THE LITHIC INDUSTRY OF OBI-RAKHMAT GROTTO, UZBEKISTAN

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ABSTRACT

The analysis of the Obi-Rakhmat archaeological materials provides us with data suggesting a process of gradual transition from the Middle to Upper Paleolithic occurring in western Central Asia. The chronometric dates available for the site indicate that the developmental processes described above occurred prior to 50,000 years ago. This new adaptation was based on Levallois technology aimed at the production of laminar blanks. The Obi-Rakhmat industry demonstrates technical and typological features similar to those noted in Late Mousterian and early Upper Paleolithic complexes in Southwest Asia and the Russian Altai.

INTRODUCTION

Northwestern Central Asia has recently been the focus of archaeological research due to the fact that this territory represents a “transitional bridge” connecting the most ancient human populations of East Asia with western Eurasia during the Paleolithic. Information accumulated during the past 10 to 15 years provides new insight into the Stone Age history of human culture in Northwestern Central Asia, particularly the history of the Middle to Upper Paleolithic transition. Initial Upper Paleolithic (IUP) industries in this region were based on several variants in the technological evolution of stone reduction strategy. Industries of this kind have been reported from many regions: Central and Southeastern Europe (Bohunice and Stranska Skala); Southwest Asia (Boker-Tachtit); western Central Asia (Obi-Rakhmat and Khudji); and the Gorny (Mountainous) Altai (Kara-Bom and Ust-Karakol-1) (Svoboda and Bar-Yosef 2003; Brantingham et al. 2004). Apparently, IUP industries associated with particular regions demonstrate a number of specific local features. Nevertheless, certain common technical and typological features can be identified, of which the most important are: (1) the predominant production of blades removed from cores exhibiting a combination of Upper Paleolithic and Levallois features; (2) the appearance of the Upper Paleolithic technique of core striking platform preparation; (3) a high index of faceting; (4) the predominance of elongated points within the category of Levallois spalls; (5) a dominance in assemblages of Upper Paleolithic tools (grattoirs, burins, chisel-like tools, and backed knives) and retouched blades (including pointed blades) (Kuhn et al. 1999).

The roughly contemporaneous appearance (c. 50,000-40,000 years ago) of these IUP complexes together with the common technical-typological features of these collections allows us to make inferences about the transcontinental character of blade industries attributed to the early periods of the Upper Paleolithic. The reason for this unification of industries appears to be very complex. Whether it is the result of convergent technological development (an adaptation-functional model) or whether the similarity developed through phylogenetic connections between the bearers of early Upper Paleolithic cultures is unknown at present. In our opinion, the resolution of this problem is closely connected with the more general issue of the initial appearance and subsequent occupation of Eurasia by anatomically modern humans (represented by the two main competing hypotheses of multiregional evolution and the ‘Eve hypothesis’) (Wilson et al. 1992; Thorne and Wolpoff 1992; Stringer and MacKie 1996; Oppenheimer 2003).

In this respect, the task of identifying the basis for the formation of local IUP complexes gains crucial importance. The leptolithic variant of Upper Paleolithic industries is typical for eastern Eurasia. These industries might have been outgrowths of local variants of Late Mousterian technologies of stone reduction, a hypothesis which seems to be in accord with models stressing convergent multiregional evolution of Upper Paleolithic cultures. On the other hand, many researchers argue that the Late Mousterian industries of South Siberia exhibit many features in common with industries reported from Southwest Asia (Okladnikov 1949; Derevianko et al. 1992, 1998; Ranov et al. 2000), and explain this fact as the result of possible migrations of early human populations. Recently, the possible migration of the bearers of a leptolithic variant of Levallois-Mousterian technology has been associated with the dispersal of archaic *Homo sapiens*.

The subsequent adaptation of anatomically modern humans bearing the above-mentioned Levallois-Mousterian technological tradition to new ecological niches might have occurred together with the coalescence of technological and behavioral characteristics of Upper Paleolithic culture. This kind of hypothesis explains the

Figure 1: Map of the Republic of Uzbekistan indicating the location of Obi-Rakhmat Cave and the topography of the site.

synchronic appearance of Upper Paleolithic industries over vast territories as well as their technical-typological similarity while exhibiting some variations specific to each particular geographic area. However, the notable drawback of this hypothesis is the existence of a considerable territorial lacuna in the known distribution of sites representing this transitional period over territories stretching from Southwest Asia to South Siberia. Recently, the sites of Khudji and Obi-Rakhmat have been investigated in western Central Asia marking one possible route of migration of Mousterian populations. As has been noted elsewhere (Derevianko et al. 1998, 1999), the Mousterian and IUP complexes associated with these sites reveal characteristic features similar to industries of Kara-Bom (located in the Altai mountains) affinity as well as to the transitional and Mousterian complexes of Southwest Asia. The present article is focused on an analysis of the Obi-Rakhmat lithic industry that represents the most thoroughly investigated Middle and Upper Paleolithic locality in western Central Asia; it has yielded a chronologically well-dated stratigraphic sequence of several metres.

GEOGRAPHICAL SETTING, ENVIRONMENTAL CONDITIONS, STRATIGRAPHY, AND CHRONOLOGY

The Obi-Rakhmat site was discovered in 1962 by an archaeological research team of the Institute of History and Archaeology, the Uzbekistan Academy of Sciences. Initially, excavations were carried out under the supervision of M.M. Gerasimov and H.K. Nasretdinov; in 1964-1965 the research was directed by R.H. Suleimanov (Suleimanov 1972); and in 1966-1986 T. Omanzhulov and K.A. Krakhmal carried out sporadic excavations at the site. In 1998, investigations at Obi-Rakhmat were renewed by a joint research team of the Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of Sciences, and the Institute of Archaeology, the Uzbekistan Academy of Sciences, under the direction of A.P. Derevianko (Derevianko et al. 1998, 1999).

The Obi-Rakhmat Grotto (N 41° 34’ 08,8"; E 70° 08’ 00,3"; 1,250 m above sea level (asl) is located 100 km northeast of Tashkent in the Republic of Uzbekistan (Figure 1). It lies in the western Tian Shan, a region characterized by diverse ecological conditions. The Central Asian desert borders it to the south, the Kazakhstan steppe and desert territories stretch to the north, and the eastern Tian Shan massif is situated to the east. The topography of the region consists of mid-elevation mountain ranges containing few high peaks. The site is located at the southwestern end of the Koksui mountain range in the western Tian Shan, near the junction of the Chatkal and Pskem Rivers, in the valley of the Paltau River, a tributary of the Chatkal. In the lower reaches of the Paltau, a shallow ravine stretching from north to south for about 500 m approaches the river. The ravine originates at a massive cliff of Paleozoic limestone containing the Obi-Rakhmat Grotto. Above the cliff, there is a linear depression. Here, a brook originates from a spring, with a small waterfall at the entry of the grotto, flows further along the ravine bottom, and joins the Paltau. The cliff containing the grotto borders the southern gentle slope of the Karatut-Bashi Mountain, exposing bedrock (limestone in various states of silicification) and taluses providing the raw material provenance for the early stone tool producers.

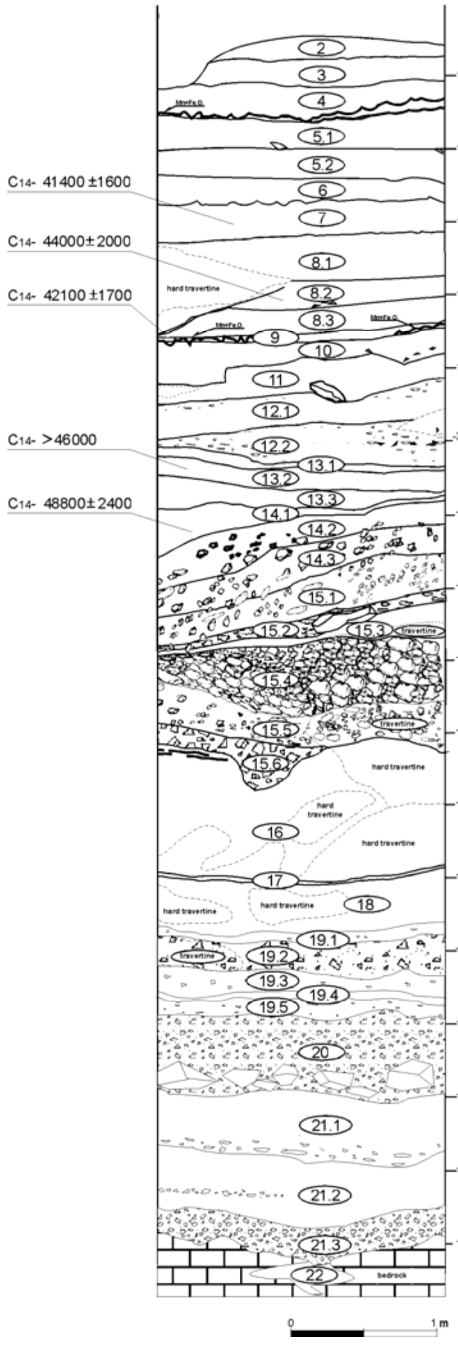


Figure 2: Obi-Rakhmat stratigraphic column based on excavations carried out in 1998-2001.

The Obi-Rakhmat Grotto is a large rounded niche facing south. Its width at the entrance is 20 m, its total length is 9 m, and the maximum height of the ceiling is 11.8 m. The sequence of soft sediments contains 22 strata, reaching a total depth of about 10 m (Figure 2). These deposits represent intercalated horizons of pale-yellow and grey sandy loam. The pale-yellow strata are usually thicker, reaching 50-60 cm, while the grey strata are 15-25 cm thick with more artifacts, fragments of charcoal, and bone remains than the yellow strata. The strata are mostly horizontal, dipping slightly to the southwest in the direction of the entryway zone and toward the western wall of the cave. Ferric-manganese laminations were noted in association with strata 4, 9, and 16. The saturation of soft sediments with debris (*éboulis*) varies from a very low proportion in the upper layers to maximum content in the middle of the stratigraphic column (stratum 15), while the lower portion of the profile (stratum 16) reveals a sharp decrease in the debris content. Such debris is mostly composed of small to medium-sized, slightly rounded limestone fragments. The contents of strata 11, 12, 14, and 15 revealed concen-trations of large (up to 40 cm in diameter) and medium-sized cobbles, suggesting rock-fall. The soft sediments are densely cemented by saturating carbonaceous water. The densest areas were noted in the immediate vicinity of the walls (the western portion of the excavation area), where the sediments in some levels represent an essentially monolithic travertine of great density and large size. These travertine areas are usually surrounded by cemented deposits intercalated with thin (3-4 cm) loose layers. Stratum 15 represents an aggregate of blocks and cobbles, but it also contains dense cemented laminations throughout. Stratum 16 is also comprised of dense cemented deposits, though unlike the overlying strata, no laminations were traced within the boundaries of this layer.

Palynological analyses of samples collected from the Obi-Rakhmat soft sediments suggest climatic conditions during the time of deposition were very similar to the present day Tian Shan (I.A. Kulkova, pers. comm., 2000). The pollen spectra reveal a practically identical floral composition throughout the profile. However, the pollen spectra also suggest variability in the proportion of different floral species throughout the sequence, reflecting changes in effective humidity. It should be noted that in the Tian Shan, even during glacial periods, the land was not completely covered by ice. Glaciers descended from the mountains and filled some depressions and valleys, while other valleys preserved their forest and meadow vegetation communities. The palynological spectra generated for the Obi-Rakhmat profile are not especially informative because of the relatively poor state of pollen preservation and the small quantities of pollen available in the samples collected. However, the data allow identification of a variety of herbaceous and shrubby species in the western Tian Shan during the period of deposition of Obi-Rakhmat's sedimentary sequence. Thus, the available palynological information suggests dry dicotyledonous - forb (mixed grass) steppe vegetation as the principal type of vegetation for the western Tian Shan during the Late Pleistocene. Even so, the fluvial valleys and the north-facing slopes of mountain ranges, where environmental conditions were comparatively humid, were occupied by maple, birch, walnut, hornbeam, pistachio, and other broad and small-leaved species. Coniferous trees, including pine, spruce, and fir, grew higher up in the mountains. The northern and southern faces of mountains of medium high elevation were occupied by open woodland and meadow-steppe grass niches. The higher the elevation, the lower the diversity was in the types of vegetation. Also,

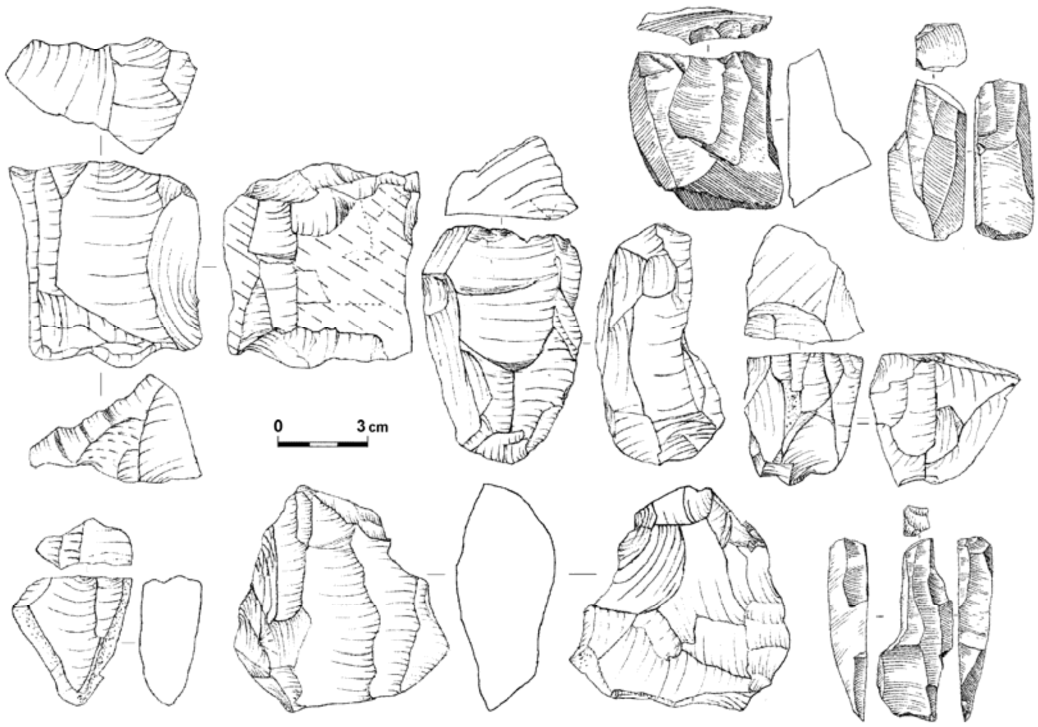


Figure 3: Lithic artifacts from Unit 1, Obi-Rakhmat Grotto.

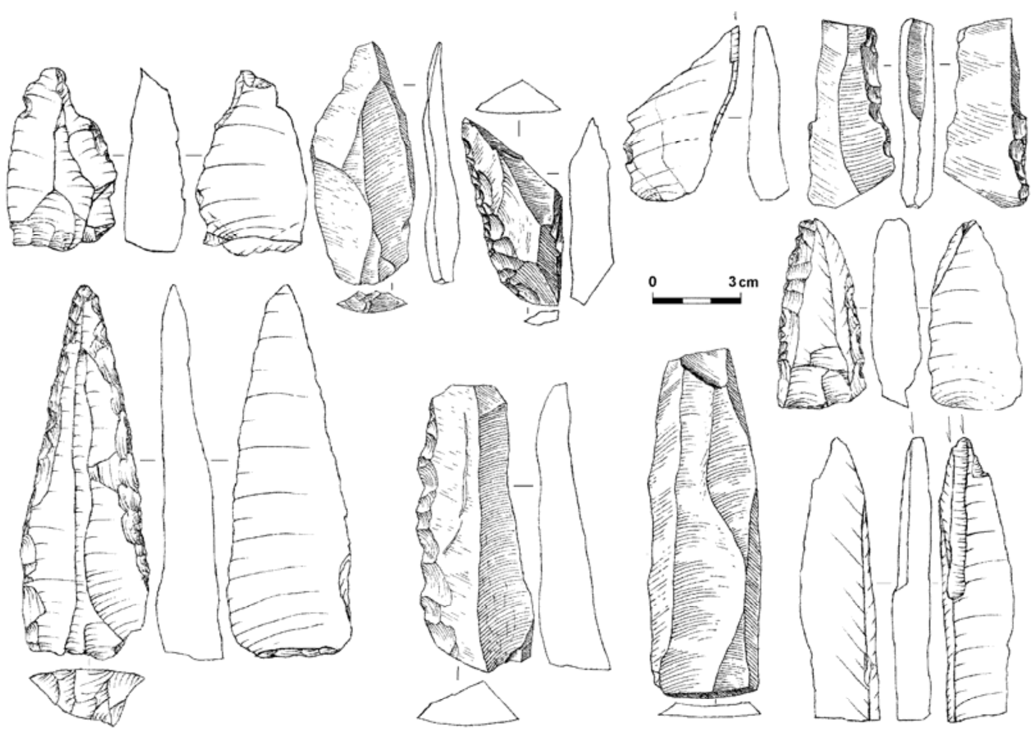


Figure 4: Lithic artifacts from Unit 1, Obi-Rakhmat Grotto.

decreased species diversity was noted in zones situated lower than the elevated shrub-forb steppe, namely in the wormwood plains and desert zones with saline, alkaline solonchak soils. Similar patterns were noted in the distribution of faunal species: the richest variety of animals was and still is typical of the shrub-forb steppe zone ranging between 800-1300 m asl. The animal bone remains recovered from Obi-Rakhmat in 1998-1999 were subjected to zooarchaeological analysis. These show a predominance of species inhabiting mountain forests and the steppe zone: deer (*Cervus elaphus*), mountain goat (*Capra sibirica*), wild boar (*Sus scrofa*), fox (*Vulpes vulpes*), and marmot (*Marmota* sp.) (I.V. Foronova, pers. comm., 2000).

The available data allow the chronological placement of most of the Obi-Rakhmat sediments in oxygen-isotope stage 3, a fact which is supported by the following AMS (accelerator mass spectrometry) radiocarbon dates (see Note 1): Stratum 14.1 is dated to 48,800±2400 BP (AA-36746); stratum 13.2 has yielded an infinite radiocarbon date of >46,000 BP (AA-35318); and stratum 8 is dated to 44,000±2000 BP (AA-31580) and 42,100±1700 BP (AA-31581) (see Figure 2).

THE ARCHAEOLOGICAL MATERIALS

Selected materials collected from strata 2-14 in the course of excavations conducted in 1963, 1968-1970, 1978, 1979, and 1986 are analyzed in the present article (see Note 2). Artifacts recovered from strata 3-14 in 1998 and 1999 are also discussed. The total number of specimens analyzed here is 31,399. The distribution of artifacts with respect to stratigraphic layers is shown in Tables 1-3 (following the text). As was initially proposed by Suleimanov (1972), archaeological collections recovered from adjacent lithological strata and demonstrating similar technical-typological characteristics were assembled in three units (see Note 3): Unit I: materials associated with strata 10-14; Unit II: materials from strata 6-9; and Unit III: materials from strata 2-5.

The Unit I artifacts (strata 10-14)

A total of 16,552 specimens was classified, including chips (n=9,678), shatters (n=972), pebbles (n=3), and other artifacts (Figures 3 and 4). Chips are small pieces of debitage less than 10 mm long resulting from the secondary retouch of tools. Shatters include all lithic debitage without a readable flaking pattern.

The category of core-like implements comprises 118 specimens and includes core-like shatters, core fragments, and cores of various types (Figure 5). The set of typologically distinct cores (n=61) is dominated by cores fashioned on spalls (n=23), most of which were identified as core-burins (n=17). Such cores were produced mostly on massive laminar spalls, the residual striking platform and/or the distal end of such spalls being utilized as a striking platform for detaching small laminar blanks from the narrow face of the core. These cores are a characteristic type of the Obi-Rakhmat industry. The category spalls combines all blanks and technical/ preparatory elements struck off a core, including blades and blade-flakes.

The second most abundant series of cores comprises 14 flat-faced flake cores and 14 flat-faced blade cores. The former category includes two principal varieties: single platform cores with only one flaking surface (n=10) and multiple platform cores with many flaking surfaces (n=4). Most striking platforms were prepared beveled at the back surface by a single blow. A series of flat-faced blade cores is dominated by single platform nuclei with one flaking surface, from which medium and small blades were detached (n=7); double platform cores were also noted, including two varieties, those with one (n=5) and two (n=2) flaking surfaces. Their plain striking platforms are distinctly beveled toward the back face. Some single platform cores exhibit traces of reshaping the distal convex end, flaking having been executed from an additional striking platform. The cores from which flaking was executed from their narrow faces to produce medium and small size blades (n=8), are classified as a single platform variety. As a rule, these specimens exhibit minimal preparation; only plain platforms beveled at the back were formed. Some specimens have crests. A small series of crested technical spalls (n=18) was also identified. Technical spalls, as defined here, are preparatory spalls with a readable flaking pattern, such as a crested blade, flake, or core tablet. One example of a proto-prismatic core and one recurrent Levallois blade core were also noted.

The collection of spalls totals 5,781 specimens. Most numerous are flakes (n=3,644 or 63.0%) and next numerous is the series of blades (n=1,845 or 31.9%). The following categories were also identified: laminar flakes (n=96 or 1.7%); pointed blades (n=67 or 1.2%); microblades (n=67 or 1.2%); triangular flakes (n=19 or 0.3%); technical spalls (n=18 or 0.3%); and elongated Levallois points (n=25 or 0.4%). Among the definable residual platforms (n=3,931), most are classifiable as plain (79.5%). Other subdivisions are not numerous: faceted platforms were noted on 9.3% of spalls (11.8% on flakes, 3.3% on blades); dihedral platforms on 6.1% of spalls (5.8% on flakes, 7.0% on blades); punctiform platforms were identified on 3.9% of spalls (2.7% on flakes, 6.6% on blades); and natural platforms were noted on 1.2% of spalls (1.4% on flakes, 0.8% on blades). The analysis of the dorsal pattern shows that most blanks were produced by longitudinal-parallel flaking executed from one platform (43.5%). Fewer cores were utilized by longitudinal-parallel flaking executed from two striking platforms and by convergent flaking.

The tool kit identified within unit I (Figure 6) comprises 168 specimens which have been classified into the following categories: retouched blades (n=37 or 22.1%); burins (n=26 or 15.5%); racloirs (n=22 or 13.1%); notch-denticulate tools (n=19 or 11.3%); retouched flakes (n=12 or 7.1%); backed knives (n=13 or 7.7%); elongated Levallois points (n=10 or 6.0%); grattoirs (n=7 or 4.2%); retouched pointed blades (n=7 or 4.2%); Mousterian points (n=6 or 3.6%); chisel-like tools (n=3 or

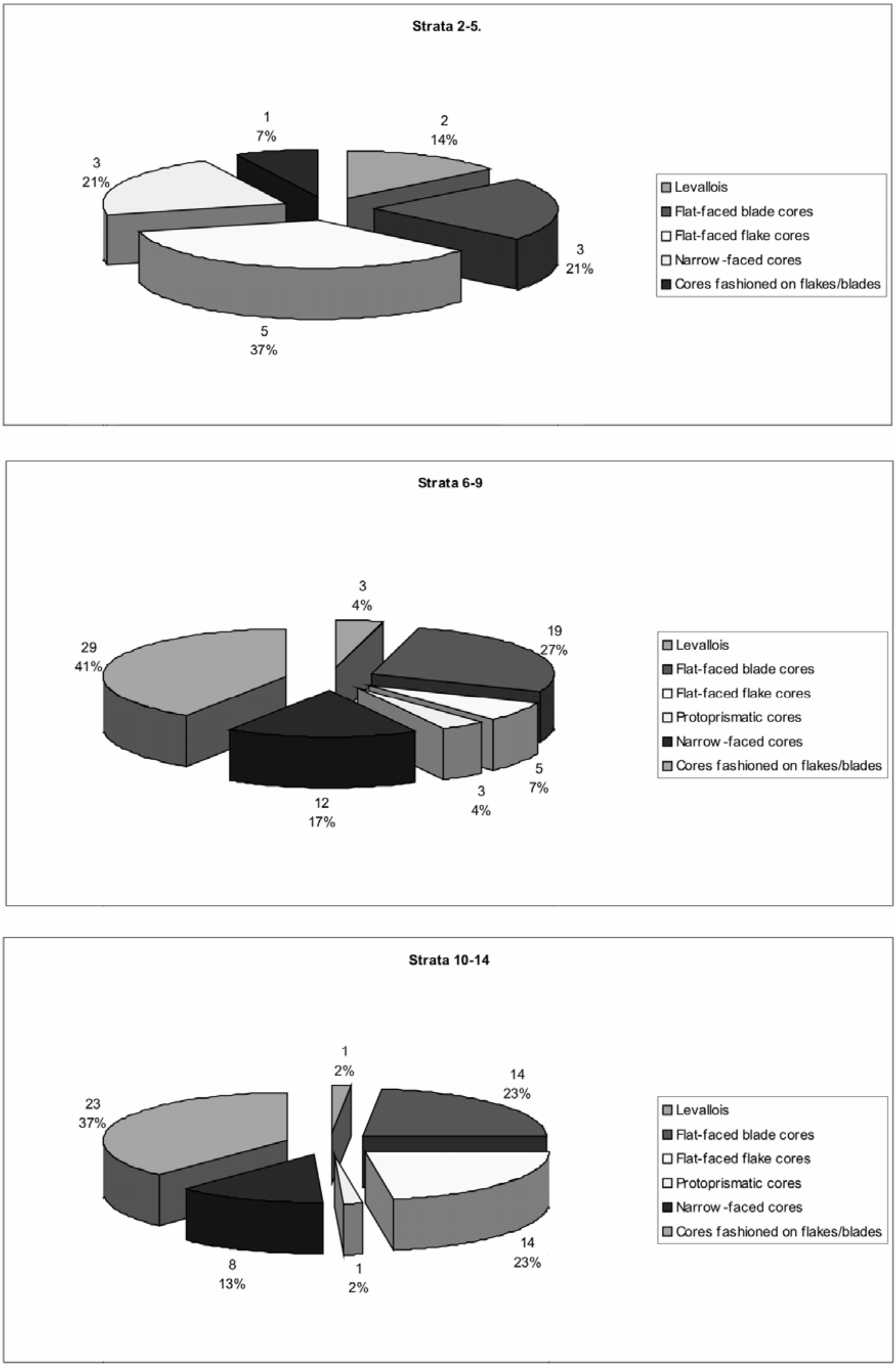
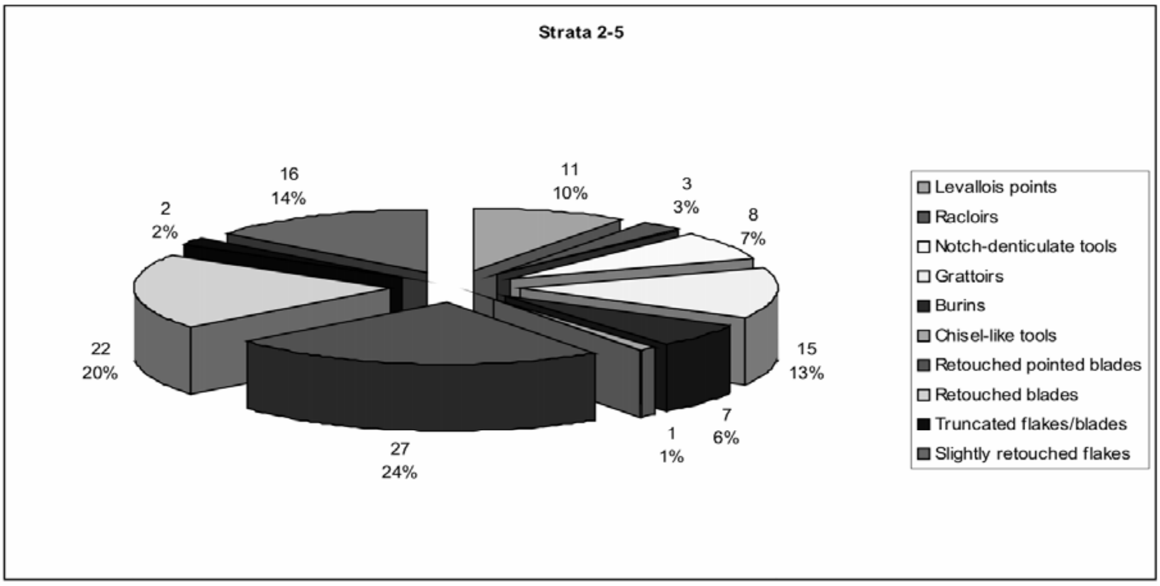
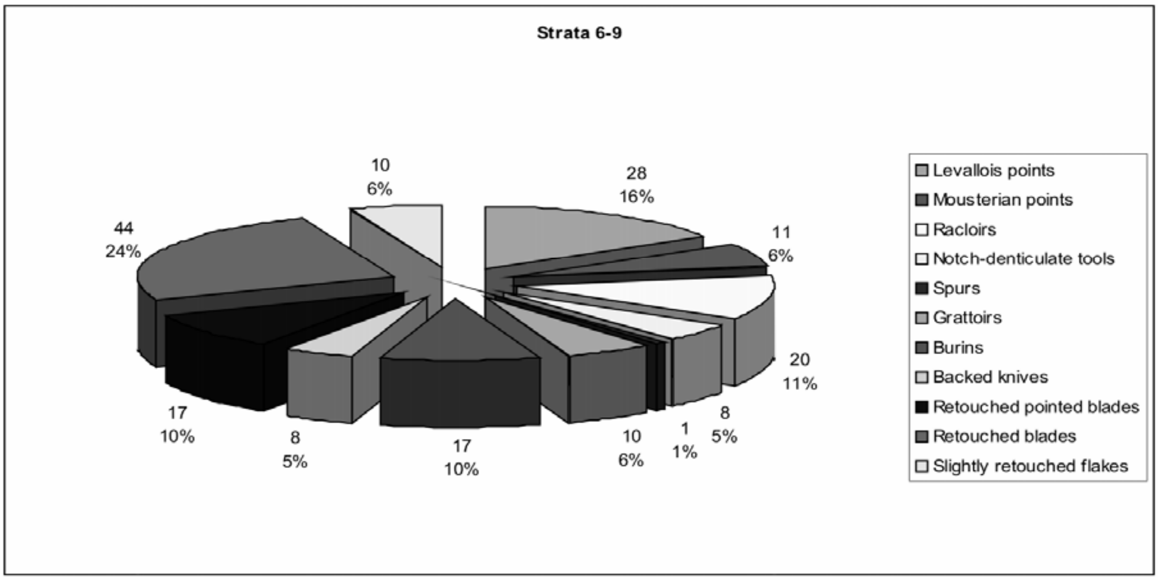


Figure 5: Diagram illustrating the distribution of core types by stratigraphic unit at Obi-Rakhmat Grotto (core-like fragments and amorphous cores are not included). The slices start at 12 .00 and rotate clockwise.





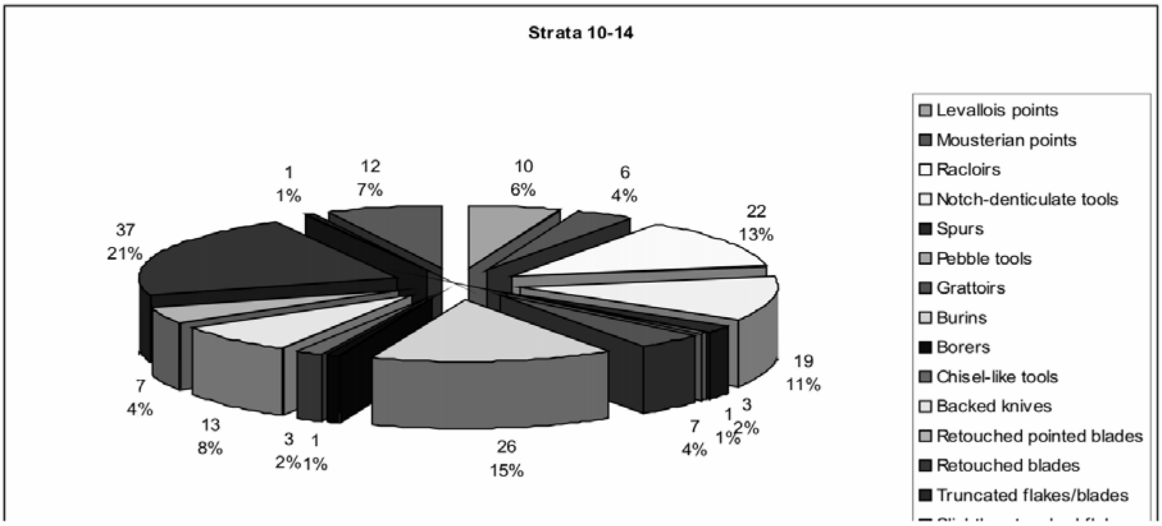


Figure 6: Diagram illustrating the distribution of tool types by stratigraphic unit at Obi-Rakhmat Grotto. The slices start at 12 .00 and rotate clockwise. (NB: The final item, missing in the submitted file, reads "slightly retouched flakes")

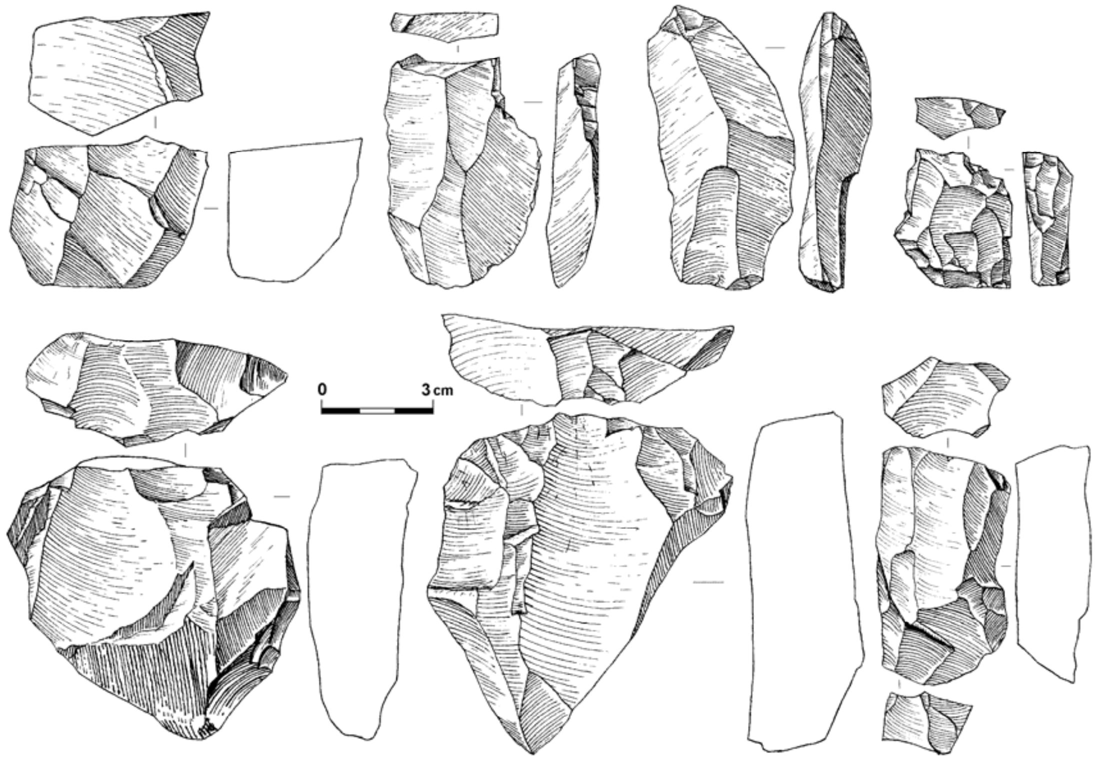


Figure 7: Lithic artifacts from Unit 2, Obi-Rakhmat Grotto.

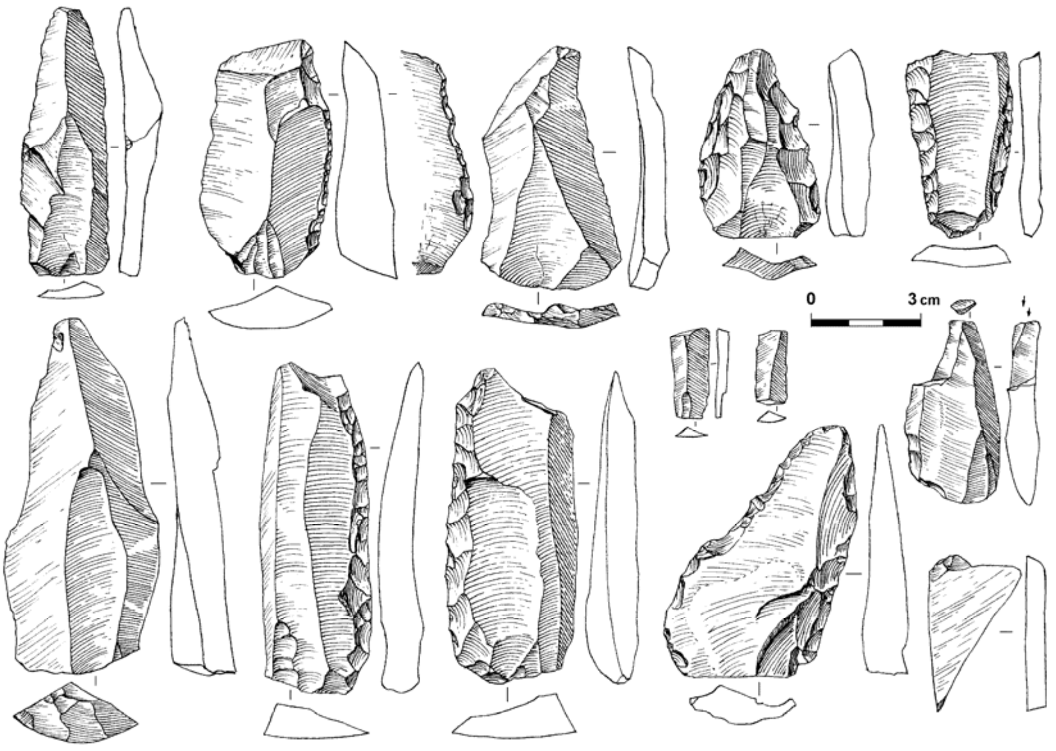


Figure 8: Lithic artifacts from Unit 2, Obi-Rakhmat Grotto.

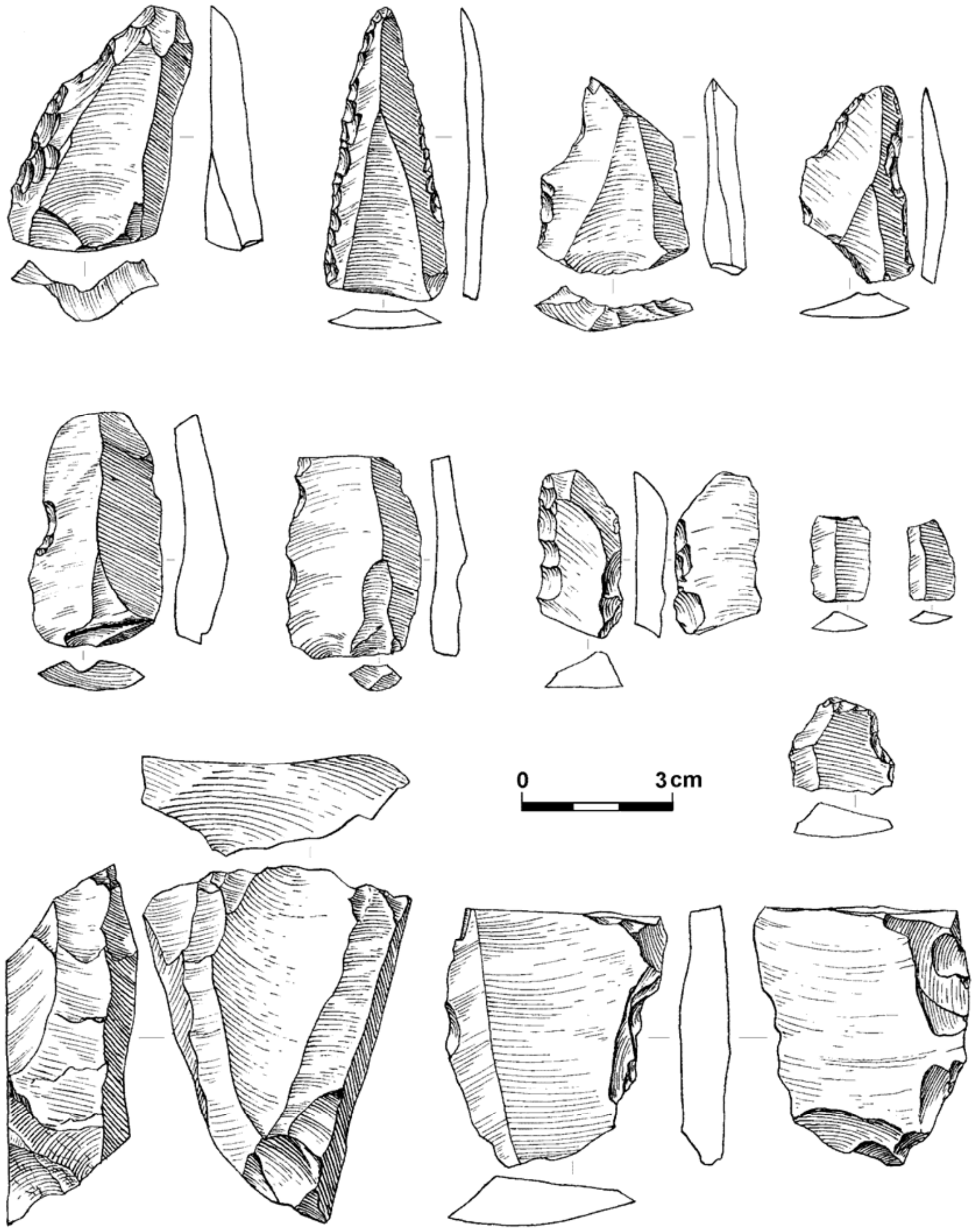


Figure 9: Lithic artifacts from Unit 3, Obi-Rakhmat Grotto.

1.7%); 'spurs' (n=3 or 1.7%); borer (n=1 or 0.6%); truncated flake (n=1 or 0.6%), and pebble tool (n=1 or 0.6%).

The Unit II artifacts (strata 6-9)

The total number of artifacts classified in this unit totals 11,986 specimens including chips (n=5,743), fragments (n=1,010), and pebbles (n=3) (Figures 7 and 8).

A total of 131 core-like pieces includes core-like fragments, fragments of cores, and cores of various types (Figure 5). As defined here, core-like fragments are small flaked pieces without a readable flaking pattern (usually exhausted cores), while fragments of cores are parts of broken formal cores. The series of typologically distinct cores (n=71) is dominated, as in unit I, by cores fashioned on spalls (n=29), most of which have been identified as core-burins (n=24). These cores were fashioned on massive laminar blanks (usually blades); their residual striking platforms and/or distal ends were used as the striking platforms and do not exhibit any additional preparation. From such platforms, small laminar blanks were detached from the narrow flaking face of the core, a reduction system similar to burin shaping.

The second most numerous category of cores comprises flat-faced blade cores (n=19) including single platform (n=12) and double platform (n=6) cores with one flaking surface, and a triple platform core with two flaking surfaces. The striking platforms were produced with a single blow, which formed platforms distinctly beveled toward the back face of the core. Narrow-faced cores, which were utilized for the production of medium and small blades (n=12), represent the single platform variety. As a rule, these cores show minimal preparation, on which only a plain platform, beveled on the back face of the platform, was formed. Some specimens have a crest, and a few crested technical spalls were noted in this collection (n=27). A subcategory of flat-faced flake cores includes five specimens, all of which are classified as single platform pieces with only one flaking surface; their plain striking platforms were beveled on the back face. The proto-prismatic and Levallois types of cores comprise three specimens each. Small, elongated points were detached from the Levallois nuclei.

The collection of spalls (n=5,099) is dominated by flakes (n=2655 or 52.1%); the second most common series comprises blades (n=2056 or 40.3%). The following categories have also been identified: laminar flakes (n=111 or 2.2%); pointed blades (n=108 or 2.1%); triangular spalls (n=69 or 1.4%); microblades (n=45 or 0.9%); elongated Levallois points (n=28 or 0.5%); and technical spalls (n=27 or 0.5%). Definable residual striking platforms were identified on 2531 spalls, of which the predominant type is plain with 84.7% identified on flakes and 81.4% on blades. Other types represent only minor fractions of the total collection: punctiform platforms occur on 6.1% of specimens (5.6% of flakes and 8.0% of blades); dihedral platforms on 5.4% (6.9% of flakes and 4.9% of blades); 3.0% of spalls have faceted platforms (2.1% of flakes and 5.4% of blades); and 0.5% have natural striking platforms (0.7% of flakes and 0.3% of blades). Analysis of the dorsal pattern of spalls (excluding small spalls, on which the flaking patterns cannot be identified) indicates a predominance of a longitudinal-parallel pattern of flaking from one striking platform with a frequency of 61.3%. A considerably smaller fraction of spalls demonstrates a longitudinal-parallel flaking pattern from two striking platforms and the convergent system of core reduction.

The Unit II tool kit (Figure 6) comprises 174 specimens and includes the following tool types: retouched blades (n=44 or 25.3%); elongated Levallois points (n=28 or 16.1%); racloirs (n=20 or 11.5%); burins (n=17 or 9.8%); retouched pointed blades (n=17 or 9.8%); Mousterian points (n=11 or 6.3%); grattoirs (n=10 or 5.7%); retouched flakes (n=10 or 5.7%); notch-denticulate tools (n=8 or 4.6%); backed knives (n=8 or 4.6%); and a 'spur' (0.6%).

The Unit III artifacts (strata 2-5)

The number of artifacts classified in this unit totals 2,861 specimens, including chips (n=641) and fragments (n=270) (Figure 9).

A series of 30 core-like pieces includes core-like fragments, fragments of cores, and cores of various types (Figure 5). The typologically identifiable cores (n=14) are dominated by flat-faced flake cores (n=5), including the single platform variety with one flaking surface (n=4) and one piece with multiple platforms and multiple flaking surfaces. The plain striking platforms are beveled toward the back of the cores and show minimal preparation. Also, three blade cores exhibiting a parallel flaking pattern (including one single platform specimen and one double platform piece with one flaking surface each and one double platform core with two flaking surfaces) and three narrow-faced cores for the production of small blades were identified. Two Levallois cores were utilized for the production of both blades and flakes. One core-burin was also recorded.

The 1920 spalls include mostly flakes (n=1024 or 53.3%) and, to a lesser extent, blades (n=786 or 40.9%). The following categories have also been identified: pointed blades (n=44 or 2.3%); triangular spalls (n=30 or 1.6%); laminar flakes (n=20 or 1.0%); microblades (n=12 or 0.6%); and technical spalls (n=4 or 0.2%).

Definable residual striking platforms were identified on 739 spalls, of which the predominant type is plain (85.9% of flakes and 90.8% of blades). Other types represent only minor fractions: punctiform platforms were noted on 3.8% of specimens with definable platforms (5.7% of flakes and 1.9% of blades), dihedral platforms on 3.7% (5.4% of flakes and 1.9% of blades), 3.7% of spalls with definable residual platforms show faceted platforms (3.0% of flakes and 4.3% of blades), 0.5% bear natural striking platforms (on blades only - 1.1% of the total). Analysis of the dorsal faces of spalls (excluding small spalls, on which the flaking patterns cannot be identified) indicates a predominance of a longitudinal-parallel pattern of flaking from one striking platform (55.3%). A considerably smaller fraction of spalls demonstrates a longitudinal-parallel pattern of flaking from two striking platforms and a convergent system of core reduction.

The Unit III tool kit (Figure 6) comprises 112 specimens and includes the following tool types: retouched pointed blades (n=27 or 24.1%); retouched blades (n=22 or 19.6%); retouched flakes (n=16 or 14.3%); grattoirs (n=15 or 13.4%); elongated Levallois points (n=11 or 9.8%); notch-denticulate tools (n=8 or 7.1%); burins (n=7 or 6.3%); racloirs (n=3 or 2.7%); truncated spalls (n=2 or 1.8%); and a chisel-like tool (1.8%).

Results of the lithic analysis

The analysis of the Obi-Rakhmat archaeological collection allows the following general inferences on characteristic features of this technocomplex to be proposed:-

Cores are dominated by types illustrating Upper Paleolithic reduction strategies; first, by narrow-faced cores, core-burins, and different varieties of microcores executed mostly on flakes and massive blades. There are few Levallois-like cores, and most of them demonstrate Upper Paleolithic reduction strategies, in particular, that the lateral side of Levallois cores was used as a platform for detaching blades and bladelets from the narrow face. This characteristic feature is typical of all the collections obtained from the whole sequence of layers in Obi-Rakhmat. Though most microcores were recovered from layers above stratum 10, the products of such core reduction were uncovered in all layers throughout the sequence down to stratum 14.

The collection of spalls includes a considerable number of laminar forms, which also represent the most typical blanks in the collection. The index of laminar pieces, i.e. blades, increases with each successive lithological stratum, similar to the number of recovered microblades. The mean dimensions of blanks also becomes smaller. The upper portion of the profile (strata 2-11) yields a laminar index of 40-55. The collection recovered from stratum 12, similar to those from the underlying strata, yields a laminar index of 20-30. The characteristic Obi-Rakhmat typological category of pointed blades represents a specific type of blank with sub-parallel edges converging at their distal margin to form a sharp tip. Such blades were noted in all strata, although their number decreases in the lower strata.

The tool kit is essentially homogeneous throughout the Obi-Rakhmat sequence. Its principal characteristic feature is the predominance of Upper Paleolithic tool types, the most numerous categories of which include burins, grattoirs, and racloirs (all fashioned on laminar blanks), and retouched blades, including pointed varieties. Levallois forms are not numerous and are represented by elongated points. Mousterian points, though typologically classical when encountered, are rare.

The technically and typologically homogenous features of the Obi-Rakhmat industry do not contradict its evolutionary character, which is illustrated by the increasing laminar index and number of microblades noted in the stratigraphically later collections, as well as a decrease in mean blank dimension and the proportion of specific tool types. Thus, we may classify the Obi-Rakhmat industry as transitional between the Middle Paleolithic (specifically, the Levallois-Mousterian blade-based variant) and the Upper Paleolithic. The available radiocarbon dates suggest a rather early emergence of the Upper Paleolithic features in this technocomplex.

DISCUSSION

The analysis of the Obi-Rakhmat archaeological materials provides us with data suggesting a process of gradual transition from the Middle to Upper Paleolithic occurring in western Central Asia. The chronometric dates available for the site indicate that the developmental processes described above occurred prior to 50,000 years ago. This new adaptation was based on Levallois technology aimed at the production of laminar blanks. As was stated above, the Obi-Rakhmat industry demonstrates technical and typological features similar to those recognized in Late Mousterian and early Upper Paleolithic complexes in Southwest Asia and the Russian Altai.

In the Altai, the most complete archaeological sequence representing the emergence of early Upper Paleolithic industries has been obtained from the Kara-Bom site, occupation horizons 5 and 6. This site has yielded the earliest known dates for the Upper Paleolithic complexes in Siberia and Central Asia with radiocarbon ages of 43,200 ±1500 BP (GX-17597) and 43,300±1600 (GX-17596) (Goebel et al. 1993). Analysis of the lithic artifacts derived from clear stratigraphic contexts at Kara-Bom allows us to document a continuous pattern of industrial development from the Middle to the early Upper Paleolithic. The early Upper Paleolithic strata (occupation horizons 5 and 6) provide evidence of the transition from a Levallois-based technology, mostly represented by recurrent Levallois blade and point cores (i.e. the strategy most characteristic of the underlying Middle Paleolithic layers), to core reduction strategies based on the removal of laminar blanks from prismatic and narrow-faced cores.

The archaeological collections associated with all horizons of the Kara-Bom sequence include a variety of Upper Paleolithic tool types. The proportion of these tools gradually increases from the lower to the upper sections of the profile, and most of the tools were fashioned on elongated laminar blanks. The tool kit associated with Kara-Bom occupation horizons 5 and 6 contains the following dominant tool types: retouched blades, elongated Levallois points, backed knives, racloirs, notches, notch-denticulate tools, and burins. Noteworthy (with respect to the Obi-Rakhmat industry) is the morphology of the elongated Levallois points from Kara-Bom, which differ in only minor ways from the pointed blades typical of the IUP. This fact is indicative of the gradual transformation of the Levallois reduction technique to the Upper Paleolithic parallel prismatic technology of core reduction.

Thus, the apparent evidence of development in both the technology of lithic tool production and tool typology has allowed the Kara-Bom researchers to make inferences about the genesis of such Upper Paleolithic industries (Derevianko et al. 2003) on the basis of the local variant of Mousterian technology which existed in the Gorny Altai between c. 100,000-50,000 years ago at the Ust-Karakol and Kara-Tenesh open-air sites and the Denisova and Strashnaya cave sites (Derevianko 2001; Derevianko et al. 2004).

In comparison, the Mousterian to Upper Paleolithic transition in the Levant is illustrated by materials obtained from the open-air sites of Boker-Tachtit and Ksar-Akil, which have yielded the most characteristic archaeological evidence of this period. The period providing qualitative evidence of changes in the technological stone working methods has been radiocarbon dated to c. 47,000-46,000 BP (Marks 1983, 1990; Marks et al. 1986). Marks has argued that the Boker-Tachtit transitional industry originated from the early Levantine Mousterian (Mousterian Tabun D type); the technocomplexes appeared around 250,000 years ago as estimated by thermoluminescence (TL) dates, and lasted until roughly 50,000-60,000 years ago (Mercier et al. 1995). The Tabun D type Mousterian is characterized by developed unipolar Levallois technology, which was based on the production of elongated blanks (blades and Levallois points).

In addition to the more widespread parallel and convergent unipolar Levallois method, other core reduction strategies have also been identified illustrated by various core types: disc cores and the single platform variety, from which blades were detached with the aid of hard hammer direct percussion. Complexes of this kind include few Mousterian tool types, like Mousterian points and racloirs with a lateral location of the working edge, while the number of denticulate tools is small and the proportion of Upper Paleolithic tools (for example, grattoirs, burins, and backed knives) is large. The later periods of these industries' evolution yield decreased frequencies of Mousterian tools until they disappear completely.

Thus, the Southwest Asian, western Central Asian (e.g., Obi-Rakhmat), and Altai evidence supports hypotheses based on the contemporaneous gradual development of Upper Paleolithic industries on the foundation of Middle Paleolithic parallel reduction strategies. In such cases, hypotheses depending on the migration of bearers of early Upper Paleolithic technologies seem improbable. Migrations of Middle Paleolithic populations appear to be more realistic. These people might have been representatives of archaic *H. sapiens* and were responsible for the dispersal of the leptolithic variant of Levallois-Mousterian technology.

It should also be noted that the palaeoecological data do not contradict this latter hypothesis because the human populations of the Levant, Central Asia, and the Altai, all apparently inhabited medium-elevation mountains and piedmonts with diverse ecological niches. Within one valley, various types of vegetation occurred during single chronological periods, allowing ancient populations to find and exploit the most beneficial habitats. The further evolution of migrant groups in different regions took place under ecological conditions regulated by a similar rhythm of adaptational processes in the formation of Upper Paleolithic technologies and culture.

In summary, the Obi-Rakhmat culture represents an early stage of a transitional industry. The initial stages of its formation occurred as early as about 50,000 years ago, and the formation of its Upper Paleolithic tool kit was completed by 44,000-42,000 years ago. The immediate predecessor of this culture has not yet been identified. The Teshik-Tash Cave industry in Uzbekistan might possibly illustrate the initial stages of the Obi-Rakhmat sequence, but represents a different variant of the western Central Asian Levallois-Mousterian based on flake production. The succeeding stages of the Obi-Rakhmat industrial evolution in western Central Asia can be illustrated by reference to the archaeological collections recovered from the Khudji, Ogzi-Kichik and Shougnou sites in Tajikistan.

NOTES

1. A date of 125,000±16,000 years (Cherdyntsev 1969) was published without reference to stratigraphic context, and we can therefore not interpret its significance.

2. Materials obtained during earlier excavations have not been published in full. Regrettably, due to improper storage conditions, catalogue numbers on many of the artifacts are now obliterated. The present analysis includes only those artifacts whose plan and catalogue references are available.

3. This subdivision is conventional, and when excavations at Obi-Rakhmat and a full analysis of the archaeological materials are completed, the proposed subdivision may be altered.

REFERENCES

Brantingham, J., S.L. Kuhn, and C.W. Kerry (eds). 2004. *The Early Upper Paleolithic Beyond Western Europe*. Berkeley: University of California Press.

Cherdyntsev, V.V. 1969. *Uran-243*. Moscow: Atomizdat. (In Russian).

Derevianko, A.P. 2001. The Middle to Upper Paleolithic Transitionin the Altai (Mongolia and Siberia). Archaeology, Ethnography & Anthropology of Eurasia 3(7):70-103.

Derevianko, A.P., U.I. Islamov, V.T. Petrin, R.H. Suleimanov, A.I. Krivoshapkin, K. Alimov, K.A. Krakhmal, I.N. Fedeneva, A.N. Zenin, and A.A. Anoikin. 1998. Issledovania grota Obi-Rakhmat (Respublika Uzbekistan) in 1998 g. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, pp. 37-45. Novosibirsk: Izd. IAE SO RAN. (In Russian).

Derevianko, A.P., U.I. Islamov, V.T. Petrin, R.H. Suleimanov, A.I. Krivoshapkin, K. Alimov A.A. Anoikin, K.I. Miliutin, and B. Saifullaiev. 1999. Issledovania grota Obi-Rakhmat (Respublika Uzbekistan) in 1999 g. In *Problemy arkheologii, etnografii, antropologii Sibiri i sopredelnykh territorii*, pp. 60-66. Novosibirsk: Izd. IAE SO RAN. (In Russian).

Derevianko, A.P. and S.V. Markin. 1992. *Mustie Gornogo Altaia* (po materialam peshery im. Okladnikova). Novosibirsk: Nauka. (In Russian).

Derevianko, A.P. and S.V. Markin. 1998. Mustie yuga Severnoi Azii v sravnenii so srednim paleolitom Vostochnogo Sredizemnomoria. In *Paleoecologia pleistotsena i kultury kamennogo veka Severnoi Azii i sopredelnykh territo-*

rii.Vol. 1: 100-106. Novosibirsk: Izd. IAE SO RAN. (In Russian).

Derevianko, A.P., V.T. Petrin, E.P. Rybin, and L.M. Chevalkov. 1998. *Paleoliticheskie kompleksy stratifitsirovannoi chasti stoianki Kara-Bom*. Novosibirsk: Izd. IAE SO RAN. (In Russian).

Derevianko, A.P. and E.P. Rybin. 2003. Drevneishee proyavlenie simvolicheskoi deyatelnosti paleoliticheskogo cheloveka na Gornom Altae. *Archaeology, Ethnography & Anthropology of Eurasia* 3(15):27-50. (In Russian)

Derevianko, A.P. and M.V. Shunkov. 2004. Stanovlenie verkhnepaleoliticheskih tradicii na Altae. *Archaeology, Ethnography & Anthropology of Eurasia* 3(19):12-40. (In Russian).

Goebel, T., A.P. Derevianko, and V.T. Petrin. 1993. Dating the Middle-to-Upper Paleolithic transition at Kara-Bom. *Current Anthropology* 34 (4):452-458.

Kuhn S., M.C. Stiner, and E. Gulec. 1999. Initial Upper Paleolithic in South-Central Turkey and its regional context: a preliminary report. *Antiquity* 73:505-517.

Marks, A.E. 1983. The Middle to Upper Paleolithic transition in the Levant. *Advances in World Archaeology* 2:51-98.

Marks, A.E. 1990. The Middle and Upper Palaeolithic of the Near East and the Nile valley: the problem of cultural transformations. In P. Mellars (ed.), *The Emergence of Modern Humans. An Archaeological Perspective*, pp. 56-80. Edinburgh: Edinburgh University Press.

Marks, A.E. and P. Volkman. 1986. The Mousterian of Ksar Akil: levels XXVI A through XXVIII B. *Paleorient* 12(1):5-20.

Mercier, N., H. Valladas, G. Valladas, J.L. Reyss, A. Jelinek, L. Meignen, and J.L. Joron. 1995. TL dates of burnt flints from Jelinek's excavations at Tabun and their implications. *Journal of Archaeological Science* 22:495-509.

Okladnikov, A.P. 1949. *Issledovania mustierskoi stoianki i pogrebenia neandertaltsa v grote Teshik-Tash*. Moscow: Nauka. (In Russian).

Oppenheimer, S. 2003. *The Real Eve: Modern Man's Journey Out of Africa*. London: Constable & Robinson.

Ranov, V.A. and S.A. Laukhin. 2000. Stoianka na puti migratsii srednepaleoliticheskogo chelovaka is Levanta v Sibir. *Priroda* 9:52-60. (In Russian).

Stringer, C. and R. McKie. 1996. *African Exodus: The Origins of Modern Humanity*. London: Jonathan Cape.

Suleimanov, R.H. 1972. *Statisticheskoe izuchenie kultury grota Obi-Rakhmat*. Tashkent: Fan. (In Russian).

Svoboda, J. and O. Bar-Yosef (eds). 2003. *Stranska skala. Origins of the Upper Paleolithic in the Brno Basin, Moravia, Czech Republic*. American School of Prehistoric Research Bulletin 47. The Dolni Vestonice Studies, Vol. 10. Harvard, MA: Peabody Museum, Harvard University Press.

Thorne, A.G. and M.H. Wolpoff. 1992. The multiregional evolution of humans. *Scientific American* 266:28-33.

Wilson, A.C. and R.L. Cann. 1992. The recent African genesis of humans. *Scientific American* 266:68-73.

Table 1: Classification of primary reduction products by stratigraphic layer, Obi-Rakhmat Grotto.

Stratum	Cores and core-like pieces		Flakes		Blades		Microblades		Laminar flakes		Pointed blades		Sub-triangular flakes		Points		Shatters		Chips		Technical elements		Pebbles		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
2	1	1.4	7	9.6	16	21.9													49	67.1					73
3	6	3.8	43	27.2	37	23.4			1	0.6			1	0.6	1	0.6	22	13.9	45	28.5	2	1.3			158
4	8	1.5	148	28.1	113	21.5	4	0.8	10	1.9	5	1.0			11	2.1	41	7.8	184	35.0	2	0.4			526
5	15	0.7	826	39.3	620	29.5	8	0.4	9	0.4	39	1.9	12	0.6	5	0.2	207	9.8	363	17.3					2104
2 – 5	30	1.0	1024	35.8	786	27.5	12	0.4	20	0.7	44	1.5	13	0.5	17	0.6	270	9.4	641	22.4	4	0.1			2861
6	22	1.5	485	33.3	328	22.5			9	0.6	15	1.0	23	1.6	7	0.5	121	8.3	445	30.6	1	0.1			1456
7	71	1.2	866	14.7	885	15.0	26	0.4	51	0.9	69	1.2	12	0.2	15	0.3	350	5.9	3525	59.9	16	0.3			5886
8	23	0.7	984	31.4	551	17.6	11	0.4	48	1.5	12	0.4	20	0.6	18	0.6	419	13.4	1043	33.3	2	0.1			3131
9	15	1.0	320	21.2	292	19.3	8	0.5	3	0.2	12	0.8	2	0.1			120	7.9	730	48.2	8	0.5	3	0.2	1513
6 – 9	131	1.1	2655	22.2	2056	17.2	45	0.4	111	0.9	108	0.9	57	0.5	40	0.3	1010	8.4	5743	47.9	27	0.2	3	0.0	11986
10	33	2.0	649	39.7	339	20.7	1	0.1	25	1.5	22	1.3	15	0.9	9	0.6	193	11.8	345	21.1	4	0.2	1	0.1	1636
11	15	0.3	967	20.8	671	14.4	34	0.7	13	0.3	18	0.4			3	0.1	213	4.6	2720	58.4	4	0.1	1	0.0	4659
12	23	1.1	641	30.8	241	11.6	8	0.4	13	0.6	10	0.5			11	0.5	199	9.6	932	44.7	5	0.2			2083
13	26	0.5	850	15.1	379	6.7	24	0.4	28	0.5	8	0.1			1	0.0	226	4.0	4095	72.6	4	0.1	1	0.0	5642
14	21	0.8	537	21.2	215	8.5			17	0.7	9	0.4	4	0.2	1	0.0	141	5.6	1586	62.6	1	0.0			2532
10 – 14	118	0.7	3644	22.0	1845	11.1	67	0.4	96	0.6	67	0.4	19	0.1	25	0.2	972	5.9	9678	58.5	18	0.1	3	0.0	16552
Sub-total	279	0.9	7323	23.3	4687	14.9	124	0.4	227	0.7	219	0.7	89	0.3	82	0.3	2252	7.2	16062	51.2	49	0.2	6	0.0	31399

Table 2: Percentage ratio of core-like implements by stratigraphic layer, Obi-Rakhmat Grotto.

Core types	2		3		4		5		2 – 5		6		7		8		9		6 – 9		10		11		12		13		14		10 – 14		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Levallois			1	16.7			1	6.7	***2***	***6.7***	1	4.5	2	2.8					***3***	***2.3***							1	3.8			***1***	***0.8***	6	***2.2***
point cores											1		2						***3***														3	
blade cores			1						***1***																		1				***1***		2	
flake cores							1		***1***																								1	
Flat-faced blade cores	1	100			2	25.0			***3***	***10.0***	2	9.1	11	15.5	3	13.0	3	20.0	***19***	***14.5***	4	12.1	1	6.7	2	8.7	3	11.5	4	19.0	***14***	***11.9***	36	***12.9***
unidirectional with single flaking surface	1								***1***		1		7		1		3		***12***		2				2		1		2		***7***		20	
bidirectional with single flaking surface					1				***1***				4		2				***6***		2		1				1		1		***5***		12	
bidirectional with two flaking surfaces					1				***1***																		1		1		***2***		3	
multidirectional with two flaking surfaces											1								***1***														1	
Flat-faced flake cores			3	50.0			2	13.3	***5***	***35.7***			2	2.8	1	4.3	2	13.3	***5***	***3.8***	5	15.2	3	20.0	1	4.3	2	7.7	3	14.3	***14***	***11.9***	24	***8.6***
bidirectional with two flaking surfaces																																		
unidirectional with single flaking surface			2				2		***4***				2		1		2		***5***		3		3		1		1		2		***10***		19	
multidirectional with multiple flaking surfaces			1						***1***												2						1		1		***4***		5	
Protoprismatic cores									***0***	***0.0***	3	13.6							***3***	***2.3***					1	4.3					***1***	***0.8***	4	***1.4***
Narrow-faced cores			1	16.7	1	12.5	1	6.7	***3***	***10.0***	1	4.5	4	5.6	3	13.0	4	26.7	***12***	***9.2***			2	13.3	1	4.3	2	7.7	3	14.3	***8***	***6.8***	23	***8.2***
Cores fashioned on flakes/blades							1	6.7	***1***	***3.3***	5	22.7	17	23.9	6	26.1	1	6.7	***29***	***22.1***	12	36.4	6	40.0			3	11.5	2	9.5	***23***	***19.5***	53	***19.0***
unidirectional with single flaking surface													1		1				***2***		3										***3***		5	
core-burins							1		***1***		5		15		3		1		***24***		6		6				3		2		***17***		42	
combined cores													1		2				***3***		3										***3***		6	
Amorphous cores											1	4.5			4	17.4			***5***	***3.8***	4	12.1			1	4.3			1	4.8	***6***	***5.1***	11	***3.9***
Core-like shatters			1	16.7	5	62.5	10	66.7	***16***	***53.3***	9	40.9	35	49.3	6	26.1	5	33.3	***55***	***42.0***	8	24.2	3	20.0	17	73.9	15	57.7	8	38.1	***51***	***43.2***	122	***43.7***
Sub-total	1	100	6	100	8	100	15	100	***30***	***100***	22	100	71	100	23	100	15	100	***131***	***100***	33	100	15	100	23	100	26	100	21	100	***118***	***100***	279	**100**

Table 3: Percentage ratio of tool types by stratigraphic layer, Obi-Rakhmat Grotto.

Tool types	3		4		5		6		7		8		9		10		11		12		13		14		Total
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Levallois points	1	25.0	9	45.0	1	1.1	7	16.7	11	13.1	10	28.6			4	10.3	2	6.5	2	10.5	1	1.7	1	5.0	49
Mousterian points							1	2.4	9	10.7	1	2.9			5	12.8					1	1.7			17
Racloirs					3	3.4	9	21.4	5	6.0	4	11.4	2	15.4	6	15.4	2	6.5	3	15.8	11	18.6			45
Notch-denticulate tools	1	25.0			7	8.0	2	4.8	1	1.2	3	8.6	2	15.4	9	23.1	2	6.5			4	6.8	4	20.0	35
Spurs									1	1.2									1	5.3			2	10.0	4
Pebble tools																					1	1.7			1
Grattoirs	2	50.0	2	10.0	11	12.5	1	2.4	8	9.5			1	7.7			1	3.2			4	6.8	2	10.0	32
Burins					7	8.0	6	14.3	2	2.4	6	17.1	3	23.1	2	5.1	7	22.6	3	15.8	9	15.3	5	25.0	50
Borers																							1	5.0	1
Chisel-like tools			1	5.0																	2	3.4	1	5.0	4
Backed knives									5	6.0	2	5.7	1	7.7	2	5.1	1	3.2	2	10.5	8	13.6			21
Retouched pointed blades			2	10.0	25	28.4	1	2.4	15	17.9			1	7.7	1	2.6	4	12.9			2	3.4			51
Retouched blades			4	20.0	18	20.5	13	31.0	23	27.4	5	14.3	3	23.1	5	12.8	11	35.5	6	31.6	12	20.3	3	15.0	103
Truncated flakes/blades			1	5.0	1	1.1													1	5.3					3
Slightly retouched flakes			1	5.0	15	17.0	2	4.8	4	4.8	4	11.4			5	12.8	1	3.2	1	5.3	4	6.8	1	5.0	38
Sub-total	4	100	20	100	88	100	42	100	84	100	35	100	13	100	39	100	31	100	19	100	59	100	20	100	454