous-siliceous and clayey-siliceous fragments, microquartzites; solitary – M, E, sphene, hornblende	3–5	0.2–0.3	1
VK-12 (VK/180)	55–60	C+Fs+G	22–25	0.05–0.3 0.1–0.2	Q followed by Fs; less frequently – siliceous, micaceous-siliceous and clayey-siliceous fragments, fragments of acid effusives, microquartzites; solitary – M, E, zoisite, anatase	15–18	0.2–2.2	2–3
VK-14 (VK/191)	55–60	C+Fs+G	25–27	0.05–0.25 0.05–0.2	Q followed by Fs; less frequently – microquartzites, micaceous-siliceous and clayey-siliceous fragments; solitary – M, E, zoisite, hornblende, sphene	12–15	0.25–1.0	2–3

Table 2 continued

1	2	3	4	5	6	7	8	9
VK-15 (VK/208)	60–65	C+Fs+G x	25–30	0.05–0.3 0.05–0.2	Q followed by Fs; less frequently – siliceous and clayey-siliceous fragments, microquartzites; solitary – M, E, sphene	8–10	0.25–1.0	2
VK-16 (VK/195)	45–55	C+Fs+G	30–35	0.05–0.4 0.1–0.25	Q (often fissured) followed by Fs; solitary – microquartzites, M, E, Zoisite, hornblende	–	–	–

Notes: KA4 –Karagai-Aul-4, KA1/ov. –Karagai-Aul-1/A, KA1/circ. – Karagai-Aul-1/B; VK – Vak-Kur-2; C – clay, D – detritus, G – grog, O – organic materials, S – sand, Q – quartz, Fs – Feldspar, E – epidote, M – mica.

(50 %) necks tend to get thicker towards the shoulder (up to 9 – 13 mm) (93.3 %). The rim edges are rounded (43.3 %) or flat (40 %), less frequently beveled on the outside (16.7 %). The wall thickness ranges from 4 – 8 mm. The bottoms are flat or rounded. The mouth diameter varies from 25 to 37 cm.

It has been possible to reconstruct one vessel completely (Fig. 4, *2*). The item is 23 cm high, with a wide mouth (32 cm in diameter) and small, flat bottom (diameter about 8 – 9 cm), decorated with the use of a large comb stamp with several rows of horizontal lines at the neck, and a net-like design on the shoulder. The transition from the neck to the shoulder is decorated with a row of round pit impressions.

As a rule, the vessels are decorated either over two thirds of the surface or, much less frequently, only in the lower part of the neck. Most rims bear comb or smooth stamp impressions, but in 33.3 % of cases all decoration is absent. The inner surface of the mouth is decorated in 50 % of objects (inclined comb or in one case, wave stamp impressions, or net-like design).

In most cases ornamentation was applied with the use of a comb stamp (83.3 %) and less frequently with a vertical-wave stamp (3.3 %). There are also single instances of the use of smooth stamp and angular impressions, as well as incisions, pin-prick decorations and amorphous impressions.

Fig. 3. Photographs of the petrographic sections of pottery samples from Karagai-Aul-4.
Numbers of sections: *1* – KA4-11; *2* – KA4-1; *3* – KA4-2; *4* – KA4-5; *5* – KA4-3; *6* – KA4-6; 7 – KA4-8; *8* – KA4-10; *9* – KA4-9; *10* – KA4-7.

Decorative elements are few (Table 3). On the mouth they consist mainly of horizontal lines (73.3 %) of comb or wave impressions, sometimes rows of inclined impressions (10 %) or, in single cases, patterns of mutually penetrating figures, nets, and rows of depressions. The neck is consistently decorated with either two rows (83.3 %) or occasionally, one row of pit impressions. The pits are of rhombic (56.7 %), round (33.3 %) or oval (10 %) shape. Sometimes they occur separated by a raised, twisted border (3.3 %). The shoulder zone is most often decorated with mutually penetrating figures (46.7 %), sometimes separated by rows of shallow, pin-prick marks. Rows of horizontal lines (40 %), zigzags

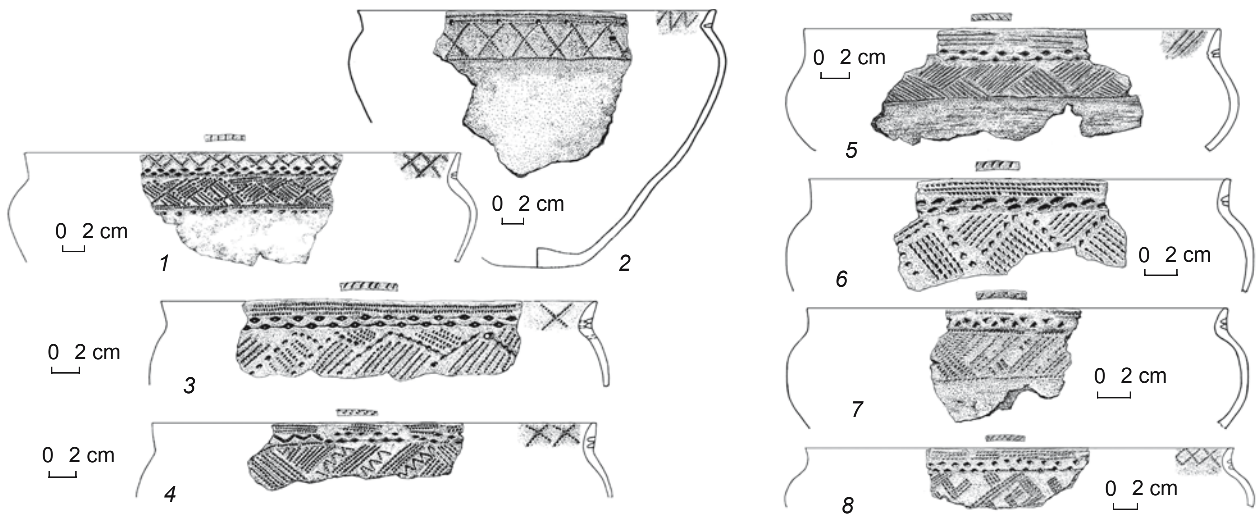

Fig. 4. Ceramics from Karagai-Aul-4.
Numbers of sections: *1* – KA4-1; *2* – KA4-6A; *4* – KA4-8; *5* – KA4-4; *7* – KA4-7.

Table 3. **Ornamental motifs characteristic of the pottery from the Yurtobor archaeological microregion, %**

Ornamental motif	Karagai-Aul-4	Karagai-Aul-1/A	Karagai-Aul-1/B	Vak-Kur-2/B	Vak-Kur-2 (settlement)
Horizontal lines	83.3	54.3	15.9	23.5	7.1
Row of inclined impressions	20	25.7	23.1	36.8	31.5
Row of vertical impressions	3.3	–	5.3	2.9	1.6
One zigzag	20	2.9	4.6	2.9	1.6
Two zigzags	3.3	2.9	1.3	–	0.8
Three and more zigzags	3.3	11.4	1.9	2.9	3.9
Vertical zigzag	–	2.9	1.3	1.5	–
Right-angled triangles	–	11.4	–	–	–
Mutually penetrating figures	43.3	37.1	5.3	7.4	1.6
Shaded ribbons	6.7	11.4	–	1.5	1.6
Net	16.7	14.3	5.9	4.4	5.5
Rhombs	3.3	–	0.7	1.5	–
Row of angular stamp impressions	–	–	27.1	30.9	8.7
Small columns	–	–	–	1.5	–
Rows of depressions	10	22.9	0.7	19.1	20.5
Raised border (between pits)	3.3	2.9	–	–	–
Triangles with apices directed up	–	–	–	1.5	–
Triangles with apices directed down	3.3	–	–	–	0.8
Horizontal herring-bone pattern	–	–	–	–	2.4
Meander	3.3	–	–	–	–
One row of pits	13.3	51.4	19.2	64.7	66.1
Two rows of pits arranged as on a chess board	83.3	42.9	3.3	7.4	0.8
Three rows of pits arranged as on a chess board	–	5.7	–	1.5	–
One row of pearls	–	–	80.8	19.1	29.1
Alternation of pits and pearls	–	–	–	7.4	3.1

(26.7 %), and, less frequently, inclined lines (16.7 %), rows of drop-shaped impressions (13.3 %), nets (10 %), shaded bands (6.7 %), triangles with the apices directed down (6.7 %), ladder-like patterns, and meanders (3.3 %) were also found. The composition is completed with one or two horizontal lines or zigzags, or horizontal lines combined with a row of either small depressions or inclined comb impressions (Table 3; Fig. 4).

Ceramics from Karagai-Aul-1. The pottery from *Karagai-Aul-1/A* is made of loam, the clay component of which is composed of montmorillonite and hydromica, constituting from 50 to 70 % of the section area. There are grounds to suppose that the potters used fluviatile or lacustrine clay: the paste often contains inclusions of small carbonaceous debris or pellets of phosphate, as well as remains of echinoderms.

Two types of paste have been identified: clay + sand + grog; clay + + detritus + grog. The second seldom being used (Fig. 5).

The grog is represented by irregular, tabular, wedge-shaped debris, constituting 3 – 15 % of the section area. The sand is composed mainly of quartz grains, feldspar and also siliceous inclusions, microquartzites, and single particles of mica, epidote, and ore minerals. Sand constitutes 18 – 37 % of the section area (see Table 2).

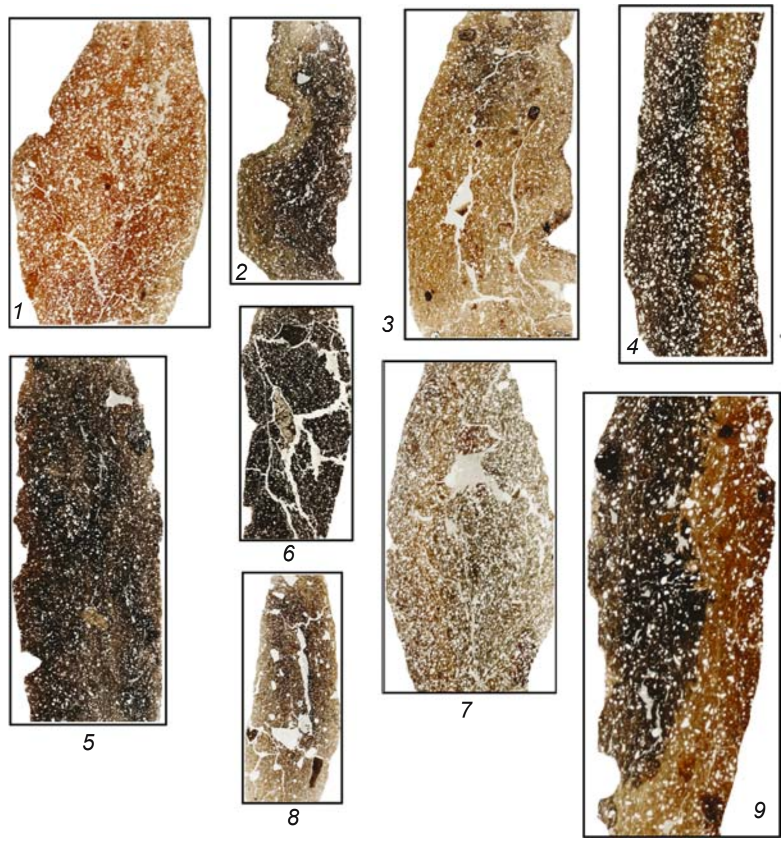

Fig. 5. Photographs of the petrographic sections of pottery samples from the Karagai-Aul-1/A (oval ground).
Numbers of sections: *1* – KA-20; *2* – KA-19; *3* – KA-18; *4* – KA-15; *5* – KA-11; *6* – KA-10; *7* – KA-8; *8* – KA-3; *9* – KA-22.

The vessels are made in the coil method using long ropes of clay, subsequently pinching the clay mass into shape. Several small cups are made of scrap-like pieces of clay rather than ropes.

The vessels are pot-like, with wide mouths, usually with convex shoulders and round bottoms. The mouths are either straight (37.2 %) or bent out slightly (51.4 %). Most (80 %) are somewhat thickened at the base. Not more than 11.4 % of the vessels are weakly profiled and as a rule have relatively poor decoration. The rim edges are in most cases round and bear no ornamentation (48.6 %). The flat edges (34.3 %) are decorated with comb (22.9 %), smooth (22.9 %), and wave (8.6 %) stamp impressions.

One pot has been reconstructed. It is of average size with a round bottom, wide mouth and straight neck without thickening. The edge of the rim is beveled inside (Fig. 6, *1*). The neck is decorated with a row of round pits and inclined impressions of short, comb stamp. The whole body is covered with rows of shallow depressions.

Most often the ornamentation is produced with comb stamp (48.6 %), and somewhat less frequently with vertical wave stamp (22.9 %). Shallow drop-shaped impressions are numerous (31.4 %). Usually it is only the upper third of the vessel surface that bears the decoration. As a rule the neck is ornamented with horizontal (31.4 %) and inclined (8.5 %) lines or nets (11.4 %). The transition to the shoulders is marked with pits of various shapes, which may form either one (51.4 %) or two rows arranged as on a chess board (40 %). Pearls occur on the inner side of some vessels. In one case, slightly protuberant pearls are placed on the neck under the rim and the transition to the body is marked by a double row of pits arranged as on a chess board. Oval pits are most numerous (51.4 %); round and rhombic pits both represent 22.9 %. In one case, a smoothed raised border has been noted under the oval pits. The shoulders are decorated with mutually penetrating figures (51.4 %), which are often separated by rows of shallow pin-prick marks, shaded bands (11.4 %), nets (14.3 %), and inclined impressions. The design is completed with one or several rows of horizontal lines and vertical short, comb stamp impressions. In most instances the inner surface of the neck is decorated with inclined impressions (68.6 %). This pottery is very similar to that from the Karagai-Aul-4 settlement.

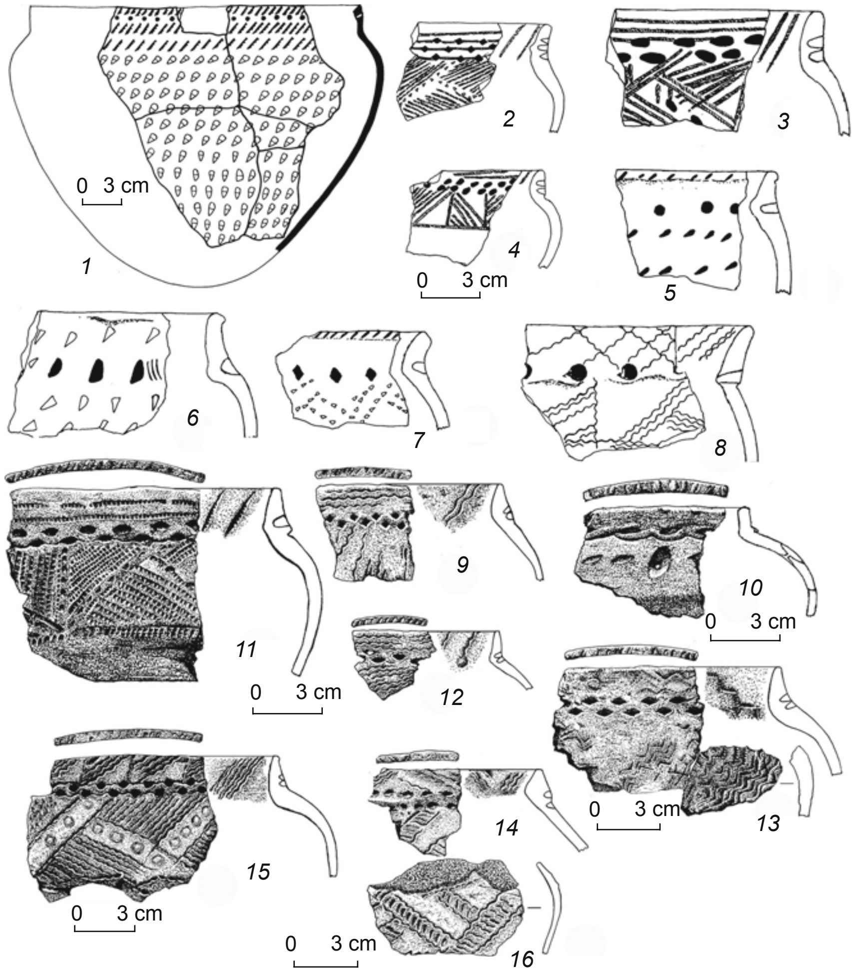

Fig. 6. Ceramics from Karagai-Aul-1/A (oval ground).
Numbers of sections: *3* – KA-3; *5* – KA-19; *8* – KA-8; *9* – KA-20; *11* – KA-18.

Vessels with poor decoration constitute 28.5 % of the total. As a rule, they are represented by weakly profiled pots with one row of pits (mostly of round shape) on the neck. Sometimes the design is supplemented with one or several rows of drop-shaped impressions on the body and neck (see Table 3; Fig. 6).

The vessels from *Karagai-Aul-1/B* are made of paste with the clay content varying from 60 to 78 %. Two types have been identified: clay + sand + grog; clay + detritus + + grog. The latter is rare, its main component being talc. The grog is composed of fragments of irregular, semi-angular, semi-rolled shape, from 0.2 to 1.2 mm in size; the content varies from single grains to 12 %. The sand composition is dominated by quartz and feldspar. Grain size 0.05 – 0.3 mm. Sand constitutes 20 – 35 % of the section area (see Table 2; Fig. 7).

The vessels were manufactured in the coil-and-shape method. The diameter of clay ropes kneaded with the fingers did not exceed 1 cm. The vessels are thin-walled. The inner surfaces of some fragments bear dents that might have been created as a result of beating; however, the subsequent working of the surfaces has destroyed all the original traces. The bases represent cups made in the coil method of laying clay ropes; fingerprints are visible on both surfaces. The outer surface of the base is rough and uneven.

Both the inner and outer surfaces of the vessels have been worked with a hard implement – a spatula with uneven working edge 0.7 – 1 cm wide, which produced straight, parallel incisions similar to that left by denticulate tools. Usually the incisions run horizontally, but towards the base they become more chaotic (Fig. 8, 9).

A vessel was found intact, standing in a pit, with its mouth pointing upwards. A further six vessels have been partly reconstructed. In addition, a number of large fragments from other vessels have been found (Fig. 10).

The vessels are short, round-bottomed with wide mouths and slightly convex shoulders. The larger vessels have conical bases. The average wall thickness is 0.5 – 0.7 cm. One miniature, undecorated pot has a flat base (perhaps a broken foot?). There are both small (mouth diameter up to 18 cm) and large (mouth diameter up to 26 – 39 cm) vessels in the collection. The rim edges are mainly flat (77.5 %). Vessels with rounded edges constitute 12.6 %, beveled outside edges – 5.9 % and beveled inside edges – 3.3 % of the total collection. In the majority of cases, the rims are decorated with smooth stamp impressions (65.6 %) and less frequently with comb and wave stamp impressions (19.2 and 10.6 %, respectively). Undecorated rims make up 2.6 %. Most vessels (74.8 %) have straight mouths (in 35.8 % the neck is well expressed, while in 39.1 % of cases the upper part is weakly profiled). Vessels with mouths slightly bent outwards (15.2 %) or slightly inclined inwards (5.9 %) are also present. In addition, some vessels have a closed shape (3.9 %).

Only the upper part of the vessels is ornamented. The decorative elements were made using a comb (23.1 %), a wave (5.2 %) or smooth (11.9 %) stamp. Spatula impressions in the form of angles (29.8 %) and other figures (15.9 %) are relatively common. Rows of pits (19.2 %) or pearls (80.8 %) on the neck represent another common element of ornamentation. Sometimes this is the only decorative element on the vessel; in other cases, it is supplemented with a row of angular stamp impressions either on the shoulder or in the zone transitional from the latter to the neck (27.1 %). Comb and wave stamp impressions form horizontal lines (15.9 %), vertical (5.3 %) and inclined (23.1 %) rows, nets (5.9 %), and mutually interpenetrating geometric figures (5.3 %). Vertical zigzags have been executed with smooth stamp impressions (1.3 %). In one case, the ornamentation has been marked with a small stick, the impressions of the latter bear some likeness to small, amorphous crosses. The zone between the neck and shoulder is decorated with zigzags in comb or smooth stamp impressions (7.8 %), rhombs (0.7 %) and one or two rows of small depressions (arranged as on a chess board). Sometimes the ornamentation of this zone includes a row of small brackets (1.9 %), which also are combined with shallow, round or triangular depressions (see Table 3; Fig. 10).

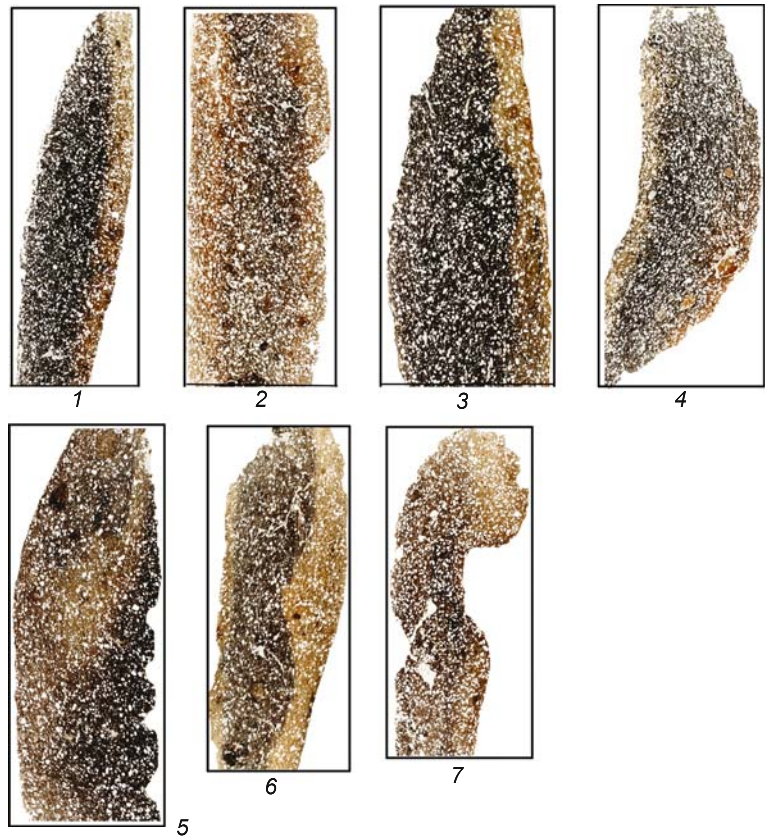

Fig. 7. Photographs of the petrographic sections of pottery samples from Karagai-Aul-1/B (circular ground).
Numbers of sections: *1* – KA1-2; *2* – KA1-3; *3* – KA1-4; *4* – KA1-8; *5* – KA1-5; *6* – KA1-7; *7* – KA1-9.

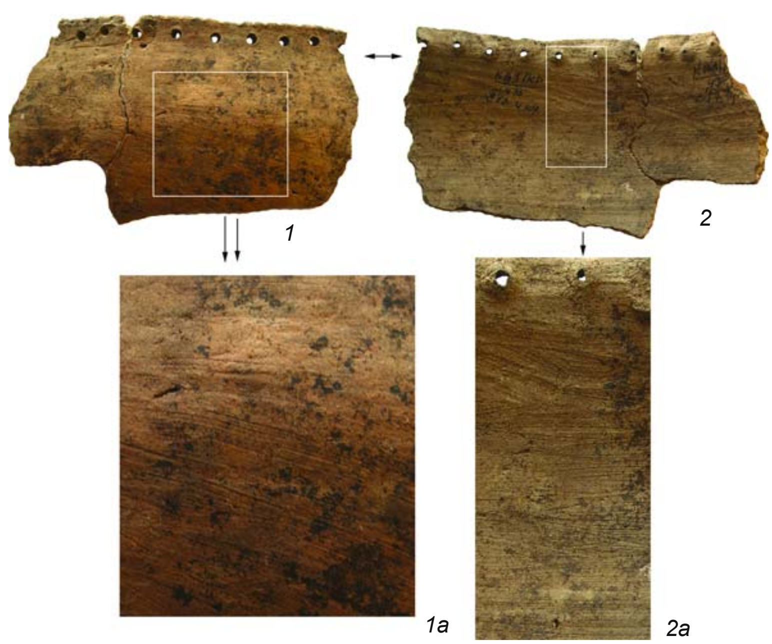

Fig. 8. Fragment of a vessel made by the coil technique, with traces of working with a hard tool (*1a*, *2a*). Karagai-Aul-1/B (circular ground).
1 – outer surface, *2* – inner surface.

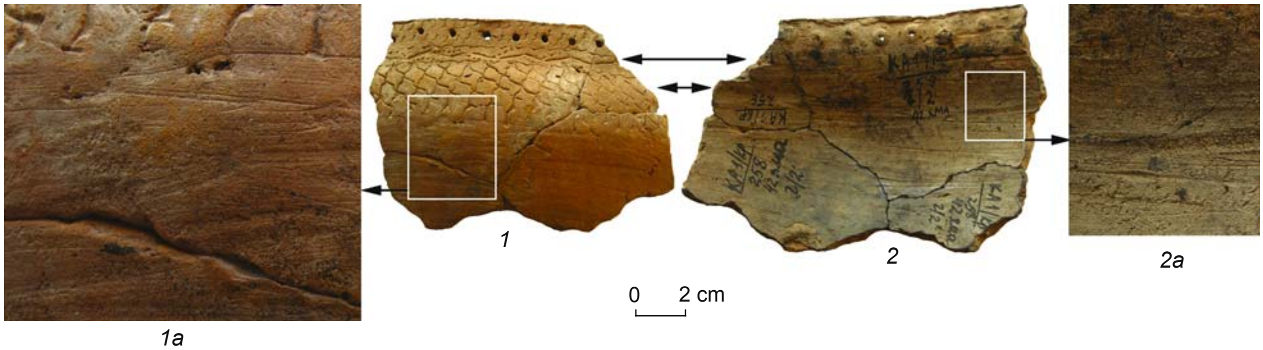

Fig. 9. Fragment of a vessel made by the coil technique, with traces of working with a hard tool (*1a*, *2a*).
Karagai-Aul-1/B (circular ground).
1 – outer surface, *2* – inner surface.

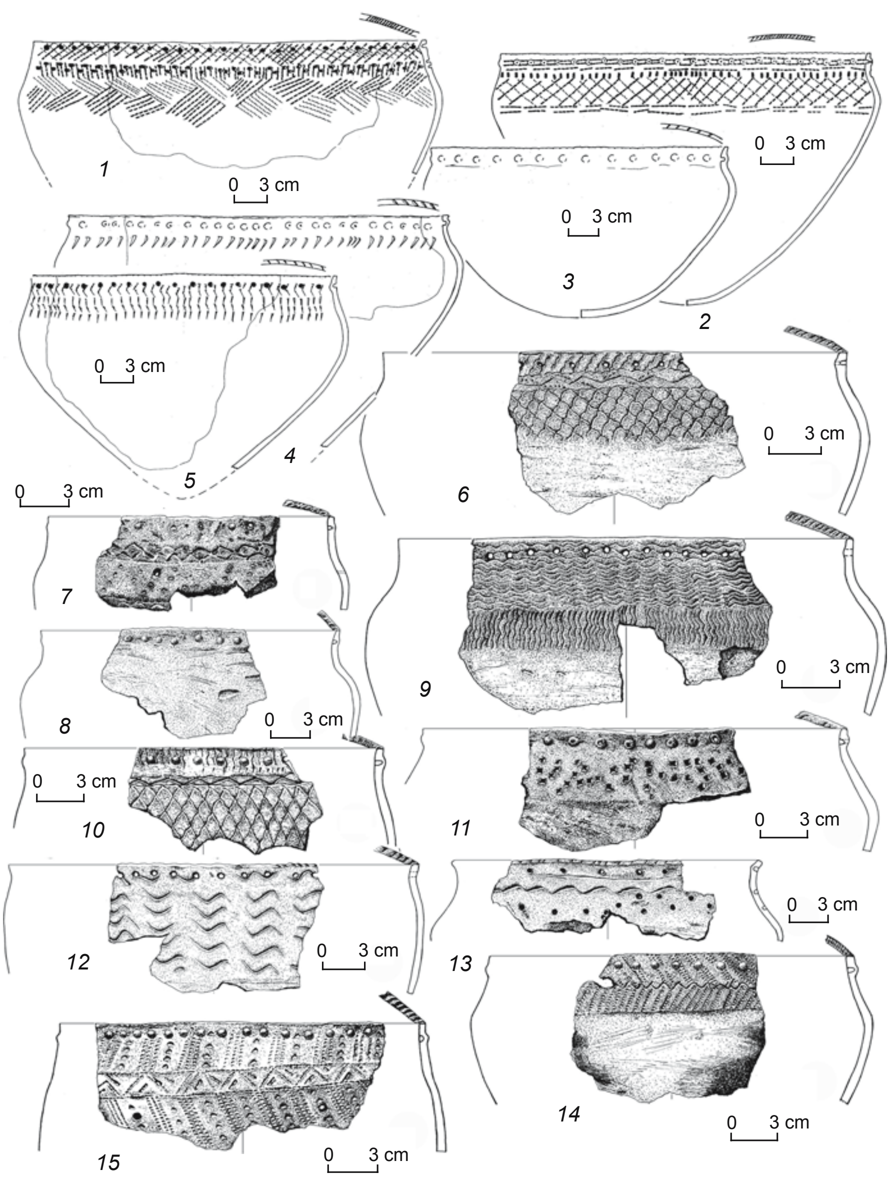

Fig. 10. Ceramics from Karagai-Aul-1/B (circular ground).
Numbers of sections: *1* – KA1-4; *2* – KA1-3; *9* – KA1-5; *11* – KA1-8; *14* – KA1-7.

Ceramics from Vak-Kur-2. It appears that here, as well as at settlement Karagai-Aul-1/A, the potters used fluviatile or lacustrine sources of clay materials. This is indicated by the fact that small remains of fish fauna have been recorded in the cement of the sections. The clay element of the paste constitutes 55 – 65 % of the section area. At the present time, just one paste type has been identified: clay + sand + grog. The grog makes up from 5 to 18 % of section area and is represented by irregular, elongated and oval fragments of different colors, 0.2 – 1 mm in size. Sand grain size varies from 0.05 to 0.4 mm, semi-angular and semi-rolled in form and constituting 22 – 35 % of the section area (see Table 2; Fig. 11).

The method of pottery manufacture is generally similar to that of Karagai-Aul-1/B: ropes of clay were coiled, overlapped and then shaped. A vessel would have been assembled in two or three stages and so the upper parts are very often separated from the lower ones. The surface was worked with a hard implement – a spatula with an uneven working edge 0.7 – 1 cm wide, which produced traces similar to those left by a denticulate tool (Fig. 12).

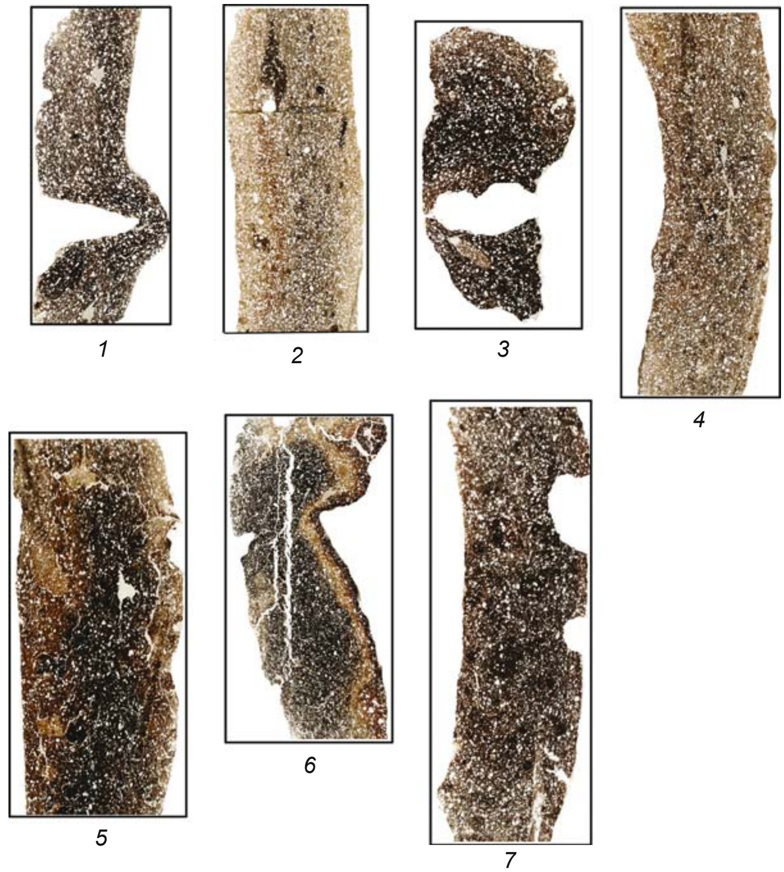

Fig. 11. Photographs of the petrographic sections of pottery samples from Vak-Kur-2.
Numbers of sections: *1* – VK-16; *2* – VK-2; *3* – VK-5; *4* – VK-7; *5* – VK-12; *6* – VK-15; *7* – VK-14.

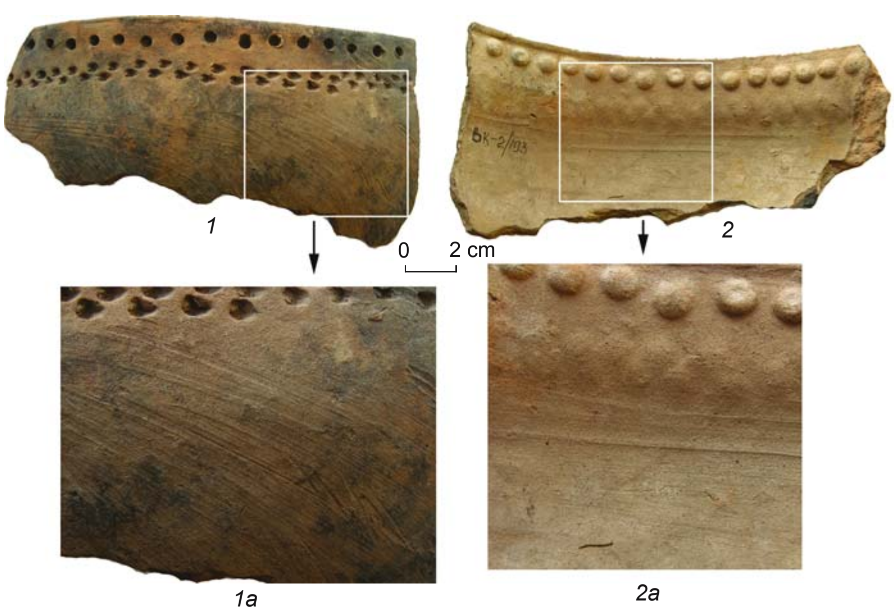

Fig. 12. Fragment of a vessel made by the coil technique, with traces of working by a hard tool (*1a*, *2a*) and hands. Vak-Kur-2.
1 – outer surface; *2* – inner surface.

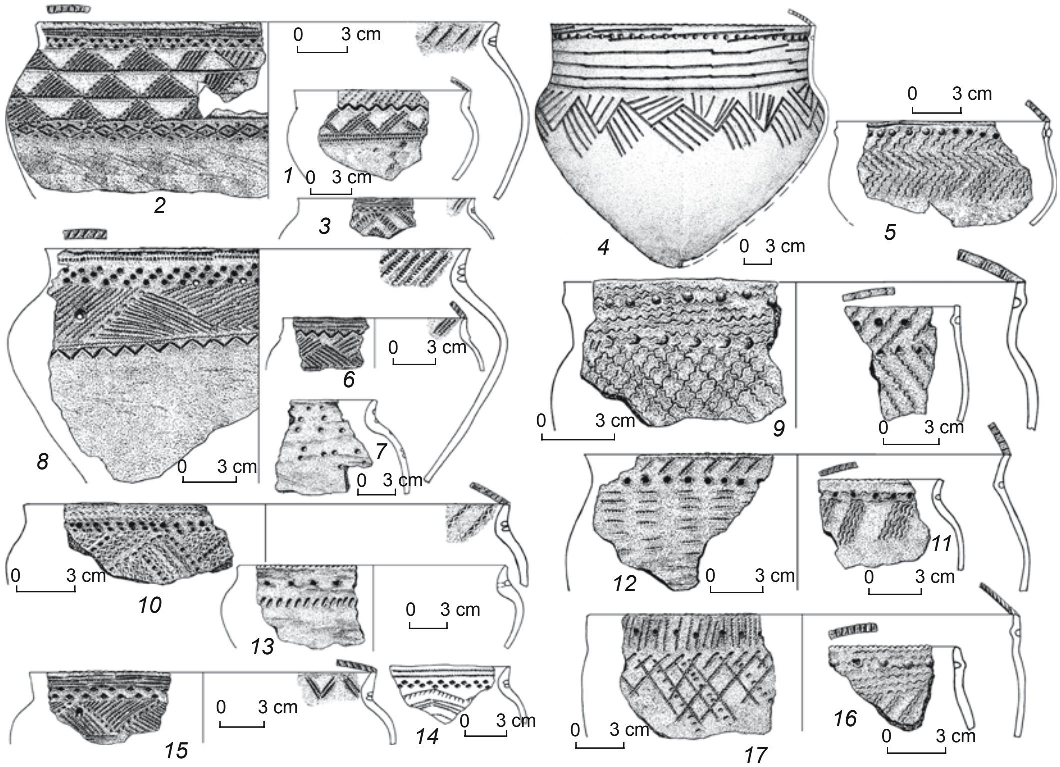

Fig. 13. Pottery from Vak-Kur-2B (circular ground).

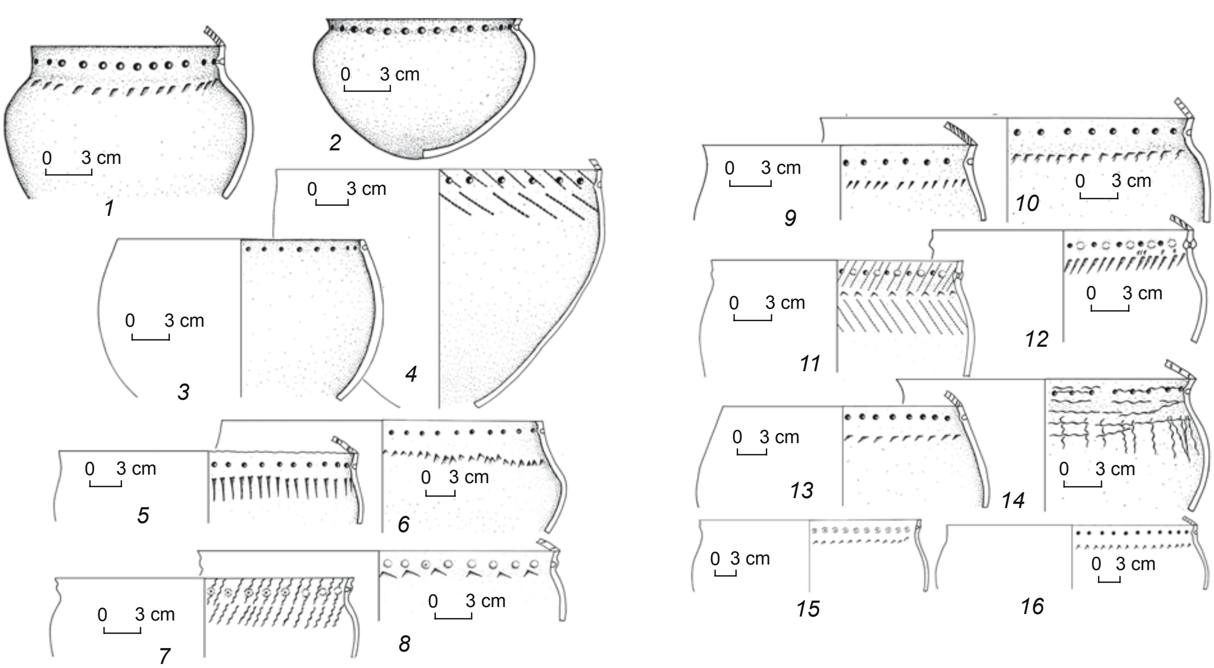

Fig. 14. Pottery from Vak-Kur-2B (circular ground).

Seven miniature round-based or flat-based cups have been found at the site. One is modeled of a single piece of clay. During the modeling process, the cup was held suspended: clear finger prints and nail marks have been left on both surfaces. Another cup was made of several scrap-like pieces of clay.

The assemblage consists of thin-walled (4 – 6 mm) round-based (sometimes cone-based) pots (Fig. 13 – 15).

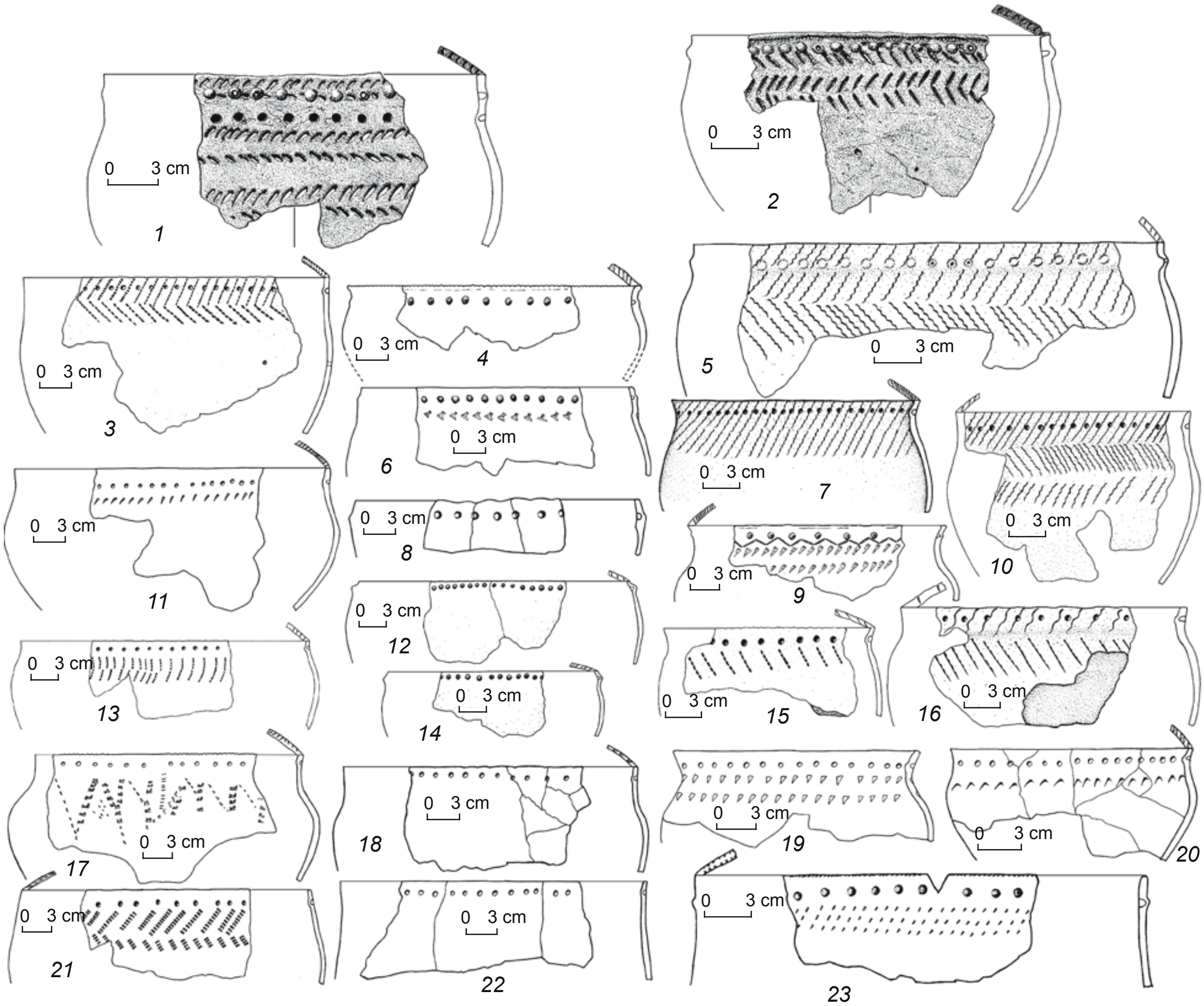

Fig. 15. Pottery (*22* – section VK-2). Vak-Kur-2 (settlement).

The mouth diameter can be reconstructed for 60 items. In seven cases, the diameter varies from 11 to 14 cm, and in the remaining cases from 17 to 35 cm; most numerous however are vessels with a mouth diameter of 22 – 30 cm. The pots have weakly convex shoulders and necks of short to medium height. The necks are either straight (63.2 %), bent slightly outwards (13.5 %), inclined slightly inwards (3.2 %), or arched (2.2 %). Examples of the latter were found at the settlement only, as well as fragments of weakly profiled vessels with well-expressed thickening on the inner side of the neck. Vessels of closed shape (11.4 %) and pots with straight neck (4.9 %) are few. The rim edges are usually flat (72.4 %); the rounded rims (23.8 %) are somewhat flattened too. The edges are decorated with incisions (66.5 %), and smooth (50 %) or comb (7.6 %) stamp impressions.

The ornamentation has been produced by comb (21.6 %), wave (14.6 %) or angular (18.9 %) stamps. There are also amorphous impressions, incisions and pin-prick marks made by a splinter or some other implement (20 %), and drop-shaped impressions produced with the angle of a spatula (5.9 %).

The ornamentation covers the upper part of the vessels – the neck and shoulders. The most frequently occurring ornamental motif is a row of pits (68.1 %) or pearls (27 %); on some vessels these elements alternate (4.9 %). On the neck the ornament is often supplemented with inclined impressions or horizontal lines. On the shoulders the decoration is dominated by patterns consisting of one or two rows of inclined comb or wave impressions (34.1 %); there are also different shaped impressions arranged in one or several rows (20.5 %). Often the transitional zone or the shoulder bear a row of impressions made by the angle of a spatula (17.3 %). Occasionally, a net pattern (5.5 %) is included. The other motifs: (rows of vertical stamps, columns of horizontal impressions made with a short comb stamp, zigzags forming one to three rows, mutually penetrating figures, a double row of shallow pits, shaded triangles with the apices directed downward, horizontal herring-bone pattern formed by short comb impressions) are represented by single examples and constitute from 0.5 to 2.2 % of the assemblage. The majority of these motifs have been identified on vessels from the settlement, which may be due to its larger sample size. In some vessels with straight mouth the decoration is present only on the edge of the rim. The vessels of closed shape as well as weakly profiled ones are also poorly decorated; their ornaments consist of pits or pearls under the rim. Sometimes, inclined impressions made with comb or smooth stamps, or various shallow depressions occur below them (see Table 3; Fig. 13 – 15).

In addition to the main ceramic assemblage that has been described above, the excavation of the fortified part of Vak-Kur-2 gave a small series of vessels (fragments of 10 objects) similar in their appearance to the ware of Karagai-Aul-4 and Karagai-Aul-1/A: with straight or slightly bent mouths and a noticeable thickening of the neck. The paste contains an admixture of talc (mica?) visible to the naked eye. An ornament of comb stamp impressions adorns the upper two thirds of the surface. One vessel bears a pattern in the form of waves and zigzags, made by smooth stamp impressions. The neck is predominantly decorated with several rows of horizontal lines (in one instance – inclined impressions). The mouth is decorated with a double row of pits arranged as on a chess board, or with one or three rows of pits, supplemented with zigzags. The shoulder bears patterns of mutually penetrating figures, zigzags, and several rows of shaded equilateral triangles. The ornamental composition is completed with horizontal lines, zigzags or rhombs bordered by shallow pits (see Fig. 13, *1 – 3*, *6 – 8*, *11*, *14 – 16*). This pottery is very distinctive from a typological point of view. The analysis of its distribution over the excavation area has however revealed no concentrations in a particular area. This gives us to consider all the fragments as constituting elements of one and the same assemblage.

Conclusion

As follows from the description of the ceramic assemblages, the ware from these three sites is very similar in appearance. This type of ware has been defined as type 2 Itkul pottery. According to the prevailing point of view, the Itkul culture belonged mainly to the Trans-Uralian region (Beltikova, 1977, 2005). The systematization of the Pritobolie sites has revealed approximately 40 occurrences of type 2 Itkul pottery where it was found in small series or isolated fragments. The highest concentration of sites with this type of pottery has been recorded in several regions, such as the lake system of Ipkul-Bairyk, the interfluves of the Tura and Pyshma, Tobol and Tap, Tobol and Iset. This may be due to the fact that these regions have been more widely researched than others.

The comparison of type 2 Itkul pottery assemblages from the Pritobolie with those from the eastern slopes of the Ural Mountains allows to draw conclusions concerning their identity. The technological, morphological, and ornamental characteristics of the ceramics fully coincide.

The fact that the clay paste of the Pritobolie pottery is tempered with talc and mica (even if in relatively small amounts) points to a direct connection with the Ural region. All the type 2 Itkul vessels have a wide mouth, and the diameter of the mouths measured in the Trans-Ural region (28 – 40 cm) is close to that measured in the Pritobolie (25 – 37 cm). The thickening at the base of the neck (one of the determining features of the type) is also characteristic of both regions. The Itkul vessels from the Trans-Ural region have rounded bodies and slightly flattened or cone-shaped bases (Beltikova, 1977: 123). The shortage of reconstructed vessels in the Pritobolie does not allow for an extensive comparative analysis of their forms. One may simply note that the majority of vessels have rather convex shoulders, and some vessels found at Karagai-Aul-4 are characterized by small flat bases.

The main, ornamental features also display similarities. Characteristic of the Uralian vessels are horizontal lines on the neck, a double row of pits in the zone transitional to the shoulder, interpenetrating figures or diversely shaded fields on the shoulder, the completion of decorative patterns with horizontal lines, horizontal zigzags and circular stamp impressions (Ibid.: 120 − 125; Beltikova, Khrushcheva, in press). Combinations of these motifs are also common in the Pritobolie pottery. Two rows of pits arranged as on a chess board, with a raised border between them (one more defining feature of type 2 vessels (Beltikova, 1977: 124)), are also present on the Itkul vessels throughout the whole area of this culture from the eastern slopes of the Urals to the right bank of the Tobol River.

Geometric patterns and single instances of meanders have also been noted in the Pritobolie pottery (Karagai-Aul-4). It is possible, that a greater percentage of vessels have decoration on the inner surface of their necks. The vertical wave stamp impressions are not characteristic of type 2 Itkul pottery of the Ural region, but are present on the Itkul vessels of Pritobolie (from 3.3 to 9.7 %). However, these specific features constitute an insignificant percent of the total number of features characterizing the Itkul pottery assemblages of the Lower Pritobolie.

In general, the most conspicuous feature of type 2 Itkul pottery is the short neck with a thickening at its base.

The ornamentation is most often produced by a comb stamp. The typical set of ornamental motifs includes horizontal and inclined lines, mutually interpenetrating figures, zigzags of comb impressions, and rows of pits which are often doubled at the base of the neck. The similarity in shape and ornamentation of the vessels from the Lower Pritobolie and the Trans-Ural region allows us to consider these assemblages as belonging to the same culture. Sites where this type of pottery has been found are attributed to the Itkul stage of the Eastern variation of the Itkul culture.

The collections from the Trans-Ural sites include both type 1 and type 2 Itkul pottery in various ratios (Ibid.: 120 – 124). At the same time, no ceramics of type 1 have been found at the Lower Pritobolie sites classified to the Eastern variation of the Itkul culture. The key settlement at Karagai-Aul-4 only yielded type 2 pottery. The two other sites in the Yurtobor microregion (Karagai-Aul-1 and Vak-Kur-2) gave in addition other ceramics similar in appearance to that of the Baitovo type, dated to the Early Iron Age. In the literature, this type is referred to as the "forest" Baitovo style (Zakh, Zimina, 2001: 148). However, both the Karagai-Aul and Vak-Kur pottery assemblages differ in characteristics from the forest-steppe and "forest" Baitovo ceramics. Equally, they differ to some extent from each other. The pottery from the ground of Karagai-Aul-1/B has been conditionally identified as the Karagai-Aul type. The main ceramic assemblage of Vak-Kur-2 has been classified as the Vak-Kur type. It bears some traits indicative of the continuity of the Karagai-Aul type whilst at the same time reflecting the further development of characteristics of the Itkul 2 and Karagai-Aul types.

Although the two grounds of the settlement at Karagai-Aul-1 existed at the same time, as has been established on the basis of their planigraphy and radiocarbon dating, their ceramic assemblages demonstrate certain peculiarities. Despite bearing close resemblance to the pottery from Karagai-Aul-4, some of the vessels from the ground of Karagai-Aul-1/A have straight necks without thickening, or weakly profiled upper parts. Vessels with small flattened bases are absent. While the ornamentation on the pottery of Karagai-Aul-4 is clearly dominated by comb stamp impressions, the vessels from Karagai-Aul-1/A are most often decorated with wavy patterns and drop-shaped impressions. In one instance, a vessel with the typical Itkul composition includes pearls which are not characteristic of the Itkul tradition. The pearls occur below the edge of the rim and above a row of doubled pits. Some vessels are poorly decorated. The clay paste is usually tempered with sand and grog, and has no admixture of talc, the use of which is characteristic of the Itkul stage.

The assemblage of Karagai-Aul-1/B represents a different ceramic tradition. In shape the vessels are similar to the Itkul vessels, being quite short and wide-necked. At the same time their walls are thinner and the thickness is more or less constant at all points. Ornamentation is sparse, produced mainly by a comb stamp but sometimes by a wave or angular stamp. Worthy of note is the preponderance of pearls (80 %) among the ornamentation elements, typical of pottery from the Barkhatovo assemblages in the Tobol region (late (Krasnogorsk) stage) (Matveev, Anoshko, 2001: 31). In general, both decorative methods and main ornamental motifs find analogies in the Baitovo culture widespread in the forest-steppe zone of Pritobolie (Matveeva, 1989). However, some are characteristic of the Itkul type of ornamentation which is represented by several rows of pits on the neck, staggered rows of depressions in the zone between the neck and shoulder and mutually penetrating figures.

Most vessels from Vak-Kur-2 display considerable similarity to the pottery from Karagai-Aul-1/B. Both the former and the latter are thin-walled, tempered with small amounts of sand. The vessels are well or weakly profiled, round-bottomed, their necks of low or medium height. Large vessels are slightly narrowed at the base. On average, up to 30 % of objects in both assemblages are decorated only with pits or pearls on the neck and some angular stamp impressions or one to three rows of depressions (often amorphous) on the shoulder. The other vessels show patterns formed by combinations of pits or pearls and rows of inclined comb stamp impressions on the neck, and one or two rows of inclined (at different angles) comb impressions on the shoulder. Much less frequent are more complex patterns consisting of various combinations of mutually penetrating figures, zigzags, rhombic nets and depressions arranged as on a chess-board. The assemblages from Vak-Kur and Karagai-Aul do not differ to a large degree: the vessels of Vak-Kur are more often decorated with a wave stamp (13.8 % compared with 5.3 % at Karagai-Aul-1/B). They more often have pits on the neck (70.2 and 19.2 %, respectively), and less often include pearls (30.2 and 80.8 %). The alternation of the latter two elements has been noted on the pottery from Vak-Kur-2, but remains absent on that of Karagai-Aul. While the morphological characteristics of the pottery of both sites are similar, vessels with arched necks have been found only at Vak-Kur (3.1 %) and only in the unfortified part of the site.

Vak-Kur vessels were found together with those of the Itkul type only in the dwelling excavated in the fortified part of the site (Vak-Kur-2/B). No such pottery has been recorded in the two structures studied within the unfortified part of Vak-Kur. Only some of the weakly profiled vessels found there, decorated with pearls or pits placed under the rim have a thickening on the inner side of the neck. The other vessels of the Vak-Kur assemblage represent a modified version of the Itkul tradition, retaining just isolated ornamental elements of the Itkul tradition: patterns of wave stamp impressions, lines of horizontal comb impressions on the neck, rows of doubled, shallow depressions, and mutually penetrating figures. This observation may reflect the chronological difference between the fortified and unfortified parts of the settlement.

Thus, the sites of the Lower Pritobolie have been classified to the Itkul culture on the basis of the presence of type 2 pottery. The recognition of different stages of the local, Eastern variation of this culture has proved possible because of the discovery of single-layer fortified settlements in the Yurtobor microregion. The study of these settlements has enabled us to establish the chronology and dynamics of the Itkul cultural stereotype in the Lower Pritobolie and to trace its gradual transformation and subsequent replacement by the Baitovo tradition.

References

Bakulin V.V., Kozin V.V. 1996
Geografia Tumrnskoi oblasti. Ekaterinburg: Sred.-Ural. knizh. izd.

Beltikova G.V. 1977
Itkulskie poseleniya. In *Arkheologicheskie issledovaniya na Urale i v Zapadnoi Sibiri*. Sverdlovsk: Izd. Ural. Gos. Univ., pp. 119 – 133.

Beltikova G.V. 2005
Sreda fofmirovaniya i pamyatniki zauralskogo (itkulskogo) ochaga metallurgii. In *Arkheologia Urala i Zapadnoi Sibiri*. Ekaterinburg: Izd. Ural. Gos. Univ., pp. 162 – 186.

Beltikova G.V., Khrushcheva N.V. (in press)
Keramika itkulskoi kultury. *Vestnik Tomskogo gosudarstvennogo universiteta*.

Fiziko-geograficheskoe raionirovanie Tyumenskoi oblasti. 1973
N.A. Gvozdetsky (ed.). Moscow: Izd. Mosk. Gos. Univ.

Matveev A.V., Anoshko O.M. 2001
K probleme khronologicheskoi differentsiatsii barkhatovskikh drevnostei. In *Problemy vzaimodeistviya cheloveka i prirodnoi sredy*, vol. 2. Tyumen: IPOS SO RAN, pp. 29 – 32.

Matveeva N.P. 1989
Nachalnyi etap rannego zheleznogo veka v Tobolo-Ishimskoi lesostepi. In *Zapadnosibirskaya lesostep na rubezhe bronzovogo i zheleznogo vekov*. Tyumen: Izd. Tyumen. Gos. Univ., pp. 77 – 102.

Pomus M.I. 1956
Zapadnaya Sibir: Ekonomiko-geograficheskaya kharakteristika. Moscow: Gos. izd. geogr. lit.

Salnikov K.V. 1962
Itkulskaya kultura: K voprosy o “Zauralskom anan’ine”. *Kraevedcheskie zapiski Chelyabinskogo kraevedcheskogo muzeya*, iss. 1: 21 – 46.

Zakh V.A. 1995
Koltsevye ukrepleniya rubezha bronzovogo i zheleznogo vekov v Nizhnem Pritobolie. In *Tretii istoricheskie chteniya pamyati M.P. Gryaznova*. Omsk: Izd. Omsk. Gos. Univ., pp. 113 – 117.

Zakh V.A., Zimina O.Yu. 1999
Gorodishche Karagai-Aul-1 v Nizhnem Pritobolie. In *Vestnik arkheologii, antropologii i etnografii*, vol. 2. Tyumen: IPOS SO RAN, pp. 151 – 156.

Zakh V.A., Zimina O.Yu. 2001
Pamyatniki Nizhnego Protoboliya rubezha bronzovogo i zheleznogo vekov (Yurtoborovskiy mikroraion). In *Vestnik arkheologii, antropologii i etnografii*, vol. 3. Tyumen: IPOS SO RAN, pp. 138 – 149.

Zakh V.A., Zimina O.Yu. 2004
Ob areale itkulskoi kultury. In *Problemy vzaimodeistviya cheloveka i prirodnoi sredy*, vol. 4. Tyumen: Izd. IPOS SO RAN, pp. 103 – 106.

Zimina O.Yu. 2002
Mesto gorodishcha Vak-Kur-2 sredi pamyatnikov perehodnogo vremeni i rannego zheleznogo veka Nizhnego Pritoboliya. In *Khronostratigrafiya arkheologicheskih pamyatnikov epokhi golotsena Zapadnoi Sibiri i sopredelnykh territiriy*. Tyumen: Izd. IPOS SO RAN, pp. 62 – 71.

Zimina O.Yu. 2004a
Issledovanie gorodishcha Karagai-Aul-1 v Nizhnem Pritobolie. In *Vestnik arkheologii, antropologii i etnografii*, vol. 5. Tyumen: IPOS SO RAN, pp. 38 – 50.

Zimina O.Yu. 2004b
Issledovanie pamyatnikov perehodnogo vremeni ot bronzy k zhelezu v Nizhnem Pritobolie v 2001 – 2003 gg. In *Vestnik arkheologii, antropologii i etnografii*, vol. 5. Tyumen: IPOS SO RAN, pp. 201 – 203.

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THE NECROPOLIS OF CHICHA-1 AND THE BURIAL RITE OF LATE BRONZE TO EARLY IRON AGE PEOPLES OF THE BARABA FOREST-STEPPE ZONE

Chicha-1 is a huge settlement dating from the period of transition from the Bronze to the Iron Age and is located in the central part of the Baraba forest-steppe region (Fig. 1). Its excavations, conducted over five field seasons, have yielded unique information published in a number of articles and two books containing excavation reports and analytical studies (e.g. (Molodin, Parzinger, Garkusha et al., 2001; Molodin, Parzinger, Garkusha et al., 2004))*.

Generally, excavations at Chicha-1, concentrating on dwellings and utility structures as well as on fortification features, were quite informative, although the excavation area was relatively small. The results concerning the burial rite revealed that the attitude toward the dead was complex and nonstandard.

In the southern part of the site, near structure 3, a burial of an adult woman was discovered. She was buried supine with flexed legs, and her head was oriented toward the south (Fig. 3). This shallow grave pit contained three vessels and a human head. The vessels date from the transitional Bronze to Iron Age period (see (Molodin, Parzinger, Garkusha et al., 2001)). Such vessels were earlier attributed to Late Irmen ceramics category 3 (Molodin, Kolontsov, 1984: 75). Typical Irmen features of the burial include the shallow grave pit and its southern orientation (Molodin, 1985). The posture of the Chicha-1 woman is similar to that of people buried at the transitional Bronze to Iron Age cemetery of Stary Sad in the Baraba forest-steppe (Molodin, Neskorov, 1992). These people were apparently immigrants from Central Kazakhstan, who later mixed with the indigenous Irmen population as well as with people associated with the Baraba variant of the Suzun culture (ceramics typical of the latter two cultural traditions are present at Chicha-1) (see (Molodin, Parzinger, Garkusha et al., 2004))*.

Excavations at the dwelling area have yielded ten burials of infants demonstrating clear ritual features (one or two infant burials in one dwelling) (Fig. 4). These burial pits are small and shallow. In three graves the dead were buried on their right side in a flexed position, with the head oriented toward the south. These features are similar to those of the Irmen culture. One of the infant burials shows an unusual position of the body – with its head downwards. Two other infants were buried on their left sides, with their heads oriented toward the north. According to anthropological and genetic data, all the burials contain male infants. The burials are suggestive of a syncretic nature of the burial practice (Molodin, Novikova, Parzinger et al., 2003: 312 – 316).

At one dwelling, a secondary burial of an adolescent containing a bronze ring-shaped pendant was uncovered (Molodin, Parzinger, Garkusha et al., 2004: 286).

In all appearances, the Chicha population had a complicated and many-featured burial practice. Apparently, there were some reasons why some of the deceased were buried within the dwelling zone and even inside houses rather than at the cemetery. Reasons for

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* Studies began with a geomagnetic sounding of the site by German and later by Russian specialists. Resulting geomagnetic images of both the settlement and the necropolis of Chicha-1 (Becker, Fassbinder, 1999; Molodin, Parzinger, Becker et al., 1999; Molodin, Parzinger, Garkusha et al., 2000) provided a basis for purposeful excavations (Molodin, Parzinger, Garkusha et al., 2004: 240 – 260) (Fig. 2).

* These monographs contain a complete bibliography.

Fig. 1. Map showing the location of Chicha-1.

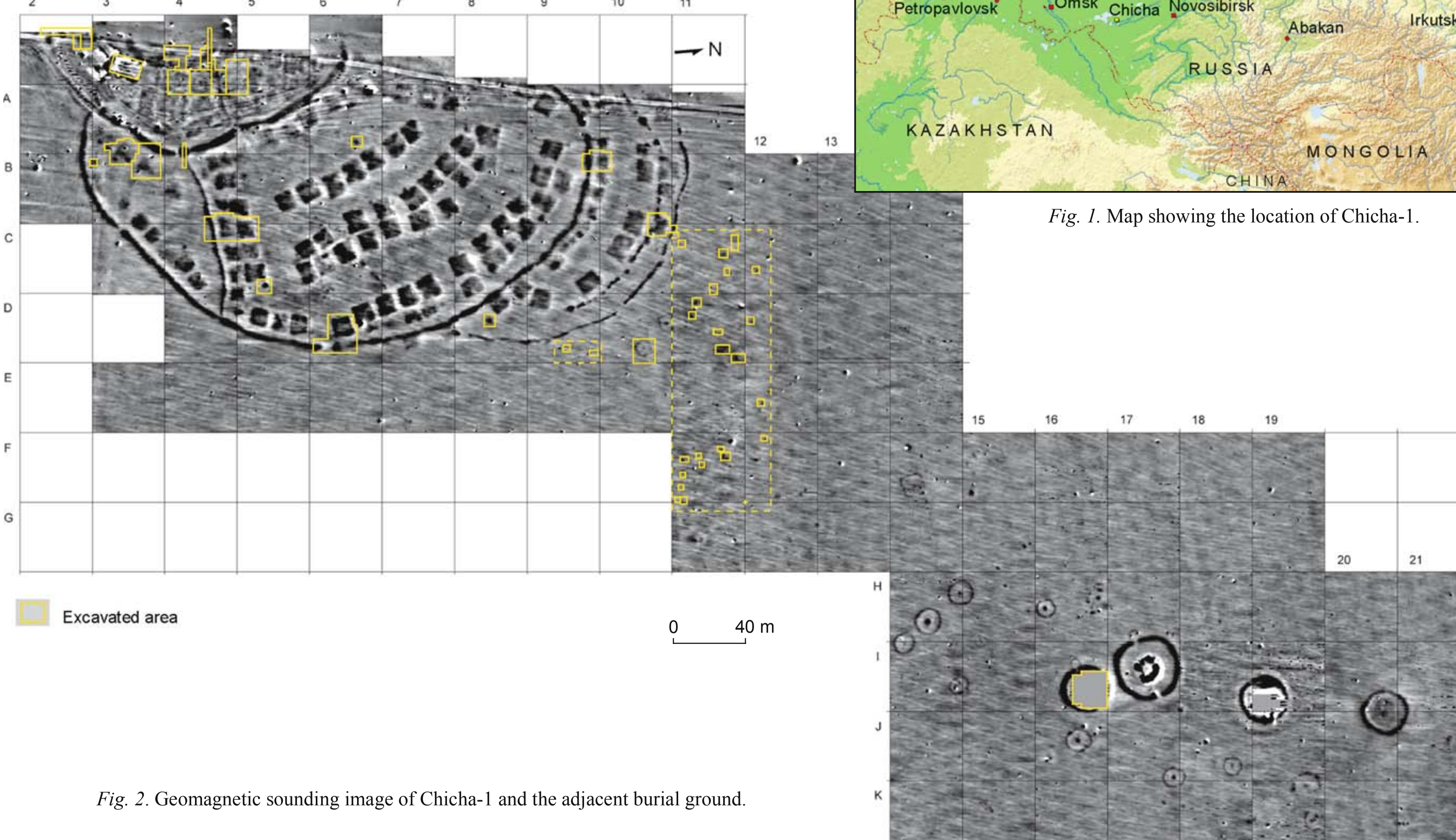

Fig. 2. Geomagnetic sounding image of Chicha-1 and the adjacent burial ground.

Fig. 3. Burial of a woman at the lower excavation area of the site.

Fig. 5. Burial with Irmen cultural features at Chicha-1.

Fig. 4. Burial of a child in a dwelling at Chicha-1.

Fig. 6. Burial with innovative features of burial rite at Chicha-1.

diverse burial rites were touched upon elsewhere (see (Molodin, Parzinger, Garkusha et al., 2001: 240; Molodin, Novikova, Parzinger et al., 2003: 312 – 316; Novikova, Schneeweiss, 2002; Molodin, Parzinger, Garkusha et al., 2004: 285 – 287)).

It is noteworthy that the studied area of the Chicha-1 site revealed a considerable number of such burials compared to the relevant cases reported from Southern Europe, Mesopotamia, Anatolia, and Central Asia, where the tradition of locating ritual burials inside dwellings was typical (see (Mishina, 2005: 27)). It is highly possible that the total number of such burials in the entire settlement will be great.

However, most burials are situated at the cemetery, which has partially been studied by the Joint Russian-German Archaeological Expedition (Molodin, Parzinger, Garkusha et al., 2004: 240 – 260). Magnetic sounding of the areas adjacent to the town at its northern, eastern and partially southern sides have shown a great number of anomalies. Most of the anomalies are connected with burials (see Fig. 2). It seems that most (or, likely, all) graves originally had some surface constructions, which were destroyed during many years of soil tillage. Such a supposition is supported by our studies of the town boundaries that were totally destroyed in their eastern portion. Magnetic sounding has shown that some graves were encircled by circular and sub-rectangular ditches (see Fig. 2).

Apparently, not all graves recognized by magnetic survey are attributable to the Bronze to Iron Age transition period. One such site has been investigated (see (Molodin, Parzinger, Garkusha et al., 2001: 134 – 139)). Approximately 200 m to the northeast from the main settlement, the barrow cemetery of Zdvinsk-1 is situated (see Fig. 2). The ground at the cemetery was also ploughed for decades. Some small constructions have been totally destroyed. Larger surface constructions like grave piles and pile bases have been also damaged, so currently it is difficult to estimate the original dimensions of the barrows. However, magnetic scanning maps provide us with the opportunity to see the real dimensions of ditches encircling earth grave constructions (see Fig. 2).

Geomagnetic monitoring has shown that the entire area between the bank of Lake Chicha and the barrow cemetery Zdvinsk-1 is occupied by the necropolis. Most of the necropolis area is now occupied by wheat fields, hence any archaeological works are impossible. However, some burials located at the western margin of the field were excavated. Based solely on the magnetic record, and by pinpoint sounding in places of anomalies, specialists studied ten burials evidently related to the site in question (Molodin, Parzinger, Garkusha et al., 2004: 240 – 261) (Fig. 5). All the graves contained one deceased; some of them demonstrated features of the typical Irmen burial tradition. The bodies were buried on their side, in a flexed position, with their heads oriented toward the south in shallow grave pits. Grave goods consisted of ceramics and bronze decoration pieces of the traditional Irmen type (Ibid.). However, some tombs from the same portion of the cemetery demonstrated features suggestive of changing burial rites. For instance, circular graves and some features typical of secondary burials (reburials) were noted (Fig. 6). The traditional grave good kit also showed some changes: original ceramics and bronze items appeared. Even if such graves had originally surface barrow constructions, the funeral rite apparently differed from the classic Irmen type.

Judging by the available magnetogram, there were several tens of graves of the type described above or similar to them in the screened area (see Fig. 2). However, the cemetery may have extended to the area that has not been geomagnetically studied. The area with graves of the described type (conventionally termed "ground burials") is adjacent to the barrows of the Zdvinsk-1 cemetery (see Fig. 2).

As it has been written elsewhere, ceramic ware from Chicha-1 was not homogeneous, yet there are features attesting to its common basis (see (Ibid.: 266 – 275; Molodin, Mylnikova, 2004: 101 – 106).

Our studies have shown that the earliest portion of this site is situated within the fortified "citadel" and is dated to the Late Bronze – Early Iron Age, most probably to the 9th century BC, the period of existence of the Irmen culture (Molodin, Parzinger, Garkusha et al., 2004: 264 – 266). The "citadel" itself has been attributed to the transitional period from the Bronze to the Iron Age on the basis of the ceramic assemblage typical of the Irmen culture. The Irmen ceramic ware was classified in the 1980s (Molodin, Kolontsov, 1984; Molodin, 1985). We are sure that the ground burials were related to the "citadel."

In the summarizing monograph addressing the Bronze Age of Baraba, I noted that the ceramics of Chicha-1 discovered during the first excavations differed from those of other Late Irmen sites. It included large gently curved jars and pots with sparsely decorated rims (Molodin, 1985: 163). N.L. Chlenova, who later analyzed the ceramics of this site, noted that its decoration was generally poor. In her view, this evidenced that Chicha ceramics had evolved in the "steppe direction" (Chlenova, 1994: 86 – 87). Ceramics of this type prevailed over pottery of other types at the site, with the only exception being finds from the "citadel," where the proportion of pottery of such "steppe" type was considerably smaller than that of the classic Late Irmen ceramics. Accordingly, we can identify two different ceramic assemblages at particular portions of a single site.

Apparently, these two portions of the town co-existed over some period of time, as is supported by available diagnostic bronze items and radiocarbon dates (see (Molodin et al., 2002)). These features may attest to a fratrial social organization that included two ethnically different populations related by cultural and economic ties and possibly by kinship.

Karagai Aul-1, the site in the Eastern Urals synchronous to Chicha-1, also demonstrates evidence of such a social model. The site's planigraphy shows two circular settlements conjoining one another (Zimina, 2004). In each area, one evidently synchronous surface structure was excavated. These structures contained two different ceramic assemblages (Zimina, 2003). V.A. Zakh and O.Y. Zimina argued that pottery from the "ovoid" settlement part showed close similarity to Gamayun ceramics, while pottery from the "circular" site was closer to the Barkhatov type. In addition, both sites yielded vessels "showing a combination of features of the two different cultures" (Sakh, Zimina, 2005: 117).

In the Tobol basin, the fortified settlements of Vak-Kur- 2, Kyrtysh-1 and 2, and others also revealed a similar pattern of dwelling space that could be explained by a dual organization of society (Ibid.: 117 – 118).

It seems that such a dual organization of society was typical of the forest-steppe zone of Western Siberia during the Bronze to Iron Age transition. Such a supposition is supported by the evidence from Chicha-1, the above mentioned sites in the Tobol basin, as well as from Inberen-5 – 7 located in the Irtysh basin and attributed to the Krasnoozersk culture (though the Inberen materials have not been analyzed from the viewpoint of social organization) (Abramova, Stefanov, 1985: fig. 1).

Such dual social organization was formed under the impact of intense migrations both in longitudinal and latitudinal directions. The synthesis of diverse cultural components is most vividly demonstrated by archaeological evidence from the contact zone of forest-steppes (probably due to the extreme climatic situation), primarily in the taiga zone of Western Siberia in the 9th – 7th centuries BC.

This hypothesis is supported by materials not only from settlements, but also from burial sites. In this respect, the settlement and burial complex of Chicha-1 and the Zdvinsk-1 cemetery forming a single monument provide substantial evidence. In order to prove the reliability of this supposition, let us discuss the materials recovered from barrow 1 at Zdvinsk-1 excavated by N.V. Polosmak in 1981 (Polosmak, 1987: 52 – 54). She excavated one of the five constructions visible on the surface. Each construction was about 14 m in diameter and elevated to 22 cm over the ground surface. Currently, with the availability of magnetograms, it is clear that not the entire construction has been excavated. A small ditch surrounding the burial construction was not included in the excavation area. However, at that time it was difficult to foresee the existence of this ditch because of the heavy damage to the earthen construction as a whole. During the demolition of the mound, Polosmak discovered an orange circle of burnt clay up to 50 cm thick under the surface earthen pile. This circle of burnt soil encircled the grave pit and was probably formed in the course of burning a wooden surface construction erected over the grave. Regrettably, the burial chamber was looted. However, there was a double burial of a woman and a child beside the main chamber. The human bones were heavily burnt, suggesting the synchronism of the entire burial complex. The woman skeleton was located in a flexed position on its right side with the head directed to the southwest. The grave goods included a stone dish-altar, a vessel (Fig. 7), and cow ribs. Excavations in the northeastern portion of the barrow revealed five additional human burials. All these bodies were in supine position. Two of these skeletons were oriented with their heads toward the northwest, two – to the west, and one – to the northeast. Polosmak suggested that all the burials constituted a single association related to the central (looted) burial, of which only solitary bones were found in the mound (Ibid.: 54). On the basis of the features of the vessel, the whole complex was attributed to the Bolshaya Rechka culture and dated to the 5th – 4th centuries BC (Ibid.: 53, pl. IX). Apparently, Polosmak was right in pointing to the western affinities of the burial (Ibid.: 54). However, we cannot agree with the suggested cultural and chronological attribution of the site. The Bolshaya Rechka burial rite has been studied and the results have been published in a number of monographs. This rite is clearly different from the one noted in materials from the burial of Zdvinsk-1. Barrows of both the Biysk and Berezovo periods of the Bolshaya Rechka culture do not contain wooden constructions over graves. Grave pits are considerably deep and have wooden ceilings. From one to several grave pits can be located under one barrow; one pit is considered central. The dead were placed in a supine position with stretched or flexed legs. The Berezovo period is characterized by gently flexed skeletons, very deep pits, some of which have undercuts (Troitskaya, Borodovsky, 1994: 24 – 29). All this is true for the site of the Kamenskaya culture (Mogilnikov, 1997; Umansky, Shamshin, Shulga, 2005). In my viewpoint, the Kamenskaya culture is actually quite close to the Bolshaya Rechka culture that was identified by M.P. Griaznov (1956) in the Upper Ob basin. However, this issue is not directly related to the topic of the present paper and deserves special discussion.

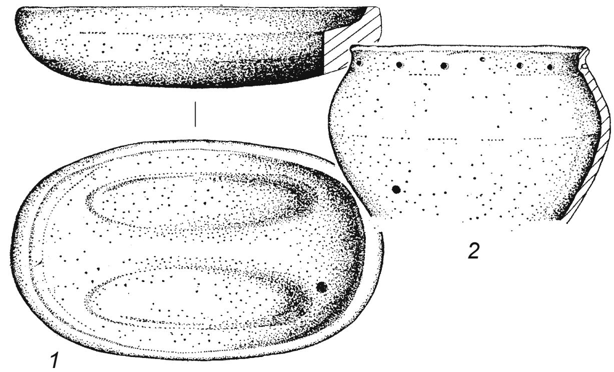

Fig. 7. Dish-altar (*1*) and vessel (*2*) from Zdvinsk-1 (after (Polosmak, 1987)).

The burial rite recognized at Zdvinsk-1 is absolutely identical to the one noted at sites of the 8th – 5th centuries BC from Northern Kazakhstan (e.g., Berlik burial ground, barrow 1; Kenes, barrows 1 and 11). There is a wooden construction over the grave showing signs of burning, the grave is surrounded by a circular ditch, a shallow grave pit is located in the center of the site. The construction is covered by an earthen barrow (Khabdulina, 1987: 6 – 13). The bodies are placed both inside the grave pits and on top of the buried soil in a supine extended position or in a flexed position on the side (15 %). Two examples of the latter rite have been registered at Yavlenka, barrow 1, and Razuevka, barrow 1. The bodies were placed on the ancient ground surface, as at Zdvinsk-1 (Ibid.: 11). These burials demonstrate similar features: the orientation of the dead and a grave good kit including stone beak-shaped altars and vessels (Ibid.; Khabdulina, 1994: pl. 58).

Accordingly, the burial site of Zdvinsk-1 is analogous to the Northern Kazakhstan sites (shallow grave pits, burials on the ancient ground surface and flexed position of the dead (Khabdulina, 1987: 19), but has nothing in common with the eastern Upper Ob burial rite.

The major characteristic features of Zdvinsk-1 suggest its attribution to the beginning of the transition from the Bronze to Iron Age, i.e. the 8th – 7th centuries BC. These same features are characteristic of the Late Bronze Age sites from Northern Kazakhstan. Another common feature for this group of sites is the noted combination of features typical of the Late Bronze tradition and new features of the Early Iron Age (wooden surface constructions, stone dishes-altars). Importantly, the vessel from Zdvinsk-1 is analogous to some specimens from Chicha-1 (Molodin, Parzinger, Garkusha et al., 2001: fig. 4, *1*; 5, *4*; 10, *1*; 12, *3, 4*; 40, *3, 4, 6*; Molodin, Parzinger, Garkusha et al., 2004: fig. 16, *1*; 91, *4*; 163, *8*; 218, *2*; 298, *2*; 313, *6*; 314, *1*; 319, *1*; 333, *7*). In addition, the ceramic assemblage from the periphery zone at Chicha-1 demonstrates certain features in common with pottery from the Berlik and Novonikolsky burial grounds in Northern Kazakhstan that have been attributed to the Bronze to Iron Age transition period (Khabdulina, 1987: fig. 4; 1994) as well as with ceramics from settlements in the Kustanai region in the Tobol basin (e.g., Zagarinskoye settlement) (Evdokimov, 1987: fig. 4, *4, 6, 7, 15, 16*). Chicha-1 pottery also shares some characteristics with ceramics from sites transitional from the Bronze to Iron Age in Central Kazakhstan (the Dongal settlement (Loman, 1987: fig. 4; 5, *1*); the burial grounds of Aktoprak, Temurtaus, and Krasnye Gory (Tkachev, 2002: fig. 191, *11, 16, 20*; 192, *4*; 195, *17, 18*)).

Doubtless, the Zdvinsk-1 burial dates from the transitional Bronze to Iron Age period (8th – 7th centuries BC) and is related to the Chicha-1 settlement and burial ground. In other words, Zdvinsk-1 is a continuation of the cemetery described above. Both the settlement and the cemetery attest to a coexistence of two cultural traditions. The fact that the cemetery reveals the same cultural dualism is especially important as it contradicts the idea that the autochtonous and the immigrant ritual spaces were distinctly separated (Smirnova, 2005: 141).

At present, then, Chicha-1 should be viewed as a unique assemblage with a complex structure revealed by both the settlement and the cemetery. More detailed information will hopefully be gained through future studies.

References

Abramova M.B., Stefanov V.I. 1985
Krasnoozerskaya kultura na Irtyshe. In *Arkheologicheskie issledovaniya v raionakh novostroek Sibiri*. Novosibirsk: Nauka, pp. 103 – 129.

Becker H., Fassbinder J.W.F. 1999
Magnetometry of a Scythian settlement in Siberia near Čiča in the Baraba steppe 1999. In *Archaeological Prospection*. München: Karl M. Lipp Verlag, pp. 168 – 172.

Chlenova N.L. 1994
Pamyatniki kontsa epokhi bronzy v Zapadnoi Sibiri. Moscow: Puschin. nauch. tsentr RAN.

Evdokimov V.V. 1987
Zakliuchitelnyi etap epokhi bronzy Kustanaiskogo Pritobolia. In *Voprosy periodizatsii arkheologicheskikh pamiatnikov Tsentralnogo i Severnogo Kazakhstana*. Karaganda: Izd. Karagand. Gos. Univ., pp. 68 – 78.

Griaznov M.P. 1956
Istoriya drevnikh plemen Verkhnei Obi po raskopam bliz s. Bolshaya rechka. Moscow, Leningrad: Izd. AN SSSR. (MIA; N 48).

Khabdulina M.K. 1987
Pogrebalnyi obriad naseleniya rannego zheleznogo veka Severnogo Kazakhstana (VIII – II vv. do n.e.). In *Rannii zheleznyi vek i srednevekove Uralo-Irtyshskogo mezhdurechia*. Chelyabinsk: Izd. Chelyab. Gos. Univ., pp. 3 – 25.

Khabdulina M.K. 1994
Stepnoe Priishime v epokhu rannego zheleza. Almaty: Gylym; Rakurs.

Loman V.G. 1987
Dongalskii tip keramiki. In *Voprosy periodizatsii arkheologicheskikh pamiatnikov Tsentralnogo i Severnogo Kazakhstana*. Karaganda: Izd. Karagand. Gos. Univ., pp. 115 – 129.

Mishina T.N. 2005
Sotsialnyi aspekt izucheniya intromuralnykh detskikh pogrebenii (po materialam epokhi rannei bronzy Tellia Yunatsite, Balkany). In *Teoreticheskie i metodicheskie podkhody k izucheniyu pogrebalnogo obryada v sovremennoi arkheologii*. Moscow: IA RAN, p. 27.

Mogilnikov V.A. 1997
Naselenie Verkhnego Priobia v seredine – vtoroi polovine I tysacheletiya do n.e. Moscow: Izd. Puschin. nauch. tsentra RAN.

Molodin V.I. 1985
Baraba v epokhu bronzy. Novosibirsk: Nauka.

Molodin V.I., Kolontsov S.V. 1984
Turunovka-4 – pamiyatnik perekhodnogo ot bronzy k zhelezu vremeni. In *Arkheologia yuga Sibiri i Dalnego Vostoka*. Novosibirsk: Nauka, pp. 69 – 86.

Molodin V.I., Mylnikova L.N. 2004
Keramika gorodischa Chicha-1 kak istochnik po istorii perekhodnogo vremeni ot bronzovogo k zheleznomu veku. In *Istoria i kultura Sibiri v issledovatelskom i obrazovatelnom prostranstve (k yubileyu prof. E.I. Solovevoi): Materialy region. nauch.-praktich. konf*. Novosibirsk: Izd. Novosib. Gos. Ped. Univ., pp. 101 – 106.

Molodin V.I., Neskorov A.V. 1992
O svyazakh naseleniya Zapadno-sibirskoi lesostepi i Kazakhstana v epokhu pozdnei bronzy. In *Margulanovskie*

chtenia, 1990, pt. 1. Moscow: Izd. Instituta arkheologii AN Kazakhstana, pp. 93 – 97, 244 – 246.

Molodin V.I., Novikova O.I., Parzinger H., Schneeweiss J., Grishin A.E., Efremova N.S., Chemiakina M.A. 2003

Pogrebeniya lyudei na zhilom prostranstve gorodischa Chicha. In *Istoricheskii opyt khozaistvennogo i kulturnogo osvoeniya Zapadnoi Sibiri*, pt. 1. Barnaul: Izd. Altai. Gos. Univ., pp. 312 – 316.

Molodin V.I., Parzinger H., Becker H., Fassbinder J., Chemiakina M.A., Nagler A., Niff R., Novikova O.I., Manstein A.K., Garkusha Y.N., Grishin A.E., Efremova N.S. 1999

Arkheologo-geofizicheskie issledovania Rossiisko-germanskoi ekspeditsii v Barabinskoi lesostepi. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, vol. 5. Novosibirsk: Izd. IAE SO RAN, pp. 454 – 461.

Molodin V.I., Parzinger H., Garkusha Y.N., Schneeweiss J., Grishin A.E., Novikova O.I., Efremova N.S., Chemiakina M.A., Mylnikova L.N., Vasiliev S.K., Becker H., Fassbinder J., Manstein A.K., Diadkov P.G. 2001

Chicha – gorodische perehodnogo ot bronzy k zhelezu vremeni v Barabinskoi lesostepi, vol. 1. Novosibirsk: Izd. IAE SO RAN. (Materialy po arkheologii Sibiri; iss. 1).

Molodin V.I., Parzinger H., Garkusha Y.N., Schneeweiss J., Grishin A.E., Novikova O.I., Chemiakina M.A., Efremova N.S., Marchenko Z.V., Ovcharenko A.P., Rybina E.V., Mylnikova L.N., Vasiliev S.K., Beneke N., Manstein A.K., Diadkov P.G., Kulik N.A. 2004

Chicha – gorodische perekhodnogo ot bronzy k zhelezu vremeni v Barabinskoi lesostepi, vol. 2. Novosibirsk; Berlin: Izd. IAE SO RAN. (Materialy po arkheologii Sibiri; iss. 4).

Molodin V.I., Parzinger H., Schneeweiss J., Garkusa J.N., Grišin A.E., Novikova O.I., Efremova N.S., Marčenko Z.V., Čemjakina M.A., Mylnikova L.N., Becker H., Fassbinder J. 2002

Čiča – eine befestigte Ansiedlung der Übergangsperiode von der Spätbronze zur Früheisenzeit in der Barabinsker Waldsteppe Vorbericht der Kampagnen 1999 – 2001. *Eurasia Antiqua*, Bd 8: 185 – 236.

Novikova O.I., Schneeweiss I. 2002

K probleme tipologii i interpretatsii zhertvennykh kompleksov v poselencheskom kontekste (po materialam pamyatnikov bronzovogo i rannezheleznogo veka Zapadnoi Sibiri). In *Severnyi arkheologicheskii kongress: Tezisy dokladov.* Ekaterinburg, Khanty-Mansiysk: Akademkniga, pp. 198 – 200.

Polosmak N.V. 1987

Baraba v epokhu rannego zheleza. Novosibirsk: Nauka.

Smirnova M.E. 2005

Territoriya mogilnikov kak kultovoe prostranstvo. In *Teoreticheskie i metodicheskie podkhody k izucheniyu pogrebalnogo obryada v sovremennoi arkheologii*. Moscow: Izd. IA RAN, p. 14.

Tkachev A.A. 2002

Tsentralnyi Kazahstan v epokhu bronzy, pt. 2. Tyumen: Izd. Neftegaz. Gos. Univ.

Troitskaya T.N., Borodovsky A.P. 1994

Bolsherechenskaya kultura lesostepnogo Priobia. Novosibirsk: Nauka.

Umansky A.P., Shamshin A.B., Shulga N.I. 2005

Mogilnik skifskogo vremeni Rogozikha-1 na levoberezhie Obi. Barnaul: Izd. Altai. Gos. Univ.

Zakh V.A., Zimina O.Y. 2005

O dualnoi organizatsii drevnikh obschestv Zapadnoi Sibiri (po arkheologicheskim materialam). In *Aktualnye problemy arkheologii, istorii i kultury*, vol. 1. Novosibirsk: Izd. Novosib. Gos. Ped. Univ., pp. 112 – 119.

Zimina O.Y. 2003

Keramicheskie kompleksy gorodischa Karagai-Aul-1 v Nizhnem Pritobolie. In *Problemy vzaimodeistviya cheloveka i prirodnoi sredy: Materialy itog. nauch. sessii Uchen. soveta IPOS SO RAN 2002 g*., iss. 4. Tyumen: Izd. IPOS SO RAN, pp. 49 – 53.

Zimina O.Y. 2004

Issledovanie gorodischa Karagai-Aul-1 v Nizhnem Pritobolie. In *Vestnik arkheologii, antropologii, etnografii*, iss. 4. Tyumen: Izd. IPOS SO RAN, pp. 38 – 50.

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MEDIEVAL MUMMY FROM YANGJU*

Introduction

Recently discovered medieval mummies have proved highly informative in the reconstruction of several aspects of medieval Korean society. In particular, several medieval mummies have been found in tombs dating to the Chosun Dynasty (1392 – 1910). According to previous reports, mummies have been found in Gwangju (1968), Cheongwon (1977), Cheongyang (1982), Ulsan (1986), Paju (1995), Andong (1998), Okcheon (2000), Yangju (2001), Paju (2002), Buan (2004), and Daejeon (2004) (Fig. 1, *A*). Despite the fact that more medieval mummies are being found with each passing year, most have in fact not been examined due to the wishes of the descendants not to have their ancestor subjected to intensive scientific examination. Instead, mummies found during reburial ceremonies (when being transferred to other graveyard places) are often re-buried or even cremated by their descendants.

Although the need for a scientific study of medieval mummies has not been sufficiently stressed in Korean society, some mummies have been examined by research teams, represented by archaeologists and experts in the study of medieval clothing and medicine. One such mummy was discovered in Yangju on November 15, 2001. The mummy was found quite unexpectedly by the descendants during reburial and subsequently became the subject of a multidisciplinary study. This provided the opportunity to analyze the physical traits of such a mummy for the first time, which served at least in part, to resolve the mystery surrounding the Korean medieval mummy. Additional studies of this specimen are currently being undertaken and it is hoped that the results may serve as a reference for future studies of a similar type of subject.

In this article, we describe the Yangju specimen by way of introduction to the various medieval mummies that have been excavated from Korean medieval tombs. In this case, the medieval tomb has also been studied and an attempt has been made to reconstruct the accompanying remains and the mummy using a variety of science-based methods. On completion of the preliminary study, it has

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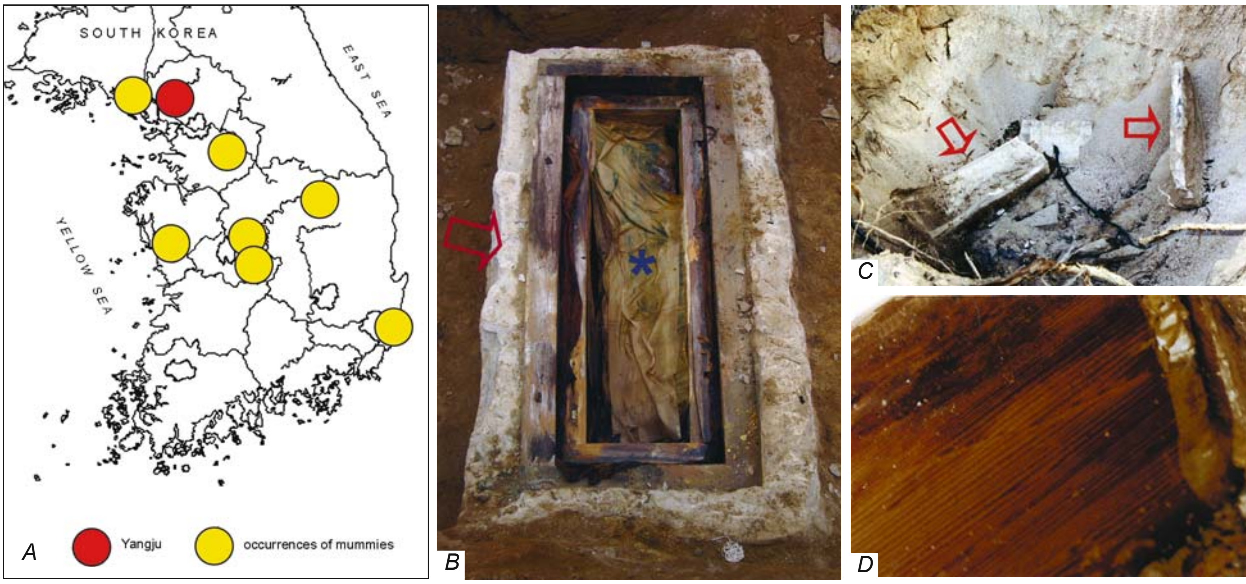

Fig. 1. Map showing sites where medieval mummies have been found in previous years (*A*). Typical structure of a tomb in which mummies have been found (*B*): the mummy (marked with asterisks) was placed in a bipartite wooden coffin (*1* – inner part and *2* – outer part) which was encapsulated in a mixture of lime and soil (shown with red arrow); photograph of the medieval tomb found in Yong In in 2005. Yangju child mummy (*C*); well-preserved coffin wooden plates (*D*).

Fig. 2. Clothes of the child mummy, removed layer by layer.

been concluded that the mummy as well as the medieval tomb should jointly be regarded as a kind of "time capsule." Since the examination of available historical and genealogical documents have made it possible to identify the mummified individual, it has also been concluded that this type of Korean mummy can provide invaluable information on medieval Korean society.

This study was conducted in accordance with "The Vermillion Accord on Human Remains, World Archaeological Congress, South Dakota, 1989."

Data presentation

Description of the mummy and accompanying remains

The medieval mummies found in Korea since the year 1968 have in each case been located in a bipartite, wooden coffin encapsulated in a mixture of lime and soil (Fig. 1, *B*). The Yangju mummy is no exception (Fig. 1, *C*). The wooden plates used for the coffin were found in a well-preserved state; the outer lime and soil cover remained unbroken even at the time of discovery (Fig. 1, *D*). Upon opening the upper lid of the coffin, medieval clothes were observed filling the inside of the coffin. Underneath the layers of clothes, a child mummy was discovered (Fig. 2, *A*). The clothes and the wooden coffin were transported to the Seok Ju Sun Memorial Museum, Dankook University, for further research. The child mummy was examined by specialists both from Dankook University College of Medicine and other academic institutions of the Republic of Korea.

Restoration of the clothes and other accompanying remains

The inner coffin made of pinewood plates was restored for display in the Museum. Restored fabric remains include: *Jiyo*, the fabric spread on the floor of the coffin; *Nama Jungchimak Suui*, the upper garment of a male child; *Nama Baji Suui*, the lower garment of a male child; *Somjangui Yomui*, a padded, upper garment of a male child; *Songin Jungchimak Yomui*, an adult upper garment; *Songin Sapokbaji Yomui*, an adult lower garment; *Somoja*, a hat placed on the deceased; *Baenetjogori*, a garment for the neonate; *Myeokmok*, the fabric used for wrapping the face of the deceased (Fig. 3). According to experts in the study of medieval clothing, the typological features of the accompanying remains including the clothes of the deceased, suggest that the mummified child lived in the 17th century.

Radiocarbon dating

Although a relative chronology can be estimated based on the patterns of the accompanying remains and the genealogical survey found in old documents, such a dating method leaves issues open to dispute and introduces a significant element of uncertainty. Therefore, radiocarbon dating was performed to determine the exact chronology of the mummy: 130 mg of silk taken from the costume and 450 mg of cotton taken from the mummy's pillow were used as samples for radiocarbon dating. The acid–alkali–acid (AAA) chemical treatment was performed to remove mineral and humic acid contamination. Pretreatment of the samples was followed by the conventional vacuum combustion procedure with copper oxide (CuO) and the graphite reduction procedure. After the reduction procedure, ion source targets were made, using reduced graphite and silver powder.

To measure the amount of ^{14}C in the sample, an accelerator mass spectroscopy (AMS) was performed. The graphite samples prepared by the reduction procedure were subjected to the Cs-sputtering ion source of the tandem-type electrostatic accelerator (Model 4130 Tandetron, High Voltage Engineering Europa) at the Inter-university Research Facility of Seoul National University. NIST oxalic acid (Ox-II) was used as the standard sample for AMS dating. The relative abundance of carbon isotopes in the sample was measured from the accumulated current of the ^{12}C and ^{13}C ion beams. The number of ^{14}C ions was measured using a gas-filled ionization detection chamber. The measurements and methods of data analysis used during the age determination process followed well-established, standard radiocarbon dating procedures.

Through chronological calibration, the age of the cotton and silk samples, found along with the mummy, was determined to be AD 1360 ± 35 (for cotton) and 1530 ± 55 (for silk). Taking a statistical average of the two dates, the mummy is estimated as dating to AD 1411 ± 42 (Shin et al., 2003).

Estimation of the mummy's age

Radiographs of both hands were taken to determine bone age by examining the carpal bones. Lateral and postero-anterior views of the skull were also taken as an orthopantomograph proved unavailable due to technical difficulties. From these radiographs, the degree of calcification of the developing, permanent teeth could be observed. Using the system proposed by Nolla (1960), the level of calcification was scored for the central and lateral incisors, the canines, and the first and second molars in the left side of the maxilla and mandible. A graph produced by Demirjian (Demirjian, Goldstein, Tanner, 1973) was used to classify the developmental stage of all the teeth in the lower left quadrant, and this maturity score was used in the estimation of chronological age. Bone age according to the Korean standard chart showing ossification status of carpal bones was estimated to be between 5.2 and 6.3 years. According to Nolla's system (1960), the age of the mummy was estimated to be between 4.5 and 6.6 years.

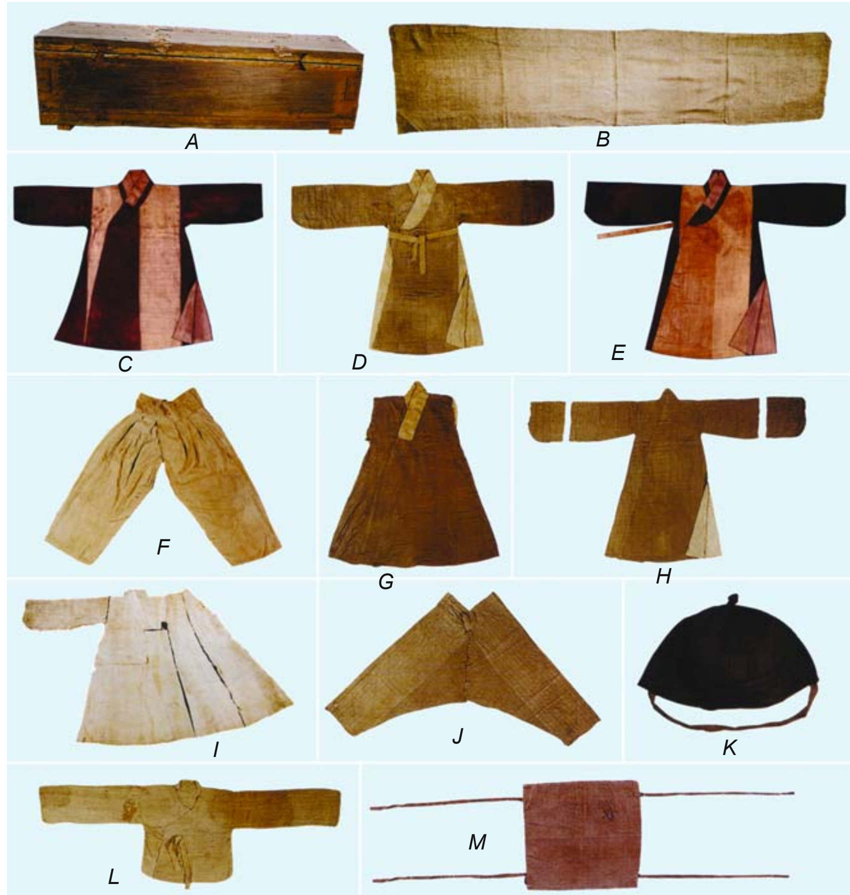

Fig. 3. Restored objects associated with the mummy: inner coffin made of pinewood plates (*A*); *Jiyo*, fabric spread on the floor inside the coffin (*B*); *Nama Jungchimak Suui*, upper garment of a male child (*C – E*); *Nama Baji Suui*, lower garment of a male child (*F*); *Somjangui Yomui*, padded upper garment of a male child (*G*); *Songin Jungchimak Yomui*, upper garment of adults (*H*, *I*); *Songin Sapokbaji Yomui*, lower garment of adults (*J*); *Somoja*, hat placed on the dead (*K*); *Baenetjogori*, garment of a neonate (*L*); *Myeokmok*, fabric put on the face of the deceased (*M*).

Fig. 4. Overview of the mummy (*A*); head with darkened parts of the face (*B*); abdominal cavity (shown with red arrows) is considerably damaged, hands are folded in the groin region (*C*); feet point to the right (*D*).

Using the method suggested by Demirjian (Demirjian, Goldstein, Tanner, 1973), the mummy is estimated to be between 5.0 and 5.9 years old. Based on these two methods for age estimation of the teeth and carpal bone ossification, we consider it most likely that the age of the child fell between 4.5 and 6.6 years (Shin et al., 2003).

DNA analysis

DNA extraction and amplification analysis was performed on the mummy's mitochondrial and Y-chromosomal DNA. Sample tissues were obtained from internal organs including the lungs, liver, and muscle tissue. DNA was extracted using phenol-chloroform-isoamyl alcohol and silica column. PCR amplification for mitochondrial HV1, HV2 and HV3 regions was successfully performed. Y-STR PCR amplification for DYS19, DYS 389I, DYS390, DYS391, DYS392, and DYS393 was also successfully performed and genotyped.

Physical examination

The mummy was also examined with the naked eye to gather basic information on physical status: Height measures at 102 cm. Although the color of some parts of the skin had darkened due to drying, the mummy's overall state of preservation was relatively good. The skin showed elasticity, being detached from the underlying bones. Creases on the skin were tough and fixed in some areas. The black hair was tied in traditional Korean style. The mouth was wide open revealing the tongue and some teeth (Fig. 4). The abdominal region of the mummy was remarkably depressed, suggesting that the contents within the abdominal cavity were in a process of shrinking. The hands were arranged in front of the groin region, the feet pointing towards the right. All nails on the hands and feet were well preserved. In the region of the back, however, defects in the skin and soft tissue were found, through which the organ samples within the body cavity were acquired.

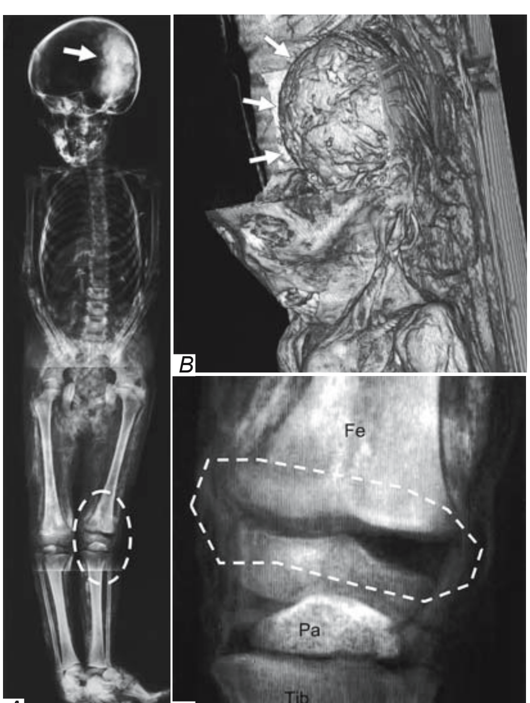

Fig. 5. Radiograph of the entire body (*A*); three-dimensional reconstruction by MDCT (*B*); magnified image of epiphyseal plates (encircled by yellow dotted lines) at the distal end of the left femur (Fe), patella (Pa), and tibia (Tib) (*C*).

Radiological studies

Radiographs of the whole body, skull, and both hands were obtained from both frontal and lateral views. A CT scan was performed twice with a 4MDCT scanner (General Electric Medical Systems, Lightspeed QX/i). A spiral volume was acquired from the head to upper thorax (1.25 mm thick slice, 1.25 mm interval, 0.7 mm reconstruction, pitch 1.5, 120 kV, 200 mAs) and from the head to the toe (2.5 mm thick slice, 2.5 mm interval, 1.25 mm reconstruction, pitch 1.5, 120 kV, 200 mAs). The reconstructed axial images were transferred to a workstation (Advantage Windows 4.2; General Electric Medical System) or PC workstation with version 2.01 Rapidia software (INFINITT, South Korea) for post-processing. Coronal and sagittal multiplanar reformats (MPR), 3D surface shading and volume rendering were obtained. The radiographs and the reformatted images of the CT scans were analyzed by radiologists.

The results of plain radiography and CT-scans giving the preservation status of internal organs have been documented previously (Shin et al., 2003). Bone density did not differ significantly from that of bones in the living state (Fig. 5, *A*). Muscles were also well preserved in some parts (e.g., thigh). Since some remaining structures were found showing soft tissue density within the skull (Fig. 5, *A*), a three-dimensional reconstruction using multi-detector computerized tomography (MDCT) was created. In this study, the brain within the skull could be clearly observed (Fig. 5, *B*). Because the shadow moved in accordance with the change in the mummy's position, it is thought that the shrunken brain was not fixed within the skull (Ibid.). At the distal end of the left femur, the epiphyseal plates of the limb bones were not closed (Fig. 5, *C*). To see the remaining organs within the body cavity more clearly, CT scans were also performed on these organs. A planar reformatted image of the coronal plane shows the skeleton to be intact including skull, spine, bony thorax, pelvic bones, and part of the upper and lower extremity bones. Soft tissues overlying the bones were relatively well preserved. In addition, it was found that various structures including the liver, spinal cord and most back muscles were still visible, while the residues

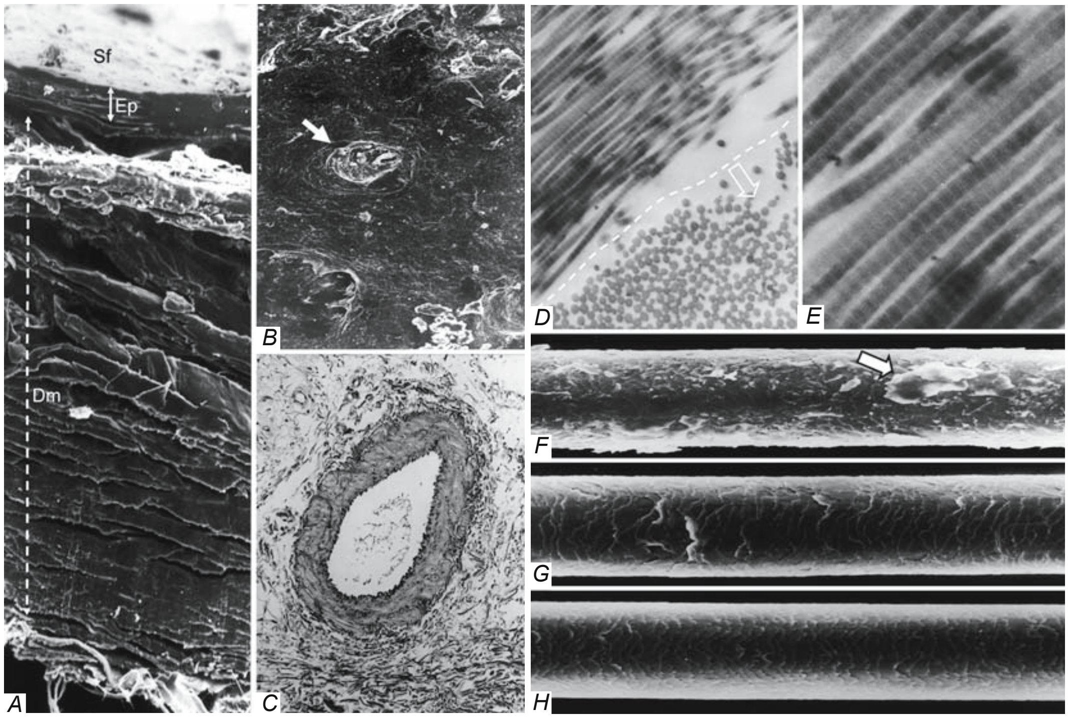

Fig. 6. SEM image of the skin (*A*): EP – epidermis, Dm – dermis, Sf – surface of the skin; surface of the skin with pores for hair shafts (indicated by arrow) (*B*); remains of vessels in the hypodermis (*C*); collagen fibers within the dermis (*D)*, compared to those in another mummy (*E*); mummy's hair before and after rinsing (*F*, *G*); hair of a living adult (*H*). Arrow in (*F*) shows materials accumulated on the surface of the mummy's hair.

of the spleen, stomach and part of a back muscle were found in the left upper abdomen (Ibid.). As concerns the internal organs in the thorax, it is considered that the thin layer of soft tissue within the left hemi-thorax is likely to be the residue of the heart whilst the soft tissue mass located in the right posterior thorax is thought to be that of the liver and residua of the right lung (Ibid.).

Cause of death

Since this child died at a very young age, it is particularly relevant to consider the cause of death. First of all, tests were performed to determine whether any diatoms were present. A microscopic examination after processing the lung tissue with strong acid revealed no diatoms, suggesting that the child did not die from drowning. An additional macroscopic physical examination did not provide any relevant information. However, an interesting clue was acquired from the histopathological test of the lung tissue. Numerous blood cells were found clotted in the airway of the bronchiole (Ibid.), suggesting that asphyxia following respiratory bleeding might constitute a direct cause of death even though the massive hemoptysis might not be the primary cause of death. It is hoped that additional tests being carried out at the present time may provide more information regarding the cause of death.

Histological studies

Various skin, skeletal muscle, lung, and liver tissues were taken from the mummified child. To obtain the lung and liver samples, the inner cavity of the thorax and abdomen were approached through the skin defects in the region of the back. To re-hydrate and fix the mummified tissues, they were immersed in 4 % paraformaldehyde overnight. After the due fixation processes were finished, dehydration of the sections was performed with graded series of ethanol from 70 to 100 % for one hour each. The tissues were laid in a vacuum oven for one hour after xylene clearing, three times for one hour each. After the paraffin embedding was performed, the sections were made using microtome by 8 µm as documented in the previous study (Anderson, Gordon, 1996). Tissue sections were mounted on slides and deparaffinized with xylene (3 times for 5 minutes each time) and 100 to 70 % alcohol (3 times for 5 minutes each time). After the sections were washed with water, they were immersed in hematoxylin solution for 5 minutes and eosin solution for 2 minutes (for a description of the procedure see (Stevens, Wilson, 1996)). To perform the electron microscopic study, the mummified tissues were re-hydrated and fixed in 4 % paraformaldehyde and 0.1 % glutaraldehyde in a neutral

0.1 M phosphate buffer. Tissues were post-fixed for one hour in 1 % (w/v) osmic acid dissolved in phosphate buffered saline (PBS), dehydrated in graded ethanol, and embedded in Epon 812. Ultra thin sections were cut and mounted on nickel grids coated with Formvar film. The grids were examined with a JEOL 1200 EX-II electron microscope with and without uranyl-lead counter staining. Observations with a scanning electron microscope (SEM) were performed in accordance with the method described previously (see (Anderson et al., 1996)). Hair samples were pre-fixed by immersion in 4 % paraformaldehyde, 0.1 % glutaraldehyde in a neutral 0.1 M phosphate buffer, and post-fixed for 2 hours in 1 % (w/v) osmic acid dissolved in phosphate buffered saline. Samples were treated in a graded ethanol series and isoamyl acetate, dried in a critical point dryer (Hitachi SCP-II), gold coated using an ion coater (JFC-1100), and observed under a JSM-840 A SEM.

The epidermis demonstrated a remarkable change in thickness while the thickness of dermis showed insignificant change (Fig. 6, *A*). As was observed in the magnified image, only the corneal layer of the epidermis was preserved. Microscopic examination revealed hair shaft pores that could be clearly seen on the epidermis surface (Fig. 6, *B*). On the hypodermis, remains of adipocyte were still visible even though no adipocyte nuclei were found (Shin, Youn, Chang, 2003). Even remaining vessels were sometimes localized within the hypodermis (Fig. 6, *C*). When the image of the dermis was magnified, long fibers became visible (most of them probably collagen fibers). Distinct cross striations revealed through the ultramicroscopic examination supports the conclusion that most fibers were collagen fibers (Fig. 6, *D*, *E*).

Similar collagen fibers were observed in most of the mummified organs with the exception of the bronchus and alveoli (Ibid.). In the respiratory system, red blood cells in the bronchial airway were surrounded by bronchial cartilage (Ibid.). In addition, a number of chondrocytes were clearly visible within the bronchial cartilage (Ibid.). Although most of the lung parenchyma did not remain intact, the alveolar structure delineated by alveolar epithelial cells could still be observed in some parts of the mummified lung (Ibid.).

In the muscles and liver, cells containing nuclei could easily be seen (Ibid.). Since cells with preserved nuclei have not easily been located in other mummies, one may suppose that the preservation status of the Yangju mummy is indeed better than that of mummies found elsewhere. Ultramicroscopic examination focused on the preservation status of the hair was also performed. After the hair had been rinsed, it became clear that the ultramicroscopic morphology of the hair did not significantly differ from that of normal adult hair (Fig. 6, *F*–*H*), which also testifies to the good state of preservation of the Yangju mummy.

Discussion

How did the mummification process occur?

There have been many previous reports on ancient or medieval mummies found elsewhere in the world in which mummies are usually placed in one of two categories, being either naturally or artificially mummified. Korean medieval mummies, however, cannot be easily attributed to either category as they seem to have been created under unique circumstances. Even though no artificial treatment was used in the mummification process in medieval Korea, neither could this process simply have been induced by the natural environment (such as drying or frost conditions) because the climate in Korea could not have enabled such conditions. In this case, the presence of a lime and soil cover may serve as a possible explanation for the mummification process. Indeed the complete sealing of the inner space of the coffin from the outer environment that such a cover provides should probably be regarded here as the main cause of mummification. However, additional experiments should be performed in order to confirm this as definite.

Korean medieval mummies – unique features

Comparing our results with previous reports on the histological structures of mummies around the world, we see that histologically, Korean medieval mummies are very similar to other specimens, formed by different mechanisms. For example, in previous studies, myelin sheath, collagen fibers and the nuclei of chondrocytes have shown remarkable resistance to disintegration processes due to their properties. On the other hand, the preservation of structures such as epithelium, reticular fiber, and muscle have proved to be poorer than in other cases (Hess et al., 1998). Since we observed relatively good preservation of chondrocytes, collagen fibers, and even the brain tissue mainly composed of myelin sheath, one may conclude that the histological characteristics of the mummified tissues in the case under consideration match those revealed in previous studies.

In some respects, however, the Korean mummies are unique. Most importantly, the internal organs of the specimen described here including the intestine, the brain and the spinal cord were not extracted prior to mummification and remain preserved. Because in other mummies such as those from Egypt or the Altai, the internal organs were extracted, medieval Korean mummies can prove much more informative with regard to the condition of health of the respective population.

Another unique feature of the Korean medieval mummy is that its personal identity is easy to establish. Indeed, the mummies were found during reburial processes performed by direct descendants. Since personal information on the ancestors buried in the graveyard is accurately recorded in clan documents or engraved on the tombstone, each mummified ancestor was successfully identified by the descendants. The genealogical relationships of all individuals in question can be determined from written records, *Jokbo*. For example, the Yangju mummy has been identified as Ho, who lived in the 17th century and died between 1680 and 1683. A record of personal history was not detailed in this case because the mummified child died at a young age. However, in other cases concerning Korean medieval mummies, because clan records provide a detailed personal history of the mummified individuals, more historical data is available. For example, *Silrok*, the record of the Chosun Dynasty, and other historical documents facilitate the reconstruction of the life histories of medieval Koreans.

Another interesting point concerns the burial goods that accompany the Yangju mummy. Remains found in the coffin were closely interwoven with the life of the mummified deceased. For example, it is possible that the child or his parents wore the clothes that were buried along with the child. Since the personal identity of the deceased has been established, information can be effectively deduced from the accompanying clothes such as the style of medieval clothing, regional features and social and chronological attribution. Family relationships can also be reconstructed with the help of the accompanying remains. Among the costumes accompanying the mummified child, items of adult clothing were found which presumably belonged to the child's parents. Given that in Chosun society a child who died before its parents was not afforded regular funeral ceremonies, the discovery of a well-equipped coffin for such a child seems exceptional. A funeral ceremony for such a young individual would hardly have been possible unless the parents bitterly grieved their loss. It is extremely unusual for clothes belonging to a child's parents to be placed in a child's coffin. Hence the notable presence of clothes that may indeed have belonged to the child's parents perhaps serves as a reflection of the level of parental affection experienced in this particular case. The presence of patched fabrics used in the funeral ceremony may well indicate the poor financial condition of the relatives. In addition, because genealogical records are available, all these facts become relevant within the context of the life of a specific, medieval, Korean clan.

It is the uniqueness and specific nature of this type of information that proves so valuable in shedding light on aspects of medieval Korean society.

Future prospects

Concerning more general issues of Korean medieval mummies and our future plans, it can be said that most mummies cannot be subjected to scientific study even though their associated items such as documents, clothes, and even wooden coffins have been transferred to museums. When medieval mummies are discovered during archaeological excavations or reburial, the descendants are usually reluctant to grant scientists permission to study them because of the damage caused to the ancestor's remains during the research process. Such damage is regarded as a lack of respect for the ancestors. Most of the medieval mummies discovered were eventually reburied elsewhere or cremated without undergoing scientific study. There is therefore a critical need for efficient non-invasive methods of studying mummies. This would enable invaluable information to be gained from newly found mummies, granted that permission be gained from the relatives.

One prospective method is the MDCT/3D reconstruction technique that assists in acquiring comprehensive data on inner organs without causing damage to the remains. This technique proved to be quite efficient in the study of Egyptian mummies. If further studies support the informative potential of this technique for analyzing the preservation status of the internal organs of mummified bodies, it will be possible to set up a database of virtual images of medieval Korean mummies. Another promising non-invasive method is endoscopy or ultrasonogram, which is currently used for diagnosing living patients.

Broader cooperation between specialists in related areas also proves to be extremely effective. Data obtained by natural scientists, for example, should ideally be interpreted by historians, archaeologists, and specialists in related areas. It is our belief that cooperation of this nature will greatly assist in the process of reconstructing Korean medieval society.

References

Anderson G., Gordon K.C. 1996
Theory and Practice in Histological Techniques. New York: Churchill Livingstone.

Demirjian A., Goldstein H., Tanner J.M. 1973
A new system of dental age assessment. *Human Biology*, vol. 45: 211 – 227.

Hess M.W., Klima G., Pfaller K., Kunzel K.H., Gaber O. 1998
Histological investigations on the Tyrolean Ice Man. *J. Phys. Anthropology*, vol. 106: 521 – 532.

Nolla C. 1960
The development of the permanent teeth. *J. of Dentistry for Children*, vol. 27: 254 – 266.

Shin D.H., Choi Y.H., Shin K.J., Han G.R., Youn M., Kim C.Y., Han S.H., Seo J.C., Park S.S., Cho Y.J., Chang B.S. 2003
Radiological analysis on a mummy from a medieval tomb in Korea. *Annals of Anatomy*, vol. 185: 377 – 382.

Shin D.H., Youn M., Chang B.S. 2003
Histological analysis on the medieval mummy in Korea. *Forensic Sci. Int.*, vol. 137: 172 – 182.

Stevens A., Wilson I.G. 1996
Theory and Practice in Histological Techniques. New York: Churchill Livingstone.

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THE ROYAL TOMB OF ARJAN-2, TUVA: A DENDROCHRONOLOGICAL STUDY*

Introduction

The elite burial mound Arjan-2, excavated by a joint expedition from the State Hermitage Museum and the Eurasian Department of the German Archaeological Institute during the period 1998 – 2003, can confidently be ranked among the most prominent archeological achievements of the early 21st century (Chugunov, Parzinger, Nagler, 2002). The burial site is situated in the Turan-Uyuk Depression in the northern part of the Republic of Tuva referred to as the "Valley of Kings." This archaeological site has proved unique in several respects no less because for the first time in Siberia, a burial of high-ranking members of the early nomadic community has been discovered intact and studied *in situ* (Ibid.: 123). This extremely significant burial site has yielded exceptionally rich and well-preserved archaeological remains including golden adornments, ceremonial weaponry, items of clothing, household objects, etc. which goes to illustrate the great informative potential of this monument. The discovery of Arjan-2 has also enabled us to employ various science-based methods in its study. The presence of wooden structures in graves 2 (variously assembled frames), 5 (double frame) and 11 (coffin) has provided the opportunity for conducting a dendrochronological analysis based on the assessment of annual increments. To date, only one other study of this kind has been conducted on sites in the given region (Zakharieva, 1976).

The objectives of the present article are as follows:

– elaboration of a generalized "flowing" tree-ring chronology;

– estimation of the relative chronology of the burials (graves 5, 2, and 11);

– ascertainment of which seasons the trees used in Arjan-2 burial constructions would have been felled.

Materials and methods

Samples for tree-ring analyses were taken directly from the site under study. Samples from grave 5 were collected by I.Y. Sljusarenko and Y.N. Garkusha (Institute of Archaeology and Ethnography) and O.Ch. Oidupaa (Department of Dendroclimatology and Forest History at the Institute of Forestry), and from graves 2 and 11 by K.V. Chugunov (Head of the Central-Asian Expedition). The samples consist of transverse slices of wood taken from the best preserved parts of the burial constructions (including the walls, floors, and roofs) and coffins.

A brief description of the wooden burial constructions is given below.

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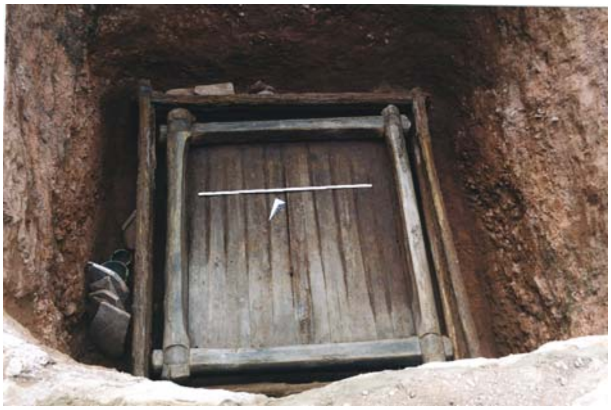


Fig. 1. General view of the grave pit containing the double frame (upper layers of both frames are removed). Grave 5.

Fig. 2. Inner frame of grave 5 reconstructed on the modern surface close to the grave pit.

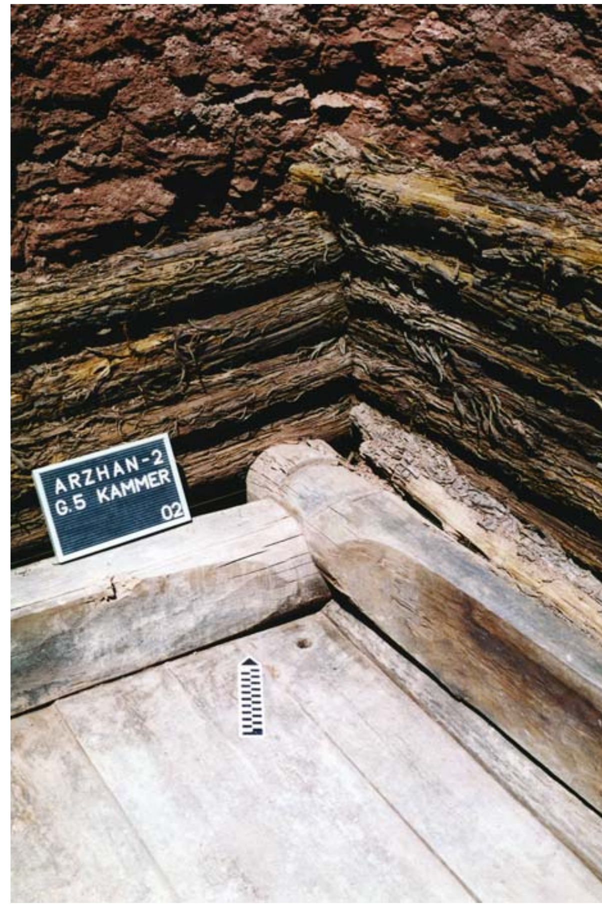


Fig. 3. Northern corner of the burial chamber of grave 5, showing different states of preservation of logs of the inner and outer frames.

Grave 5. A burial chamber with double walls made of whole logs was constructed at the bottom of a 4.34 meter-deep grave pit; its long axis oriented NW – SE (Fig. 1). The outer burial frame consists of eleven layers of hewn logs, 13.5 – 18.0 cm in diameter. The interior dimensions of this frame measure 3.41 by 3.68 m. The wood is poorly preserved with the top and bottom logs most affected by decay. The inner frame consists of seven layers of logs; the interior surfaces of six are hewed, while the lowest layer is composed of round logs with the bark preserved (Fig. 2). The logs vary from 22 to 30 cm in diameter. The interior dimensions of the inner frame measure 2.42 by 2.58 m (Mylnikov et al., 2002: 396).

The roofs of both frames are constructed of tightly arranged logs. The roof of the outer frame consists of 22 unhewn logs, 13 – 17 cm in diameter, placed in a SW – NE direction. The roof of the inner frame consists of nine logs hewed on one side, 16.5 – 25 cm in diameter and laid perpendicular to the logs of the upper roof. The floor of the inner frame consists of ten half-logs, smoothly hewed, tightly arranged and positioned in a NE – SW direction, i.e., parallel to the roof logs. With the exception of a few of the roof logs (Fig. 3) (Mylnikov et al., 2002: 400), the timber of the inner frame has been well preserved. In the center of the inner frame, the remains of a man and a woman were found (Chugunov, Parzinger, Nagler, 2002: 116).

Grave 2. Inside the grave a double layered log construction was found resembling a "cage." One log was laid upon the end of another from the perpendicular wall, leaving gaps between the two consequent logs. The logs formed a discontinuous wall resembling that of a cage. The "cage" logs measure 15 – 20 cm in diameter and are caped with stone slabs. The construction was positioned along the N – S axis. The tips of the logs were inserted into specially made grooves found at the corners of the earthen walls of the grave. The external dimensions of the construction measure 1.2 by 1.6 m. Under the "cage" lie the remains of a wooden roof consisting of six logs positioned along the N – S axis. At the very bottom of the grave pit, a tow-layered log frame was situated, its external dimensions measuring 1.4 by 1.8 m. None of the logs making up this burial construction were hewed. The floor was laid with

Fig. 4. View of the coffin in the pit of grave 11.

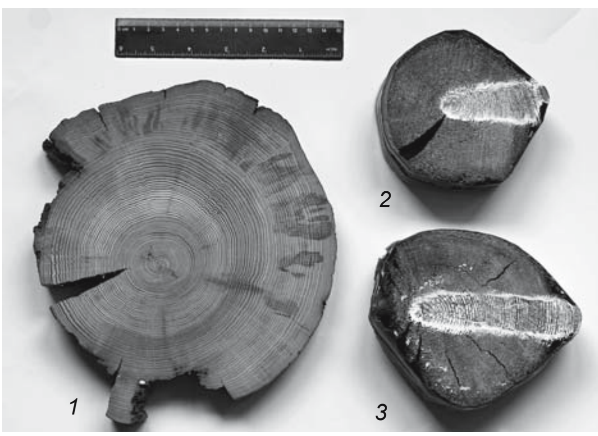


Fig. 5. Samples of a single age from the inner and outer frames of grave 5.
1 – sample 20 from the inner frame (88 rings); *2* – sample NW7 from the outer frame (84 rings); *3* – sample NW9 from the outer frame (92 rings).

poorly preserved boards lying in the same direction as the roof logs. No bone remains were recovered from this grave pit, suggesting that the grave served either as a cenotaph or some other ritual construction.

Grave 11. At the bottom of the grave pit, 0.8 m deep and filled with stones, a child's coffin (1.0 by 0.6 by 0.2 m) was found (Fig. 4) inside of which a child's skeleton was located. The coffin wood showed severe signs of decay, the most outer tree-rings not having been preserved.

Samples were taken from all the well preserved elements of the wooden constructions. Wood pieces with well-preserved tissue immediately under the bark were also sampled. From this tissue it is possible to determine the year in which a tree was felled. Laboratory examinations began with sample grinding. Then the transverse surfaces were cleaned with a scalpel. The width of the tree-rings was measured along two or three radii (depending of the structure of wood tissue and the state of preservation of the sample) from the center to the periphery with the semi-automatic LINTAB-2 device (mean accuracy of 0.01 mm). Treatment of the wood was complicated by a high level of mineralization.

The techniques of tree-ring analysis, including cross-correlation analysis and graphic cross-dating, allow us to establish a relative chronology within an individual series and to recognize erroneous and missing tree-rings. The cross-correlation analysis was carried out with the special program package for tree-ring research DPL (Holms, 1984). Graphical cross-dating was conducted using the "TSAP system V3.5" (Rinn, 1996) software system, with the subsequent visual correlation of curves reflecting absolute and indexed values of radial tree growth. The graphic diagrams presented in this paper have been produced with the program "Statistica 6.0". For convenience, the first year of the general tree-ring chronological scale (M5) based on samples from the inner frame of grave 5 was taken as the relative zero point (0).

Tree-ring analyses of collected samples

Grave 5. Of the total collection of samples from grave 5, 38 slices from the inner frame and twelve from the outer frame were selected on the basis of visual observation. These slices demonstrate both the well preserved state of the peripheral area and the greatest number of tree-rings. Comparisons of slices from the inner and outer frames show that the latter are smaller in diameter although their age is the same (Fig. 5). It is probable that the trees used in the outer frame grew under less favorable climatic conditions.

Measuring annual rings in samples from the inner frame did not present any particular difficulty due to the wood being well preserved and showing clear and comparatively wide increment rings. The resulting tree-ring scales were subjected to graphical cross-dating (Fig. 6), which made it possible to correlate the series and reveal erroneous and missing rings. Variation in individual series has been assessed with the sensitivity coefficient, *m* (Ferguson, 1969), and standard deviation (σ). The former parameter estimates the relative annual variation in tree-ring growth, while the latter reflects absolute variation (Table 1).

Table 1 shows the mean age of most trees studied (60 %) as being between 80 – 100 years. The high variance and sensitivity of individual series (average value of *m* is 0.37) points to tree-ring width as being a sensitive indicator of climatic fluctuation. Inter-series correlation coefficient values (average value, 0.70) reveal a high degree of conformity in the annual increment between the samples. This supports the accuracy of the cross-dating and allows us to group individual chronologies of samples from the inner frame into a general dendrochronological

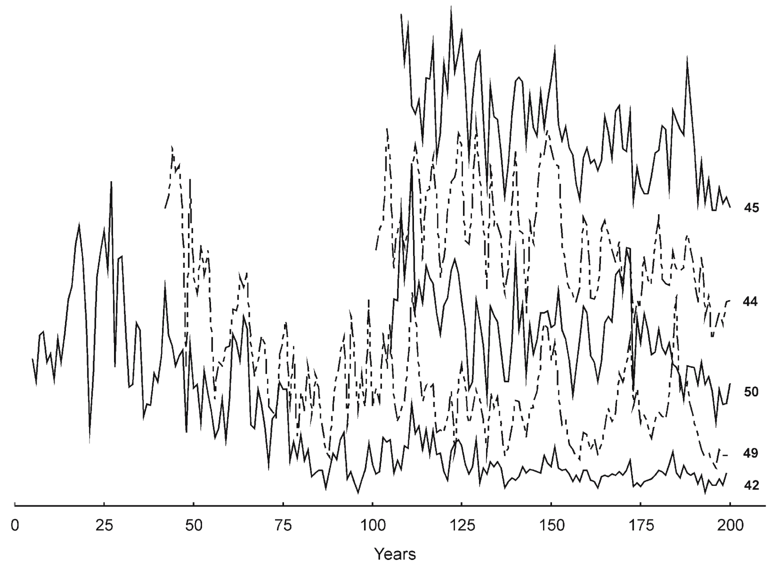


Fig. 6. Example of cross-dating in samples from grave 5.
42, 44, 45, 49, 50 – individual series of measurements from grave 5 samples. All samples except N 42 have the "subcortical" layer preserved.

Table 1. **Cross-dating results of samples from the inner frame of grave 5**

N	Tree-ring (year)		Series length (years)	Correlation coefficient	σ	*m*	Note
	central	peripheral					
1	2	3	4	5	6	7	8
1	41	198	158	0.72	0.50	0.40	Frame log
2	110	199	90	0.68	0.64	0.37	Log from layer 3 of the southwestern wall
3	103	189	87	0.59	0.82	0.29	Log from layer 1 of the southwestern wall
4	39	199	161	0.79	0.56	0.37	Northeastern wall of the frame
5	40	199	160	0.68	0.48	0.38	Log from layer 1 of the southeastern wall
6	43	199	157	0.73	0.40	0.43	Log from layer 5 of the northwestern wall
7	105	199	95	0.91	0.60	0.30	Log 4 from frame floor
8	50	199	150	0.73	0.28	0.37	Frame log
9	40	199	160	0.77	0.33	0.38	Log from layer 3 of the southeastern wall
12	101	199	99	0.75	0.71	0.29	Log from layer 2 of the southeastern wall
13	5	199	195	0.73	0.70	0.36	Log from layer 1 of the northeastern wall
14	101	199	99	0.66	0.79	0.32	Roof log 2
15	103	199	97	0.78	0.73	0.32	Roof log 7
16	43	199	157	0.79	0.54	0.41	Log from layer 2 of the northeastern wall
20	112	199	88	0.71	0.53	0.34	Log from southwestern wall
21	109	199	91	0.76	0.78	0.37	Frame log
22	104	197	94	0.82	0.74	0.39	Roof log 3
23	105	188	84	0.61	0.84	0.42	Frame log
25	105	199	95	0.78	0.62	0.33	Log from layer 4 of the southeastern wall
26	107	199	93	0.76	0.74	0.37	Frame log
27	74	197	124	0.53	0.68	0.40	Log 5 from frame floor
28	42	199	158	0.82	0.55	0.40	Frame log
29	0	171	172	0.67	0.59	0.45	Roof log 8

Table 1 continued

1	2	3	4	5	6	7	8
31	106	199	94	0.56	0.53	0.39	Log from layer 4 of the northwestern wall
33	101	199	99	0.69	0.46	0.37	Roof log 11
34	101	187	87	0.60	0.77	0.42	Frame log
35	110	198	89	0.74	0.56	0.35	Log from layer 6 of the northwestern wall
36	113	199	87	0.78	0.41	0.35	Roof log 10
37	103	199	97	0.86	0.83	0.36	Log 3 from frame floor
38	122	199	78	0.60	0.89	0.37	Frame log
42	4	198	195	0.68	0.53	0.40	Frame log
44	100	199	100	0.75	0.58	0.31	Log from layer 5 of the southwestern wall
45	107	199	93	0.77	0.53	0.35	Log from layer 2 of the northwestern wall
46	105	198	94	0.80	0.68	0.28	Frame log
48	112	199	88	0.45	0.51	0.28	Log from layer 3 of the northwestern wall
49	41	199	159	0.78	0.53	0.41	Log from layer 3 of the northeastern wall
50	104	199	96	0.68	0.51	0.37	Log from layer 4 of the northeastern wall
51	96	199	104	0.35	0.57	0.27	Log from layer 7 of the northeastern wall
Mean value				0.71	0.59	0.37	–

Note: Hereafter, wherever the central ring was missing, the first preserved ring has been taken as being the central ring. Likewise, where the last peripheral ring is missing, the most external, preserved ring is taken as the peripheral ring. σ – standard deviation, *m* – sensitivity index.

Table 2. **Cross-dating results of samples from the outer frame of grave 5, Arjan -2 burial mound**

N	Tree-ring (year)*		Series length (years)	Correlation index	σ	*m*	Note
	central	peripheral					
NW6	121	199	79	0.52	0.75	0.40	Log 6 of the northwestern wall
NW7	108	191	84	0.63	0.52	0.37	Log 7 of the northwestern wall
NW9	106	197	92	0.64	0.55	0.32	Log 9 of the northwestern wall
NE2	65	199	135	0.48	0.37	0.33	Log 2 of the northeastern wall
SE3	79	199	121	0.44	0.49	0.33	Log 3 of the southeastern wall
SE5	64	153	90	0.53	0.55	0.24	Log 5 of the southeastern wall
SW0	56	147	92	0.32	0.72	0.36	Log 0 of the southwestern wall
SW2	61	196	136	0.29	0.53	0.33	Log 2 of the southwestern wall
SW6	99	147	49	0.45	0.90	0.30	Log 6 of the southwestern wall
SW7	94	199	106	0.51	0.51	0.34	Log 7 of the southwestern wall
SW9	74	198	125	0.42	0.82	0.35	Log 9 of the southwestern wall
10	133	192	60	0.37	0.52	0.31	Outer frame log
Mean value				0.46	0.58	0.33	–

* For simplicity, the age of samples has been estimated relative to the first year of the general chronological scale (M5) based on sample measurements from the inner frame of grave 5.

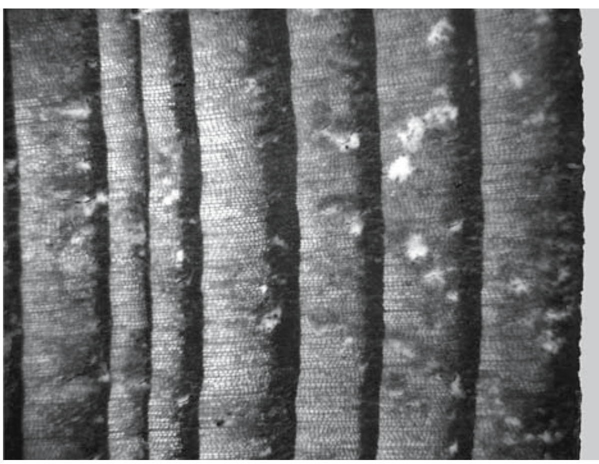
scale spanning a period of 200 years (M5 chronology: years 0 – 199 on the relative scale).

The logs from the outer frame are in a poorly preserved state. Direct soil contact has particularly affected the peripheral rings. Series of increment measurements have been correlated both one against another (Table 2) and with the general chronological scale based on samples from the inner frame. Samples NE2, SE3, SW2 and SW9 showed periods of depression lasting between 10 – 15 years that were not observed in other series.

The analysis of samples from both the inner and the outer frames in which the last "subcortical" ring is preserved show that all the trees were felled in one and the same year – 199 on the relative scale (Fig. 6, samples 44, 45, 49, and 50). Because the formation process of this latest ring is complete (Fig. 7, *a*), it can be concluded that trees for the burial frame were felled either during the autumn or the winter.

Grave 2. Nine samples were selected from grave 2 for dendrochronological analysis. Visual examination has revealed that the wood was in a poorly preserved state, damaged by rot and deformed, showing no peripheral rings despite the relatively young age of certain samples. For this reason, considerable effort was spent on the preliminary treatment of these samples before measurements were taken. Only sample k3 showed well-preserved peripheral rings, suggesting the presence of a "subcortical" ring pointing to the year when this tree was felled.

Individual increment data were subjected to statistical analysis ("COFECHA" program) and graphical dating. Not only the coincidence of benchmark (narrow) annual rings was taken into account, but also the general shape of the curve with alternating periods of slower and more rapid increment. The results are shown in Table 3. Due to age characteristics (in young trees, annual growth mostly depends on individual rather than climatic factors), the lowest correlations were found in samples c3, k2a, and k2b.



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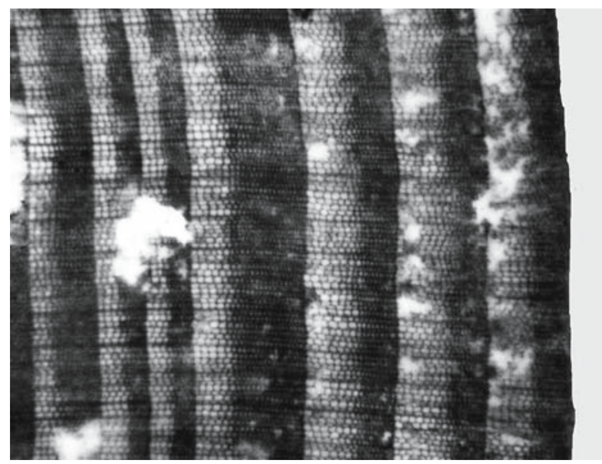

b

Fig. 7. Fragments of samples with the "subcortical" ring preserved.
a – sample 20 from grave 5; *b* – sample k3 from grave 2.

Table 3. **Results of cross-dating on samples from grave 2, Arjan-2 burial mound**

N	Tree-ring (year)*		Series length (years)	Correlation index	σ	*m*	Note
	central	peripheral					
c1	49	135	87	0.69	0.51	0.39	Frame log 1
c2	47	154	108	0.74	0.75	0.44	Frame log 2
c3	84	153	70	0.23	0.40	0.28	Frame log 3
c6	112	167	56	0.59	0.58	0.36	Frame log 6
c7	106	164	59	0.32	0.31	0.29	Frame log 7
k2a	79	167	89	0.25	0.40	0.23	Cage log 2
k2b	73	140	68	0.21	0.34	0.25	Cage log 2
k3	75	199	125	0.36	0.60	0.29	Cage log 3
k4	47	171	125	0.59	0.67	0.49	Cage log 4
Mean value				0.47	0.54	0.35	

* See note for Table 2.

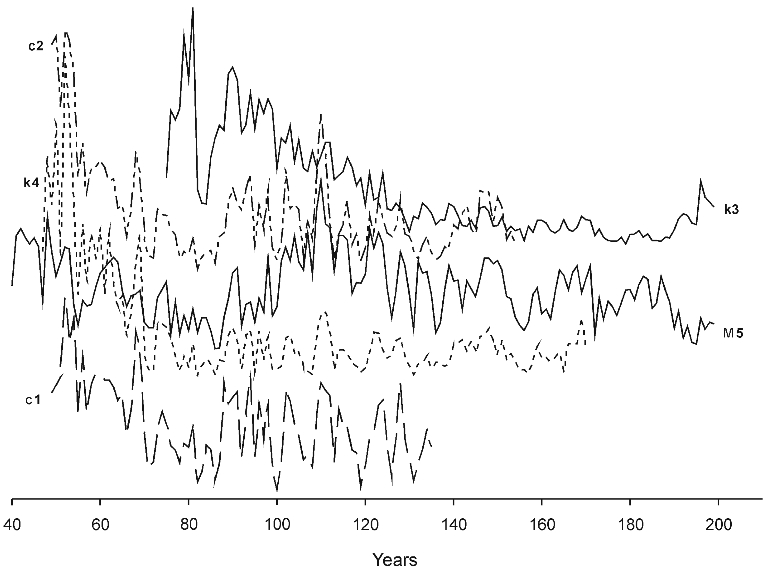

Fig. 8. Results of cross-dating on samples from grave 2 relative to the general chronological scale based on samples from grave 5 (M5).
C1, c2, k3, k4 – individual series of measurements of samples from grave 2.

The cross dating of separate series of samples from grave 2 with the general chronological scale based on samples from the inner frame of grave 5 revealed a high level of correlation (Fig. 8). The graph shows that the last peripheral ring in sample k3 and the last ring from chronological curve M5 were formed in the same year. It seems reasonable to infer that other trees used for the wooden constructions of grave 2 were felled simultaneously. The well-preserved state of the last ring in one sample enables us to estimate the time when the trees were felled within a season. In our case, the complete last ring in sample k3 (see Fig. 7, *b*) suggests that trees from the ritual construction in grave 2 were also felled during autumn or winter. The synchronicity of alternation in the width of peripheral annual rings (one wide – two narrow – four wide) supports the accuracy of the cross-dating results.

In sum, based on the results of the dendrochronological analysis, one may conclude that the trees from which the wooden constructions in graves 2 and 5 were made were felled within a single year, during the autumn – winter period.

Grave 11. Due to the poorly preserved state of the wood, only two samples proved suitable for analysis. These were taken from the western side of the coffin. Visual examination revealed traces of hewing on the outer surface. Graphical dating of individual series showed that the dates overlap within a thirty-year interval. This allowed us to construct a generalized chronological scale spanning 84 years by averaging the width of the annual increment (Table 4). This scale was successfully correlated with the general chronological scale based on wood samples from the outer frame in grave 5 (Fig. 9). There is a 25-year difference between the last annual ring

Table 4. **Statistical features of samples and general chronological scale from grave 11, Arjan-2 burial mound**

N	Tree-ring (year)*		Series length (years)	Correlation index	Growth values (mm)		σ	*m*
	central	peripheral			average	max		
r1	121	174	54	0.87	2.34	4.14	0.59	0.24
r2	91	152	62	0.94	3.70	6.76	1.08	0.27
M11	91	174	84	0.98	3.11	5.52	1.08	0.25
Mean value				0.93	3.09	6.76	0.95	0.25

* See note for Table 2.

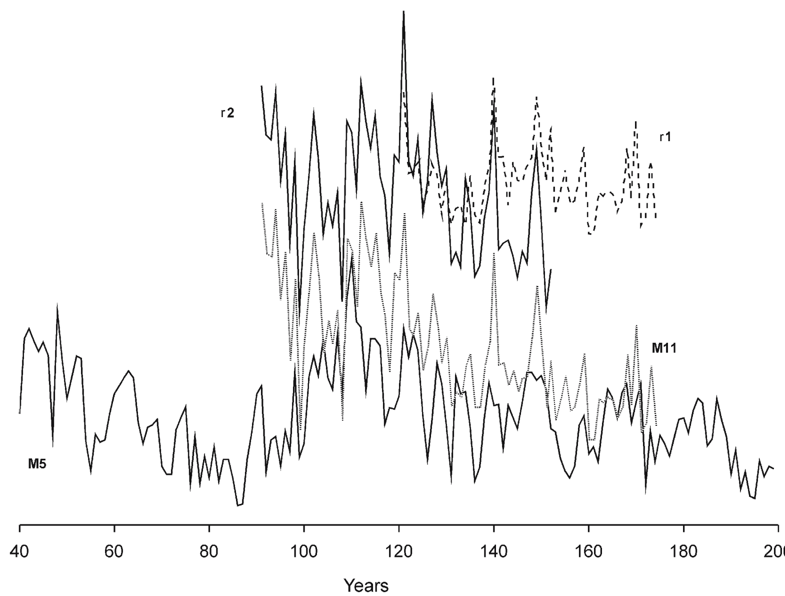

Fig. 9. Results of cross-dating on samples from grave 11 relative to the general chronological scale based on samples from grave 5 (M5).
M11 — general chronological scale based on samples from grave 11; r1, r2 – individual series of measurements based on two samples from grave 11.

in samples from grave 11 and the last annual ring of the M5 chronological scale. However, because samples from the coffin contained no "subcortical" ring, this difference may be explained by the loss of some peripheral rings during the manufacturing of the coffin or the decaying process of the wood.

Discussion

According to the basic principles of dendrochronology, living arboreal species respond to limiting external factors in the same way, provided that environmental conditions are similar (Shiyatov et al., 2000: 18). Therefore, similarities and differences in the annual increment rates of trees used for burial constructions can be highly informative. A high level of correlation between the series and the synchronicity of increment patterns in samples from the inner frame of grave 5 (see Table 1) indicate that this construction was made from trees growing in a single area. Similarly, an equally high degree of synchronicity has been observed between these samples and those from the coffin in grave 11. Therefore, one may deduce that these trees grew under similar conditions.

Comparisons of samples from the inner frame of grave 5 with those from the outer frame and from grave 2 reveal a different pattern. Even at the measurement stage, it became clear that samples from trees of the same age vary in diameter (see Fig. 5). Consequently, trees from the outer frame in grave 5 and those from the frame in grave 2 grew under less favorable conditions (possibly in more arid places). The graphical analysis revealed a marked correlation between these different series. The comparison with the general chronological scale based on data from the inner frame of grave 5 demonstrates that, generally, the curves coincide. However, some differences have been noted which were more likely to have been caused by micro-local conditions rather than by age. Trees used in the construction of the inner frame in grave 5 and the coffin in grave 11 evidently grew in a different environment compared to those used in the outer frame in grave 5 and in the grave 2construction.

Notably, 60 % of samples from the inner frame of grave 5 show growth as beginning during the period of 100 – 119 relative years on the chronological scale, whereas 18 % of the samples show growth as beginning in the 40s (see Table 1). Such an upsurge can only be explained by the extinction of dominant trees (theoretically possible reasons for which include fire, insect population explosion, human economic activity, etc.) and a drop in within-species competition followed by the rapid growth of young trees. The cause of fire can be excluded as not a single sample shows traces of burning. Indicators of depression over ten or more years in samples NE2, SE3, SW2, and SW9 from grave 2 can be viewed as indirect evidence of damage produced by needle-eating insects. Available data shows that a considerable amount of timber was used in the construction of burial chambers in numerous mounds. For instance, the central wooden platform in burial mound Arjan-2 alone included a central frame and 70 additional frames surrounding it (Zakharieva, 1976: 101; Bykov, Bykova, Sljusarenko, 2005). Hence, this upsurge in tree growth can be explained by a period of felling that occurred 80 – 90 years prior to the construction of Arjan-2 and that was aimed at constructing a huge burial mound; the precursor to Arjan-2. One may also determine that felling took place during the relative years 110 –120 rather than 100 – 110, because the age of the preserved tree-rings measures at 5 – 20 years or more.

The fact that all the trees in which the last peripheral ring has been preserved were felled either during the autumn or winter months may be explained on two accounts. The first concerns wood working traditions. (Mylnikov, 1999: 21). The Arjan-2 burial constructions and the inner frame of grave 5 in particular reflect the fact that the population of Arjan-2 must have had a developed tradition of wood working. Secondly, the mountain steppe environment of the intermountain troughs of the Sayan-Altai supports stable animal husbandry with a vertical seasonal migration pattern. In the summer months, highland pastures were used, whereas in the winter months the livestock would have grazed on open meadows at lower altitudes less covered with snow. The most ideal winter pastures are situated in the wide, marshy valley of the Uyuk River (near the village of Arjan). The presence of reed and high grasses free from snow cover encourages winter grazing. Here heavy winds remove the snow from the gentle, mountain slopes, providing forage for sheep and horses (Griaznov, 1980). The population size and resources of this relatively limited valley area would therefore have been maximized in the autumn and winter making it possible to construct labor-consuming "royal tombs."

Conclusions

The present study shows that the trees used in the constructions of graves 5 and 2 were felled in the same year at some point during the autumn or winter. As such one may also suppose that the various Arjan-2 burials were constructed simultaneously. Samples from grave 11 suggest that the trees used in that coffin were felled if not during the same year, then certainly within a narrow chronological time span.

The dendrochronological analyses of wood samples from Arjan-2 have made it possible to construct a "floating" tree-ring chronological scale spanning a period of 200 years. In the future, when the results of similar analyses of wood samples from burial mounds in the "Valley of Kings" (including Arjan) become available, it should become possible to extend this scale in both directions. The tree-ring technique could then be applied more widely both in producing dating antiquities and in resolving various ongoing issues of chronology in the nomadic culture of eastern Central Asia.

References

Bykov N.I., Bykova V.A., Sljusarenko I.Y. 2005
Burial constructions in the studies of wood utilization in the Pazyryk culture. *Archaeology, Ethnology and Anthropology of Eurasia*, N 2: 60 – 67.

Chugunov K.V., Parzinger H., Nagler A. 2002
An elite burial of the period of early nomads in Tyva. *Archaeology, Ethnology and Anthropology of Eurasia*, N 2: 115 – 124.

Griaznov M.P. 1980
Arjan. Leningrad: Nauka.

Ferguson C.W. 1969
A 7104 year annual tree-ring chronology for Bristlecone pine, Pinus aristata, from the White Mountains, California. *Tree-ring Bull.*, vol. 29, N 3/4: 3 – 29.

Holms R.L. 1984
Dendrochronological Program Library: Laboratory of Tree-Ring Research. Tucson: Univ. of Arizona.

Mylnikov V.P. 1999
Obrabotka dereva nositelyami pazyrykskoi kultury. Novosibirsk: Izd. IAE SO RAN.

Mylnikov V.P., Parzinger H., Chugunov K.V., Nagler A. 2002
Elitnoe pogrebalnoe sooruzhenie iz dereva v Tuve. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territoriy: Materialy godovoi sessii Instituta arkheologii i etnografii SO RAN 2002 g.*, vol. 8. Novosibirsk: Izd. IAE SO RAN, pp. 396 – 402.

Rinn F. 1996
TSAP V3.5. Computer program for tree-ring analysis and presentation. Heidelberg: Frank Rinn Distribution.

Shiyatov S.G. Vaganov E.A., Kirdianov A.V., Kruglov V.B., Mazepa V.S., Naurzbaev M.M., Khantemirov R.M. 2000
Metody dendrokhronologii: Uchebnoe posobie. Pt. 1: Osnovy dendrokhronologii. Sbor i poluchenie drevesno-koltsevoi informatsii. Krasnoyarsk: Krasnoyarsk. Gos. Univ.

Zakharieva E.I. 1976
Dendrohronologicheskoe issledovanie kurgana Arjan. *Sovetskaya arkheologiya*, N 1: 100 – 106.

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ADAPTIVE CHANGES IN THE CLOTHING OF ANCIENT IMMIGRANTS IN THE NORTH: THE CASE OF PULLOVER CLOTHING AMONG SIBERIAN NATIVES

Introduction

Early populations of the North with its severe climate (low winter temperatures, long winters, constant need for warm clothing, permanently heated dwellings, etc.) had to adapt their entire material culture to extreme conditions. Clothing is the key element of this adaptation. In many traditions, it falls into several basic types such as that used for hunting, traveling, sleeping, holidays, dancing, rituals, burials, etc.

For migrants to the North adaptive changes have affected all basic features of clothing: fabric, cutting, and decoration. These changes were so profound that some of them have survived after many centuries. However, decoration and design, being elements of the ideological system, were less affected by innovations.

Adaptive changes in Samoyed clothing

N.F. Prytkova (1970) identified changes that occurred with the Samoyeds in their traditional clothing with an open front. The Samoyeds came to the northern regions of Western Siberia from the south, and their traditional clothing was changed under the impact of the local pre-Samoyed population as well as climatic conditions. Prytkova has shown that the construction of clothing can be regarded as a reliable and valuable historical source of information concerning both the origin of traditional garments and the history of an ethnic group.

Prytkova succeeded in her attempts to reconstruct the clothes of early Uralic-speaking populations of Western Siberia. She identified methods for the adaptation of clothes which originally were open in the front into items which were closed in the front, because the latter pullover type of clothing was better adapted to the severe climate of the North. She proved that Samoyed tribes migrated to Western Siberia from the Sayan Mountains and brought their typical clothes with an open front. This type of attire was used by both men and women. Prytkova argued that the original type of clothing with an open front was used by all the Samoyed tribes both in the past and present; however, comparative analysis of cutting patterns of the whole diversity of existing types has shown that the major common characteristic of the Samoyed attire is the absence of longwise construction seams at the sides. The original form of such attire resembles a wrap and was initially made of a complete animal hide. Hides were worn with the tail at the top. Two cuts at the sides served as the armholes, to which sleeves were attached. Such an overcoat has a round collar and seams at the shoulders. The two front parts overlap one another from collar to waist. Below the waist, the front parts were narrow, slightly covering the hips. The lower edge was straight. In other words, it was the typical southern variant of a garment with an open front resembling but not identical to the so-called "Tungus tail-coat" (Ibid.: 26). Such garments were short and had neither edgings nor other fur details to make the coat longer and warmer.

Museum collections and ethnological data of the end of the 19th – first half of the 20th century show that in Western Siberia, the gown-like attire with the open front (consisting of two lateral parts) was still used as the Samoyed women's garment, as home and sleeping outfits of Nenets men, and as Selkup men's overcoats. Such type of attire is also portrayed on all the male cult figurines of the Nenets. The male Samoyed upper clothing was changed into attire with a closed front, i.e., the pullover type of clothing, under the conditions of the North.

Prytkova also identified two major techniques of transforming the southern garment with open front into a pullover:

1) a narrow piece of animal hide was inserted between the front parts from neck to hem; triangular wedges were added to the back part of the hem (Fig. 1);

2) foreparts were tightly sewn together from neck to waist; a large semi-circular piece was inserted at the front from the waist to the hem (Fig. 2).

Ethnographical records contain information on other technologies of construction of pullover garments. The ancient hunting clothing *scrad* represents a complete animal hide covering the head, back, and sides. It was modified with additional pieces of hide covering the chest and belly. Such a new type of clothing was constructed under the influence of local groups of Arctic natives. According to Prytkova, three cutting patterns of men's garments were worked out by the Samoyeds under the influence of Arctic clothing styles:

1) two whole deer hides were sewn together at the sides leaving spare arm holes for sleeves; the hides were sewn with the fur inside and the tail part to the bottom; the hem was edged with a wide band of hide with the fur outside (the Nenets) (Fig. 3);

2) two rectangular hides served as the front and back parts of an overcoat; at the sides, two narrower pieces were sewn in; long cuts were made in those lateral parts that served as armholes with large gussets; the upper part of such clothing was made in the form of a yoke (sometimes only in the front or back); the bottom was edged with a wide band of fur (the Nenets) (Fig. 4);

3) the torso consisted of two major elements: the upper (from neck to waist) and the lower pieces.

A characteristic feature of such garments is that they had no longwise seams at the sides (the Nganasan).

Prytkova correlated the recognized Samoyed pullover type of clothing with the relevant attire of the Paleo-Asiatic populations. The latter three cutting patterns have been regarded as analogous to the open garment of people inhabiting Northeastern Siberia: the first and the second patterns have parallels in traditional clothing of the Koryaks and Chukchi, while the third pattern and some elements of ornamentation have analogies in clothing of the Asian Eskimos. Hence, Prytkova hypothesized the existence of a common origin of various types of

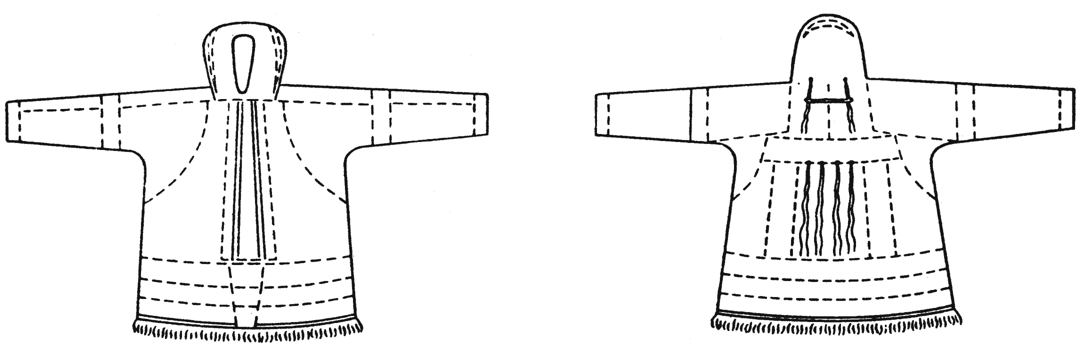

Fig. 1. Nganasan men's outerwear.

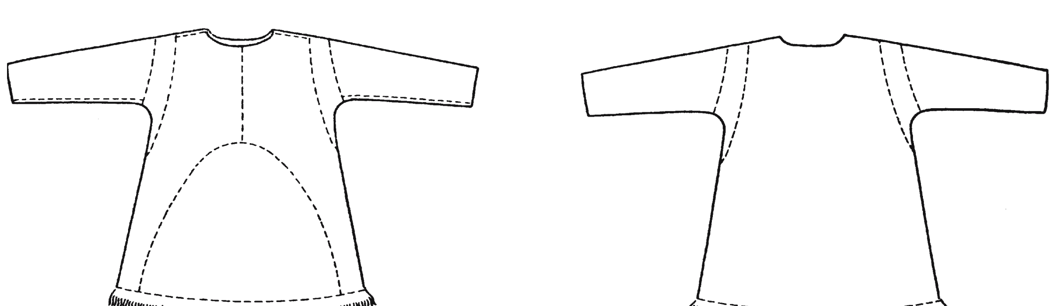

Fig. 2. Nganasan men's clothes.

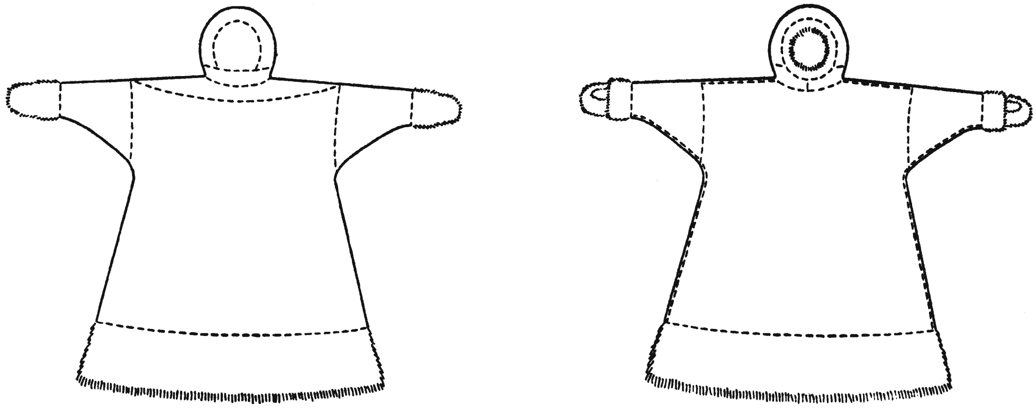

Fig. 3. Nenets men's *malitsa*.

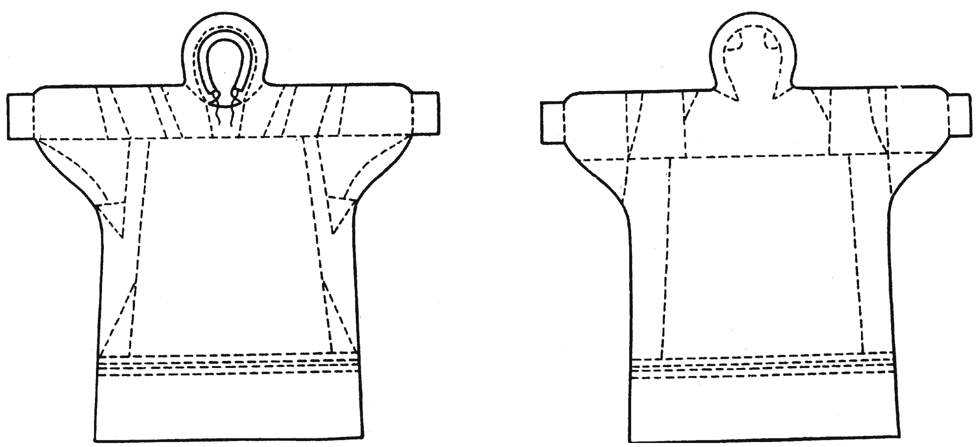

Fig. 4. Nenets men's *sokui*.

clothing. It cannot be excluded that this origin was in the clothing of some ancient Arctic natives (Ibid.: 94), that is, the pullover type of some ancient, pre-Samoyed population of Western Siberia as well as that of some autochthonous populations of Central and Eastern Siberia representing a kindred Uralic ethnic substrate (Simchenko, 1976).

Adaptive changes in the clothing of the Paleo-Asiatic populations

Y.B. Simchenko argued against the idea that traditional clothing of native Siberian populations was mostly of a pullover type. He believed that it was typical of the sedentary population of the Arctic zone, whose subsistence was based on the hunting of sea animals. The closed cut of year-round clothing was stipulated by climatic conditions and features of their basic economic activities. In Simchenko's viewpoint, the garment with two front parts and an additional chest-covering piece is more convenient for the sub-Arctic forest zone. Such well-adapted hunting attire is still used by most Tungus-speaking population groups and Yukaghirs nowadays (Ibid.: 174). Simchenko inferred to the possible co-existence of two major types of clothing in the circumpolar culture of wild reindeer hunters of northern Eurasia. Preferences in types of clothing are linked with the environment-climatic zone: close pullover clothing is mostly used in the Arctic coastal zone, while open clothes with a chest cover is used in the sub-Arctic forest zone. However, the Tungus-speaking population group does not belong to the circumpolar culture of reindeer hunters. The Tungus dispersed over Siberia during the later periods, most likely during the early Metal Age. The use of open clothing in the Yukaghir culture has been defined as an example of cultural borrowing from the Tungus culture (Johelson, 2005; Yukagiry, 1985).

In addition, the Even people (northern Tungus) populating the Arctic and sub-Arctic zones of Central and Eastern Siberia kept using their traditional open-type clothes despite the climate, while the pullover attire (*kukhlianka*) was borrowed from native populations and is still used for traveling and hunting clothing (Alekseyeva, 2003; Istoriya…, 1997). The *kukhlianka* overcoat is also used by northern Yakutian reindeer herders (Gurvich, 1977). In other words, the traditional clothing of immigrant populations (the Even – northern Tungus and the Yakut) of Central and Eastern Siberia demonstrate the same adaptation trend of the originally southern types of clothing to climatic conditions of the Arctic as what has been identified in the Samoyed peoples by Prytkova.

When describing clothing of the circumpolar cultural unity of northern Eurasia, Simchenko mentioned works of V.P. Monastyrskaya, who did comparative research of traditional attire of the Chukchi, Koryaks, Itelmen, Aleut, and Eskimos of Asia and America. She classified traditional garments by the construction of various types of pullover clothes. According to Monastyrskaya's analyses, there are two distinct groups of traditional clothing: the Chukchi–Koryak and the Eskimo–Aleut clothes. Characteristic features of Chukchi and Koryak clothing suggest their common origin. When comparing the Chukchi–Koryak apparel with the Eskimo and Aleut–Itelmen items, Monastyrskaya came to the conclusion that the Chukchi–Koryak garments originated from the open type of clothing with a chest piece resembling the Tungus clothing. This type of dress is directly correlated with hunting on foot. Monastyrskaya argued that the Chukchi–Koryak apparel is unlike the garment used for hunting sea animals. The latter category is further subdivided into the Eskimo and the Aleut–Itelmen types. The latter two types have one common feature: a complete front part of a poncho type (Simchenko, 1976: 174). Despite the seeming homogeneity, traditional clothing of all the population groups under study can be subdivided into a number of major types that developed from different original forms. The diversity of original forms might be a result of ethnic-cultural diversity in the past (Ibid.).

Monastyrskaya's inferences can be taken as illustrations of the uniformity of adaptive changes in traditional clothing of the peoples populating Western Siberia and the Arctic coast of Northeastern Asia. The general tendency can be defined as follows. Native populations of Northeastern Asia (Eskimos, Aleut, and Itelmen) have preserved their traditional clothing and major cutting patterns until the present. However, the traditional apparel of immigrant populations (in Monastyrskaya's viewpoint, ancestors of the modern Chukchi and Koryaks; their ancestry was most likely mixed) have been modified considerably in the course of adaptation. Adaptive changes are reflected in cutting patterns of the upper- and full-body garment and in transformation of the open garment types into closed garments.

It is noteworthy that such changes have become stable and are still present in the traditional garments of these population groups. Thus, the examples of traditional clothing from Central and Eastern Siberia (northern Tungus and Yakut) which were reviewed as well as those from Northeastern Asia allow us to identify the general adaptive changes in clothing of immigrant populations of the Arctic and sub-Arctic zones. This transformation of the originally open apparel into pullover clothes has been noted throughout the vast region of northern Eurasia, which has a mostly similar environment and climatic conditions and testifies to similar adaptive processes.

It may be asked why the Samoyeds have preserved their original open type of traditional garment, whereas the Chukchi and the Koryaks have not. Several facts should be considered:

– the environment and climate of Northeastern Asia are harsher than in Western Siberia;

– other relevant factors include time of immigration, number of immigrants, length of the immigration period, and the area occupied by the immigrant population by the end of that period;

– also important is whether or not the immigrants maintained direct or indirect contacts with their homeland;

– it should be asked whether the immigrant Samoyeds were linguistically and ethnically akin to the native pre-Samoyed (possibly Uralic-speaking) populations;

– possibly, all clothing worn by autochthonous populations of the extreme Northeastern Asia was of the pullover type, and the custom may have been borrowed by the immigrants. In contrast, the natives of Western Siberia may have been familiar with the open type of clothing prior to the immigration of the Samoyeds, probably due to earlier migrations from the south.

Conclusions

The comparison of results obtained by Prytkova and Monastyrskaya reveals certain parallels between the pullover clothing of the Yenisei natives and of the Northeastern Asians. Specifically, Prytkova points to similar cutting patterns of pullover clothing without side seams worn by Nganasan reindeer-breeders and that of the Aleut and Eskimo sea hunters and fishers. However, constructive features of clothing worn by peoples inhabiting the tundra and taiga zones of Central Siberia, i.e., territories separating the Samoyed and the Northeastern Siberians, are virtually unknown. It seems reasonable to assume that this clothing resembled that worn by ancient inhabitants of the Yenisei region and of

Northeastern Siberia. The analysis of pre-Tungus clothing of Central Siberia (an area evidently inhabited by remote ancestors of modern Yukaghir, who were possibly related to early Uralians) and that of the immigrants such as the Tungus (Evenki and Evens) might yield important results. This analysis would help answer several important questions: (a) whether or not pullover clothing existed in native Central Siberia; (b) if it did, what were its common and particular features, and (c) whether it resembled Samoyed and Northeastern Siberian pullover clothing.

No less important than constructive features are the material and the decoration of Central Siberian clothing. Their study will hopefully shed light upon a number of unresolved questions in the history of the Siberian population.

References

Alekseyeva E.K. 2003
Ocherki po materialnoi kulture evenov Yakutii (konets XIX – nachalo XX v). Novosibirsk: Nauka.

Gurvich I.S. 1977
Kultural severnykh yakutov-olenevodov: K voprosu o pozdnikh etapakh formirovaniya yakutskogo naroda. Moscow: Nauka.

Johelson V.I. 2005
Yukagiry i yukagirizirovannye tungusy. V.H. Ivanov, S.I. Ivanova-Uvarova (trans.). Novosibirsk: Nauka.

Istoriya i cultural evenov: Istoriko-etnografichekie ocherki. 1997
St. Petersburg: Nauka.

Prytkova N.F. 1970
Odezhda narodov samodiiskoi gruppy kak istoricheski istochnik. In *Odezhda narodov Sibiri*. Leningrad: Nauka, pp. 3 – 99.

Simchenko Y.B. 1976
Kultural okhotnikov na olenei Severnoi Evrazii: Etnograficheskaya rekonstruktsiya. Moscow: Nauka.

Yukagiry: Istoriko-etnograficheski ocherk. 1985
Moscow: Nauka.

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PHOTOETHNOGRAPHY

THE NORTHWESTERN ALTAI: FOUR SEASONS

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AUTUMN. WEDDINGS IN YAKONUR. THE CLAN MOVEMENT AMONG THE ALTAI NATIVES: THE PAST AND PRESENT

The Altai Republic is situated in the southwestern part of Siberia in the center of Eurasia. It is located at the border of Russia with China, Mongolia, and Kazakhstan. The Altai Republic also borders other parts of the Russian Federation: the Republics of Tyva and Khakassia, the Altai Territory, and the Kemerovo Province. According to the 2002 population census, the total number of permanent residents in the Republic is 202.9 thousand including an urban population of 53.5 thousand, and a rural population of 149.4 thousand.

There are ten administrative regions in the Republic, including one city and 243 rural communities. The Altai people mostly inhabit the central, western, and southern regions of the Republic (Ongudai, Ust-Kan, Ulagan, Shebalino, and Kosh-Agach Regions). The proportion of indigenous population is 33 %. The Russians mostly populate the northern regions (Maima, Choi, Turochak, Chemal, and the southeastern part of Ust-Koksa); they constitute 63 % of the Republic's population.

Established in 1922, the Oirot Autonomous Province was later renamed as the Gorno-Altai Autonomous Province. Establishment of national autonomy facilitated formation of sustainable territorial, economic, and cultural ties between various Altai ethnic communities, preserving their original language and culture.

In June 1991, the Autonomous Republic was renamed the Gorno-Altai Soviet Socialist Republic, and in May 1992 it became the Altai Republic. Since the early 1990s, there has been marked growth in the sense of ethnic identity among the native people of the Altai. Ideas of national revival have become the keynote of public life in the Republic. In the mid-1990s, foundations, associations, and other public organizations dealing with the protection of social, economic, and cultural rights of the indigenous population constitute about one half of all the officially registered social institutions. A search for models of future development has been oriented towards the values of a traditional way of living. These ideas have served as basis for the following acts: *The Concept of National Schools of the Altai Republic* (1992) and the *Law on the Historical-Cultural Heritage of the Peoples of the Altai Republic* (1994).

The program of national school development, scheduled for 1992 – 2010, focuses on the "development of national identity through the involvement of the new generation in the maintenance of the spiritual and cultural values of their people, and through the comprehension of the place and role of these ethnic values in world culture. The rise of ethnic consciousness will contribute to a mutual enrichment of peoples, to the development of national culture, language and ethnic uniqueness, and to the restoration of the sense of historical memory, pride, self-esteem, and identity" (Kontseptsiya natsionalnykh shkol…, 1992: 3 – 4). The educational program, aimed at elaborating an optimal model for shaping intelligent people through an obligatory assimilation of the traditional ethnic culture and modern civic education in the Republic, is based on the concept of "ethnic personality" (Ibid.: 3 – 4).

The key element in the development of ethnic identity among the native people of the Republic is knowledge of their clan affiliation. Clan structures of the Altai native society have maintained their function within several interchanging political and administrative systems. The traditional social organization of Altai natives was hierarchical. It emerged within the structures of Central Asian nomadic empires and passed through certain transformations in the course of political, historical, and cultural changes. In 1756, the Royal Russian Collegium for Foreign Affairs issued an act on the procedure of naturalizing "Mountain Kalmyks" of the Altai.

By that time, in the Altai there were five *diuchinas* (tax-administrative districts) populated by "loyal Kalmyks" that paid taxes to the Russian State and that existed since the period of Jungarian rule, and two diuchinas of double taxation in the Chuya region that were later transformed into volosts*. A diuchina consisted of several clans, or *seoks* (*seok* means 'bone') that united extended families, 'patronimias,' which were linked by family relations.

The first five diuchinas were believed to have emerged as families of the five *zaisans* (heads of clan–seoks): Kypchak, Irkit, Todosh, and Mundus, that were naturalized in the Russian Empire. The title of zaisan was borrowed by the Altaians from the Western Mongolian state together with its administrative system. When the Altai was included into the Russian State, Altai traditional formal structures (clans and diuchinas) were preserved in the new system of administration and taxation.

Zaisans are representatives of the largest seoks that were the cores of municipal units: diuchinas and volosts. Hereditary *uktu zaisans* were the most respectable. In the late 19th century, this title was awarded to six Altai zaisans, leaders of the first (seok Mundus), second (seok Kypchak), third (seok Todosh), fourth (seok Irkit), and fifth (seok Todosh) diuchinas, and the first Chuya volost (seok Tölös) (Oktyabrskaya, 1997: 57).

By the end of the 19th century, there were seven Altai diuchinas. According to the population census of 1897, there were 36 Altai family clans that were included in various administrative and fiscal structures. In the late 19th century, the second diuchina included up to 60 % of the representatives of Kypchaks; the third and the fifth diuchinas mostly united Todoshes; in the fourth diuchina, almost 87% of all the members were Irkits. The sixth diuchina, separated from the second one, was mostly comprised of Tölös forming 84 %; the seventh diuchina, separated from the fifth one, was mainly composed of Maimans (Naimans) (84 %). Smaller seoks joined the large ones, for instance, the fourth diuchina included representatives of 19 clans in addition to Irkits (Sherstova, 2005).

Clans were stable unions based on people's belief in their common ancestry and mythic past rather than on economic and territorial unity. The clan name was a consolidating symbol. Tribal units, based on the classificatory kinship system and patrilinearity, maintained exogamy and avunculate, had their own sacred places and a complex system of attributes: a hero ancestor, a worshiped mountain and a tree, a taboo bird or animal, and a sacred token among others.

Members of a single seok were considered to be relatives. Each seok consisted of several smaller unions, for instance the Kypchak seok included Kodonchi, Koton, Ak, Tuzhat, Diyat, Sary, Suras, Shodon; that of Sagal included Sary, Mogol, Kara, Ak, Bai; and Kobok was comprised of Ak, Kara, Tas, Mogol, etc. Most seoks formed kindred groups. For instance, Kypchak, Mundus, and Kergil formed a single kindred group, and Todosh, Chapty, Ochy were also kin (Tadina, 1995: 24).

Traditional clan institutions played important roles in the life of the common people. They served as the basis for self-organization of nomadic communities.

The major functions of clans included that of maintaining social unity through economic and normative relations, through reference to common historical backgrounds, and regulation of preferential (cross-cousin) marriages. Knowledge of any Altai citizen about belonging to a particular clan was the prime basis determining the right to use a particular hunting area, mutual assistance of members of a single clan in economic activities (i.e., in cases of cattle blight, during epizootic disease, building a house, at hay time, in collecting bride-money, in arranging wedding festivals, etc.). Belonging to a certain clan regulated relations between a member of society and the people around him, with blood and non-blood relatives (Shatinova, 1981: 35).

In the 19th – early 20th centuries, processes of "clan concentration" and clan enlargement within the territory of a particular diuchina took place in the mountain-steppe zone of the Altai. The reason for these processes was the limitation of diuchina territories and growing significance of inter-diuchina marriages. Establishing social groups on the territorial-clan basis, "secondary clan formations," stipulated processes of ethnic consolidation in the central regions of the Altai. Clan and diuchina-based institutions gained certain political features.

The incorporation of Altai native societies in the Russian state was accompanied by the strengthening of tribal principles in all spheres of life. Archaic as they were, these principles proved viable and adaptive under socio-political changes.

In the late 19th century, the administrative system of the Russian Empire became more unified. In the 1880s, the diuchina administration system was changed; the status of zaisan corresponded to that of an elder: this position became elective and its tenure was limited to three years. The Altai people perceived these innovations as an infringement of their century-long traditions. The process of separation of diuchinas began. Throughout the 19th century, the Altaians gathered at conventions

* Volost, a small administrative peasant division in Russia.

(*shulgans*) of all the seven diuchinas. The last All-Altaian convention took place in Ust-Kan in 1886 (Sherstova, 2005).

By the end of the 19th century, the inter-diuchina system of self-administration broke down. The first diuchina occupying the right bank area of the Katun River populated by the Russians, separated from the Altai union. Later, two smaller ethnic-political unions emerged. One union comprised the second, third, and fourth diuchinas organized in the course of naturalization of the Altai people as the citizens of the Russian Empire. Another union comprised the fifth, sixth, and seventh diuchinas. Representatives of the new Altai elite, like the Kuldzhin brothers, renowned Altai entrepreneurs, became leaders of these new unions. The unions competed with one another (Ibid.). Confrontation of the leaders hampered the process of consolidation.

Eventually, however, the amalgamation of secondary clans, the leveling out of cultural and economic differences, and the formation of a common dialect in central Altai, where six diuchinas were moving between the rivers Charysh, Kan, Anui, Kenga, and Katun, resulted in the emergence of Altai-Kizhi – a group that became eponymic to the entire Altai native community. An important factor of its integration was the strengthening of national ideology, which, in 1904, culminated in the emergence of a national form of the Burkhan religion – the so-called White Faith of the Altai.

After the new religious doctrine demolishing inter-clan religion variations had been proclaimed, the Kuldzhin brothers, leaders of the seventh diuchina, took up the pro-Burkhanism position and opposed hereditary zaisans of the second, third, and fourth diuchinas. The Kuldzhin brothers argued that all the Altai diuchinas should be united under the rule of a "supreme zaisan" proclaiming the true, monotheistic religion.

The consolidation process, which developed in a religious form, was terminated by the administrative and legal structures, who were concerned about growing inter-ethnic tension and separatism caused by the rise of religious reformation in the Altai.

A trial of the Burkhanist leaders and the subsequent socio-political developments in the Altai led to the rise of the ethnic and tribal identity of the natives. In the early 20th century, renowned representatives of the first generation of Altai intelligentsia added their clan name to their family names: Tiber-Petrov, Choros-Gurkin, Chagat-Stroev, and Mundus-Edokov among others (Shatinova, 1981: 19).

In the 1920s, when the Soviet regime gained a foothold in the Altai, the natives were granted the right to self-determination in the form of ethno-territorial autonomy. The contradictory nature of the Soviet policy toward natives, supporting political autonomy while boosting internationalism and unification as opposed to ethnic specificity, eventually backfired, leading to an independence movement in the late 1900s.

In the post-Soviet period, the ethno-political reshaping of the multiethnic society of the Altai was accompanied by a large-scale revival of the traditional tribal system. Return to the archaic social structure became a factor in ethnic modernization. This principle was first tested by the Soviet administration as early as the 1920s, when the *Provisional Rules of Administration of Natives in the Northern Parts of RSFSR* were issued by the Central Executive Committee Presidium on October 26, 1926. Under these rules, the clan became a legal unit within the Soviet administrative system (Uvachan, 1970: 17).

In the Soviet leaders' view, the establishment of a clan-based local government at that time set the stage for the transition of northern native societies to autonomous rule according to ethno-territorial and economic principles. In December 1930, the Central Executive Committee Presidium passed the act *On the Establishment of National Units in Northern Regions Populated by National Minorities*. This marked the beginning of an administration system for natives as envisaged by the Soviet leaders (Ibid.: 18 – 19).

A new stage in the political development of clan structures took place in the 1980s – 1990s and was linked with social and political reformations in Russia.

Clan traditions of the indigenous population in the Altai were revived in the late 1980s, though local communities had always been arranged according to the principles of clan organization, and adapted to various social-economical and political reforms of the Soviet period. In 1932, in the course of the collectivization campaign in the Altai, L.P. Potapov, a renowned Russian scholar, wrote that members of all the Altai collective farms under study knew their own clan. Even three-year old children distinguished clans. For instance, small boys from the collective farm "Kyzyl Tan" in the Tolguek locality told their proper name and added the name of their clan (Potapov, 1932: 40). The name of one's clan was and still is significant for people. A question *Soogin ne*? (What clan?) is still quite common in the Altai.

In 1981, N.I. Shatinova, an author of profound research in the family relationships of the Altai peoples, wrote that as a result of considerable changes in the economy, politics, and culture of the Altai peoples that occurred during the Soviet period, belonging to a particular clan was no longer perceived as one of the most important factors determining all the sides of human life and behavior. However, clan identity was still regarded as one of the most important factors in marriages among the Altai peoples. Shatinova noted the formation of new marriage regulations in the Altai. New norms corresponded to the Soviet legislation and moral norms of modern life. Such traditional marital norms as marriages between close blood relatives, levirat, sororat, marriages between a grown-up girl and small boys, and marriages by agreement between parents no longer are found. However, such a marital norm as exogamic marriage was still observed. The general attitude toward violation of the rules of exogamy was negative (Shatinova, 1981: 35 – 36). According to the data of polls in the late 1970s, 77 % of Altai males and 79 % of females were for observance of exogamy requirements (Ibid.: 38). The clan was and still is the institution that secures the prosperity of the whole nation.

In the 1990s – 2000s, clan principles traditionally observed in private life were acknowledged by social structures in an attempt to overcome social crisis. In the Altai as well as everywhere in Russia, the 1990s were the years of disorganization of marital-family relationships and development of a demographic crisis. Social and economic problems produced a considerably bad effect on the family institution. Statistical data have shown that in the 1990s, such negative tendencies in the demographic situation as a low marriage rate and a high rate of divorce, low birth rate and high death rate were typical of the Altai. Other features are an increase of non-registered marriages, growing rate of extramarital births, lowering of reproductive family expectations, increase of age of people who marry for the first time, and transformation of traditional stereotypes in family relations (Zhenschiny i muzhchiny…, 2001). In such a social context, revival of traditional social institutions was perceived as a method of control over destructive modern tendencies. Legitimization of traditional positivistic legal structures took place together with the destruction of the unitary system.

In the summer of 1989, the first festival of the Maiman clan took place in the Ongudai Region. This festival was initiated by the elders of the clan. In 1990, the newspaper *Zvezda Altaya* (Altaian Star) published an article on the significance of the institution of clans in the development of the Altai Republic. “On July 7, the people of the Maiman clan held the first kurultai of their clan in Tekpenek, Ongudai Region. The hosts invited guests from other seoks and prominent people from other regions of the Altai. Among other honored guests at the Maiman festival there was Michael Porphirievich Scherbakov, who spent all his 90 years among the Altai people. The main aim of the modern seok is to unite people and provide help to everyone on the basis of clan and family relationships. It would be very good if everyone could turn to such pure sources.”

The Maimans elaborated on a program of the seok council including such headings as providing senior or handicapped citizens with help, upbringing the youth in folk moral traditions, assistance to the law machinery, and protection of the environment (Kuzmin, 1990: 4). Later, people of the Mundus, Kypchak, Tolos, Irkit, Todosh, and Sagal seoks also held their conventions. This national movement has become crucial for a public conception of the origins of the nation and its historical background as well as re-organization of the nation in the spirit of neo-traditionalism. It gave birth to such public associations as Tolostar, Mundustar, and Otok of the Maiman seok. In the 1990s, some seoks were re-organized into public associations and “clan parties,” like Keril-Berlik and Todosh (Oktyabrskaya, 1997: 52).

The political programs of the clan associations focused on the tasks of restoration of traditional customs, increasing the significance of mutual assistance within a clan, ecological problems linked with religious beliefs of the Altaians including such issues as determination of the status of mountains and other places regarded as clan sacred sites. Leaders of this national movement appeal to clan associations for help in “consolidation of all public organizations promoting cultural, spiritual, and economic prosperity of the country” (Kazantsev, 2006: 217).

Authors of the Charter of the Kergil-Birlic public association invite people to create and participate in projects aimed at revival of national culture, traditions and customs, handicrafts, revival of the ancient religious cults of Uch-Kurbustan, Ulten and Umai-ene, development of family and clan relations as a guarantee of sustainability of civic society. Leaders of the clan movement insist upon the preservation and maintenance of the natural, archaeological and historical heritage sites and monuments of early nomads, and studying historical and clan burial sites in the areas determined as the clan sacred places of the Kergil seok, and seoks akin to Kergil. It is important to develop public respect for the historical past of the nation and for family traditions, restoration of original features of tribes and clans including restoration of clan and family totems and other distinguishing features (Ibid.).

Leaders of the public association, Todosh establish similar objectives for their activities: protection of political, social, economic and cultural rights, freedom and interests of members of the Todosh seok; preservation of ethnic and historical backgrounds and the environment of the Altai people; development of the language and culture; and restoration of traditions, customs, and religion.

Members of clan associations took active part in activities of governmental bodies. A key feature in the development of the tribal movement is the political aspect. According to the Altai Republic *Law on Local Administration* (1999), the jurisdiction of tribal communities and their administrative bodies in regions with a predominantly native population extends to land utilization and to the protection of natural environment and of cultural monuments in areas controlled by rural communities.

This law was followed by the project of *The Law on the Clan Community of the People of the Altai*, designed to establish basic principles of the organization and functioning of tribal communities of the Altai-kizhi and other native groups, and to protect the traditional environment, lifestyles, and legal rights of natives under a market economy. The law is intended to define the legal bases of the rural community as a unit of the system of self-government, to define the state guarantees of its functioning, and its relationships with regional authorities and public organizations.

According to national leaders, the clan community of the Altaians (seok) is determined as an original and self-governing form of civic organization of individuals, families, and clans of the Altaians and other ethnic groups that are united by principles of blood-relations and/or neighborhood and common interests. Clan communities are formed for the sake of defense of their original locations, preservation and development of a traditional economy, way of life, different trades, and culture of an indigenous people. Currently, the process of legitimization of clan associations has ceased its development, clans are still active in managing family and clan relations, and serve as the primary mark in self-identification of the Altaians.

In the late 20th century, the institution of elected zaisans was established as a part of the process of restoration of the high social status of clans. The Maiman seok was the first clan where zaisan elections took place. In the course of development of the clan movement, the authority of new zaisans has increased and led to the establishment of local councils of elders all over the Altai. Traditional public organizations join the existing administrative-political system; this process determines further development of the ethno-political situation in the Republic. In 1993, a public organization Torgoo uniting Altai zaisans was established. The authority of the present clan chiefs rests on historical tradition and on the status of the twelve zaisans, who signed the naturalization treaty with Empress Elizabeth.

In the summer of 2006, the festival El Oiyn of the Altai Republic was held in the village of Elo. This festival was organized to celebrate the 250th anniversary of inclusion of the Altai in the Russian state. The major topic of celebration was: this great historical choice. The opening ceremony began with a theater performance showing the 12 heroes-zaisans, some of whose roles were acted by the leaders of modern Altai clans. This show was a symbol of continuity between the modern and historical elite. In this way, it provides the legal basis for the institution of zaisan and promotes its higher public and political status. Nowadays, the shaping of a nationwide ideology has become a focus of clan movement. The keynote in the political life of the Republic of Altai is the revival of the historical past, supposed to provide answers to present issues.

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References

Kazantsev A.Y. 2006

Etnopoliticheskie protsessy v Respublike Altai v kontse XX veka. In *Altai-Rossia: Cherez veka v buduschee*: *Materialy Vseros. nauch.-praktich. konferentsii*, pt. 1. Gorno-Altaisk: Izd. Gorno-Altaisk Gos. Univ., pp. 214 – 220.

Kontseptsiya natsionalnykh shkol i Programma razvitiya narodnogo obrazovaniya Respubliki Altai na perekhodny period. 1992

Gorno-Altaisk.

Kuzmin Y. 1990

I chist, i sviat rodnik. *Zvezda Altaya*, July 20: 4.

Oktyabrskaya I.V. 1997

Tyurki Altaya: Problemy mezhnatsionalnogo soobschestva. In *Narody Sibiri: Prava i vozmozhnosti*. Novosibirsk: Izd. IAE SO RAN, pp. 48 – 60.

Potapov L.P. 1932

Poezdka v kolkhozy Chemalskogo aimaka Oirotskoi avtonomnoi oblasti. Leningrad.

Shatinova N.I. 1981
Semiya u Altaitsev. Gorno-Altaisk: Gorno-Altaisk. otd. Altai. kn. izd.
Sherstova L.I. 2005
Tyurki i russkie v Yuzhnoi Sibiri: Etnopoliticheskie protsessy i etnokulturnaya dinamika XVII – nachala XX veka. Novosibirsk: Izd. IAE SO RAN.
Tadina N.A. 1995
Altaiskaya svadebnaya obriadnost XIX – XX vv. Gorno-Altaisk: Uch-Sumet.
Uvachan V.N. 1970
Sotsialism i narody Severa. D.Sc. (History) Dissertation. Moscow.
Zhenschiny i muzhchiny v Respublike Altai: Kratki statisticheski sbornik. 2001
Gorno-Altaisk.

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1. **S. Zelenski.** Fall at the Kelei Mountain Pass.

The Altaians named their religion ak jan, 'White Faith.' The brilliant white colors of ritual ribbons and sheets symbolize the purity of their beliefs and prayers. White milk, a white wedding curtain, white snow in October, and a white growing moon have been perceived as harbingers of the bright happiness of a new family.

2. **S. Zelenski.** A white curtain is among the most significant features of a wedding ceremony.

3. **S. Zelenski.** Birch branches on top of an *ail* (traditional Altai dwelling) symbolize marriage celebrations.

The wedding space is formed by symbols modeling the traditional worldview. Clan sacraments such as white ribbons, birch and juniper twigs, and the hearth combine with signs of the modern age. Sparkling garlands surround a placard with a traditional saying (alkysh): "Two logs join – let the flames be bright. Two children join – let the family be happy."

4. **S. Zelenski.** The nephew of the bride or bridegroom is an important person at the wedding.

5. **S. Zelenski.** Elder women-relatives escort the bride to her bridegroom's home.

"There is nothing as important as fire" is the most popular saying when people sit around the fire. Centuries have passed by, but for a nomad, the fire in a hearth providing warmth and protecting the family is the highest value and true spirit of a home. People still address the fire with a traditional prayer: "Fire – Mother with four umbilical cords. Fire – Mother with white flames. You have united families with your yellow ribbon as in a frame."

6. **S. Zelenski.** Bridal hearth ready for the ritual of "treating fire."

7. **I. Lagunov.** The bridegroom’s uncle is another important person at the wedding.

Tai, the mother’s brother, is among one’s closest relatives. The uncle participates in upbringing the children of his sister and in matchmaking. He performs the first worship of the family hearth for his nephew. Three white ribbons, three strips of raw fat, and three juniper twigs are attached to a tripod. People make three rounds of the hearth according to the sun, and pour fat into the fire. The high flames in the fire warrant future happiness.

8. **I. Lagunov.** “Treating fire” offers prosperity for a new family.

9. **I. Lagunov.** Ritual plaiting of a bride's hair into two braids.

The major ideas of an Altai wedding are those of transition and transfiguration. A bride hides herself behind a wedding curtain and takes on the new look of a married woman. Assistants brush her hair, soak it with milk, and plait it into two braids. Only upon changing her image does the bride appear again in front of the guests. One of the relatives of her husband throws open the curtain with a whip handle or a gun butt to reveal the face of the bride. According to the rite, she treats all the people present with a bowl of milk and listens to their good wishes. The ritual opens communication with new relatives and helps to establish good relations.

10. **I. Lagunov.** A bowl of milk is a symbol of the holiness of marriage.

11. **I. Lagunov.** Wedding table.

Family and marriage are crucial not only for a separate individual but also for the whole clan in general. It warrants prosperity and continuity of life through the changing of generations. Marriage is a public act. Clan communities share the expenses and efforts of creating a new family, thus establishing close mutual relations. The wedding ritual is perceived as a secure foundation of an agreement between clans that has been supported by all possible means including exchange of gifts and abundant food.

12. **I. Lagunov.** Traditional cauldrons for cooking wedding food.

13. **I. Lagunov.** Waiting for a bride price.

The traditional Altai wedding includes the display of mock antagonism, mutual joking, and ridicule. The idea of an inherently contradictory unity of two opposed elements, male and female, is extended to the relationships between the clans. Step-by-step, the wedding rite overcomes the symbolic opposition of two family clans. The playful essence of the festival makes it easier for people to cope with tension. The new family emerges as an entity equally belonging to both clans.

14. **I. Lagunov.** Bridegroom's trials.

15. **S. Zelenski.** Just married. Yakonur, October 2005.

In a traditional Altai marriage, the union between a man and a woman is celebrated through rituals of conjoining. The two fortunes are bound together, interwoven and put together in the same way as threads, locks of hair or sheets of felt to form a new whole – a family.

16. **I. Lagunov.** The most “interested” spectators.