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8 – Research question 3: inter-regional comparisons

Whereas the previous section provided an overview of the Gorny-Altai regional record in order to test a chrono-cultural model, the following enlarges the perspective by proposing a selective review from neighboring regions. The goal is to address the research question 3 which suggests that long distance comparisons support multi-regional scenarios of MH emergence. A special emphasis is paid to assemblages illustrating the end of the MP and the beginning of the UP and that share technological, typological or chronological similarities with the defined Altai IUP or EUP. From west to east, the overview of archeological evidence from Central Asia, western, central and eastern Siberia, and northern Mongolia proposed below will support further discussions in the next chapter.

8.1 CENTRAL ASIA

The southeast Tian-Shan and the Tajik depression are physical boundaries between Central Asia and Xinjiang, with some of the world highest mountain peaks over 7,000 m. The lowlands join the Altai through eastern Kazakhstan and, therefore, represent a possible route toward Northeast Asia. In the south, the Pamir, the Hindu-Kush and the Kunlunshan ranges extend to the Tibetan plateau, closing access to the Takla-Makan desert (Figure 211, num. 2). The following section focuses on the sites distributed along the western edge of the Tian-Shan up to the Altai foot hills.

According to Davis and Ranov (1999), the discovery of the Teshik-Tash Neandertal, in 1938, triggered a general interest in the Paleolithic of Central Asia. Okladnikov discovered remains of a juvenile Neandertal associated with a lithic assemblage attributed by F. Bordes (1955) to Quina-Ferrassie Mousterian. The site is located on the western side of the Hissar range at circa 1800 m asl and near the Uzbek town of Baisun. The cave was excavated between 1937 and 1938 by Okladnikov over a surface of 132 m². Five cultural layers were defined within a 1.5 m thick section and separated by sterile horizons. Each cultural layer contained remains of combustion features. The fauna consists of *Capra sibirica*, with an occsonal occurrence of carnivores, such as hyena and leopard. About 2,000 lithic artifacts were collected, mainly made of local silicified limestone but with the occurrence of quartz and jasper. The assemblage is dominated by flake blanks detached from discoidal and unidirectional cores whereas blade blanks are rare. The most representative tool is the Quina-type sidescraper which gives the assemblage a Mousterian character. As noted by Vishnyatsky (1999), the attribution to a more precise facies is subject to debate (*e.g.* Okladnikov, 1949; Bordes, 1955; Ranov *et al.*, 1979).

Recently, Keates (2007) suggested that a carinated endscraper originally illustrated by Okladnikov (1949) and subsequently by Movius (1953a) could represent evidence for a bladelet/microblade production. The illustrated piece displays a few sub-cortical, hinged removals and appears insufficient to support the occurrence of such technology in a Mousterian context. Other prismatic cores mentioned by Movius (1953a) (N=4) are not documented. In sum, the Teshik-Tash assemblage appears to be clearly Mousterian and similar to an MP assemblage associated with sub-prismatic cores reported at the nearby site of Amir-Tenir (Okladnikov, 1940; Movius, 1953a; Vishnyatsky, 1999).

In 2002, the cave of Anghilak was discovered in the Kashkadariya region of southeastern Uzbekistan. Five stratigraphic units were described with a small MP lithic assemblage (N=450) concentrated in two units and with depths ranging from 30-85 cm below the ground level (Glantz *et al.*, 2003). The few illustrated bladelets appear insufficient to attribute

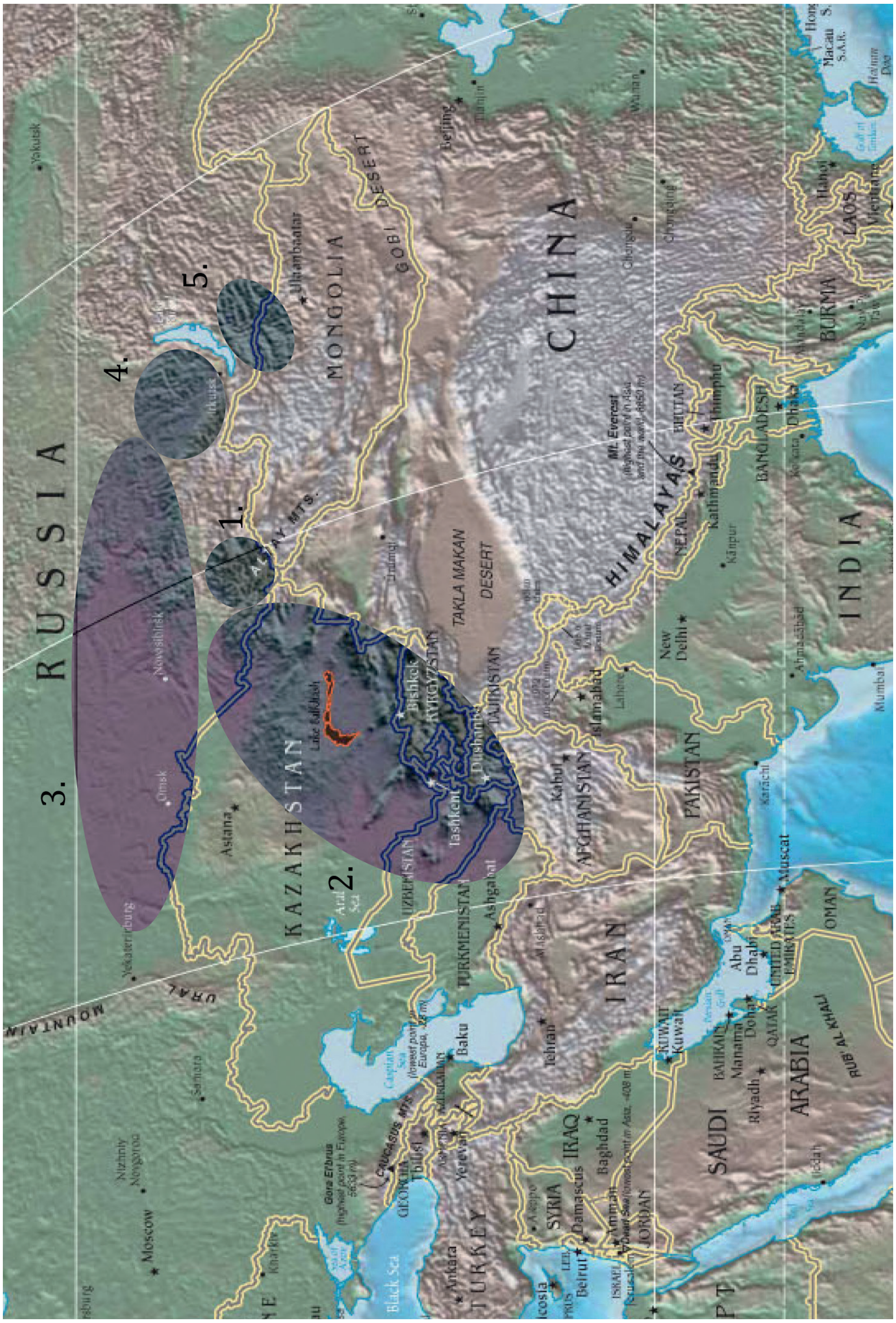

Figure 211: Map of Central and Northeast Asia. Shaded areas correspond to the main regions described in this study. 1, Altai; 2, eastern part of Central Asia; 3, western and central Siberia; 4, Cis-Baikal; 5, Trans-Baikal and northern Mongolia

a UP component to the assemblage. A fifth human metatarsal (AH-1) of an unknown taxon was discovered among the collection from the 2002 test pit. Its position and association with the lithic assemblage is not clear. Radiocarbon dates obtained on the stratum from which AH-1 is derived resulted in ages of 43,900 ± 2,000 and 38,100 ± 2,100 ^{14}C BP (Glantz *et al.*, 2008). Lab numbers are not available as chronological data are not fully published yet.

8.1.1 ZERAVSHAN BASIN

The Zeravshan river basin has yielded MP remains in open-air sites such as Kuturbulak. At this site, discoidal technology occurs along with numerous laminar blanks. Bidirectional and unidirectional cores are common, some being similar to Levallois flat-faced blade cores (*e.g.* Vishniatsky, 1999, Fig.6. num 16). At circa 18 km from Samarkhand, the Zirabulak site is said to be comparable to Kuturbulak, however, in a disturbed context (Vishnyatsky, 1996, 1999, 2004). This surface collection includes elements of bladelet reduction such as cores on flake edges and nosed and carinated endcrapers (Le Brun-Ricalens, personal comm.). The site of Sammarkandskaya is among the best known UP sites from this region and is associated with MH remains (Dzhurakulov, 1987). It has been excavated since 1939 over a surface of more than 1,000 m². Although it is mentioned by Otte (2004) as a possible Aurignacian site based on the presence of carinated endscrapers and Dufour bladelets, other scholars expressed serious doubts regarding the homogeneity of the assemblage (Vishnyatsky, 1996, 1999, 2004; Davis and Ranov, 1999).

8.1.2 AFGHANISTAN

In northern Afghanistan, the site of Kara-Kamar is located between the Turkestan plateau and the northern border of the Hindu-Kush (Ranov and Karimova, 2005). It was discovered and excavated by Coon in 1954 (Coon, 1957). Level III is composed of loessic sediments and includes two paleo-soils. Artifacts were selected during the excavation (N=87 among circa 3400 artifacts) and include a series of carinated and nosed endscrapers (N=32) and some bladelets, although the provenience of the latter is uncertain (Davis, 2004; Vinogradov, 2004). Radiocarbon dates were produced in the early stages of the technique and provided a minimum age of 25 ka ^{14}C BP for the units C12 and C13 and of 32 ka ^{14}C BP for the unit C11 (Coon and Ralph, 1955; Davis, 1978). Carinated endscrapers have been used to assign the assemblage to the Aurignacian in the context of migration models from west to east (Vinogradov and Ranov, 1985) or from east to west (Otte and Kozlowski, 2007). Other scholars rather argue for a technological convergence (Davis, 2004; Vishnyatsky, 2004).

In the Kyzyl-Kum desert, clusters of surface finds led to the identification of several sites (Kuk-Ayaz 1-3) (Sayfullayev and Cauche, 2004). Although the general aspect of the assemblages suggests a UP attribution, contextual and chronological data are lacking.

8.1.3 TAJIKISTAN

The southern part of Tajikistan is bordered by the Tian-Shan in the northeast and the by the Pamir in the southeast. The preservation of massive loess accumulations is one of the major features of this region. Successions of loess layers and paleo-soils reaching 200 m in total thickness are correlated with sections from northern China (Dodonov and Baiguzina, 1995). These two regions yielded high resolution sequences, recording Asian climatic fluctuations for a period ranging from the Miocene to the last interglacial (Dodonov and Zhou, 2008). The pedo-complexes 6 (PC6) and 5 (PC5) have yielded remains of Karatau and Lakhuti Lower Paleolithic traditions (e.g Ranov, 1995) that were first dated to 200 ka and 130 ka by TL (Dodonov, 1991). As demonstrated by Zhou and colleagues (Zhou *et al.*, 1995), the TL dates ranging from 800 ka to 20 ka widely underestimated the ages of the deposits. The early TL results obtained in the Kiev laboratory in the early 1970's (Shelkoplyas, 1974) have since been recognized as problematic. Subsequent improvements in luminescence dating have provided ages correlating PC1 with OIS5 (Zhou *et al.*, 1995). The Brunhes/Matuyama boundary corresponds to OIS19 in the marine record and is well documented in the loess sequences in PC9. Depending of the section, it may show inconsistencies in the measured positions implying that ages may be over-estimated by a few to maximum circa 30 ka (Zhou and Shackleton, 1999). The loess sequences are now dated by correlations with paleo-climatic curves and the Karatau and Lakhuti occupations are attributed to OIS15.

The Chonako and Obi-Mazar sequences are correlated with the marine isotopic curve (ODP-667) and with the Tenaghi-Philippon pollen record (Schäfer *et al.*, 2003) (Figure 212). This suggests that the first MP occurs at Chonako 3, in PC2, and is dated circa 250 ka. The Levallois-Mousterian appears within PC2b circa 220-200 ka, followed by a Levallois-Mousterian with blades in PC2a. Refits show that post-depositional processes have affected these subunits, and assemblages from PC2a-b-c are described as a whole. Nevertheless, blades are well represented and consist of about 20% of the set (N=circa 350). The loess interstadial 2 (LI2) is associated with the laminar assemblage (N=circa 90) LI2b that includes genuine pyramidal cores (N=3). The cores are similar across levels with triangular flaking surfaces displaying unidirectional and convergent removals (Schäfer *et al.*, 1998; Ranov and Schäfer, 2000). Striking platforms are plain and the reduction is semi-turning or circular. According to Schäfer *et al.* (2003), the 'bladelet' horizon derived from LI2a occurs prior to the climatic optimum of OIS5e, about a meter below the interglacial soil. The age of LI2a is estimated at circa 150 ka (Schäfer *et al.*, 1998). The lithic material associated with LI2a consist of a small assemblage (N=25) dominated y blades and bladelets (N=11)(Schäfer *et al.*, 1998). PC1 is not well documented, but the Levallois artifacts found are not laminar and remain older than the radiocarbon dates associated with other Mousterian sites in Central Asia (Ranov and Schäfer, 2000). Objections against this chronology are raised by Ranov (Ranov and Schäfer, 2000) who mentions unpublished TL dates obtained by Vlasov and Kulikov on Chonako loess. The dates would be similar to those previously obtained by Shelkoplyas, circa 40 ka for PC1. However, there is likely confusion between TL and RTL techniques, and the latter may have some methodological issues (Kuzmin, 2000). If one accepts the long chronology, this sequence would document the oldest occurrence of volumetric laminar technology in Central Asia and would then become roughly contemporaneous with Tabun D-type or other MP laminar assemblages from the Levant (*e.g.* Bar-Yosef and Meignen, 1992; Mercier *et al.*, 1995, 2007; Meignen, 2000, 2007).

The site of Khudji is located circa 40 km from the city of Dushanbe. It was partly destroyed by the construction of a road and only the lower part of the sediment was preserved (15-50 cm thick). During the 1978 campaign, a surface of circa 230 m^2 was excavated (Ranov and Amosova, 1984). Three combustion features were identified in loessic-loam deposits attributed to the Dushanbe formation. The fauna is not fully published but seems to be dominated by sheep/goat (Vishnyatsky, 1999, 2004). A radiocarbon date of 38,900 ± 700 ^{14}C BP (GIN-2905) was generated from a charcoal sample. The site was re-excavated in 1997, yielding a second and distinct upper complex (Ranov and Laukhin, 1998). A date of 42,100+2,440/–1,870 ^{14}C BP (GrN-23686) was obtained on a charcoal sample collected from horizon 8 in the lowermost part of the upper complex. In addition, a deciduous human tooth was discovered during wet screening. The tooth consists of a worn crown and a broken root and is interpreted as a lateral deciduous incisor (Trinkaus *et al.*, 2000). The morphology of the root indicates that the tooth was removed mechanically, and Trinkaus *et al.* (2000) suggest that the individual died at an age ranging from 3 to 5 years old. The specimen could not be attributed to a specific taxon, but it falls into the metrical range of Late Pleistocene hominins. The lithic assemblage from the lower complex (N=7,642) includes non-diagnostic cores and a similar amount of blade (N=397) and flake (N=375) blanks. Vishnyatsky (1999) notes that more than the half of the retouched tools (N=136) are on blades, a situation that appears to be in agreement with the frequencies of blanks. Retouched blades bear continuous or bilateral retouch and are classified as sidescrapers or as points. Small asymmetric triangular points on flake blanks are also described. The lithic material from the upper complex is reported as comparable with the lower complex (Trinkaus *et al.*, 2000) and, due to its high laminar index, is attributed to the Levallois facies as defined by Ranov (1968). The high frequency of retouched tools and the coexistence of flake and blade reduction also suggest a Levallois-Mousterian attribution as defined by the same author (Ranov and Davis, 1979). More recently, Vishnyatsky supported an MP association in a broader sense (2004).

A similar assemblage is reported from Ogzi-Kichik Cave (Ranov and Nesmeyanov, 1973; Ranov and Karimova, 2005), but no clear cultural layer has been identified and the integrity of the assemblage has been questioned (Abramova, 1984; Vishnyatsky, 1999).

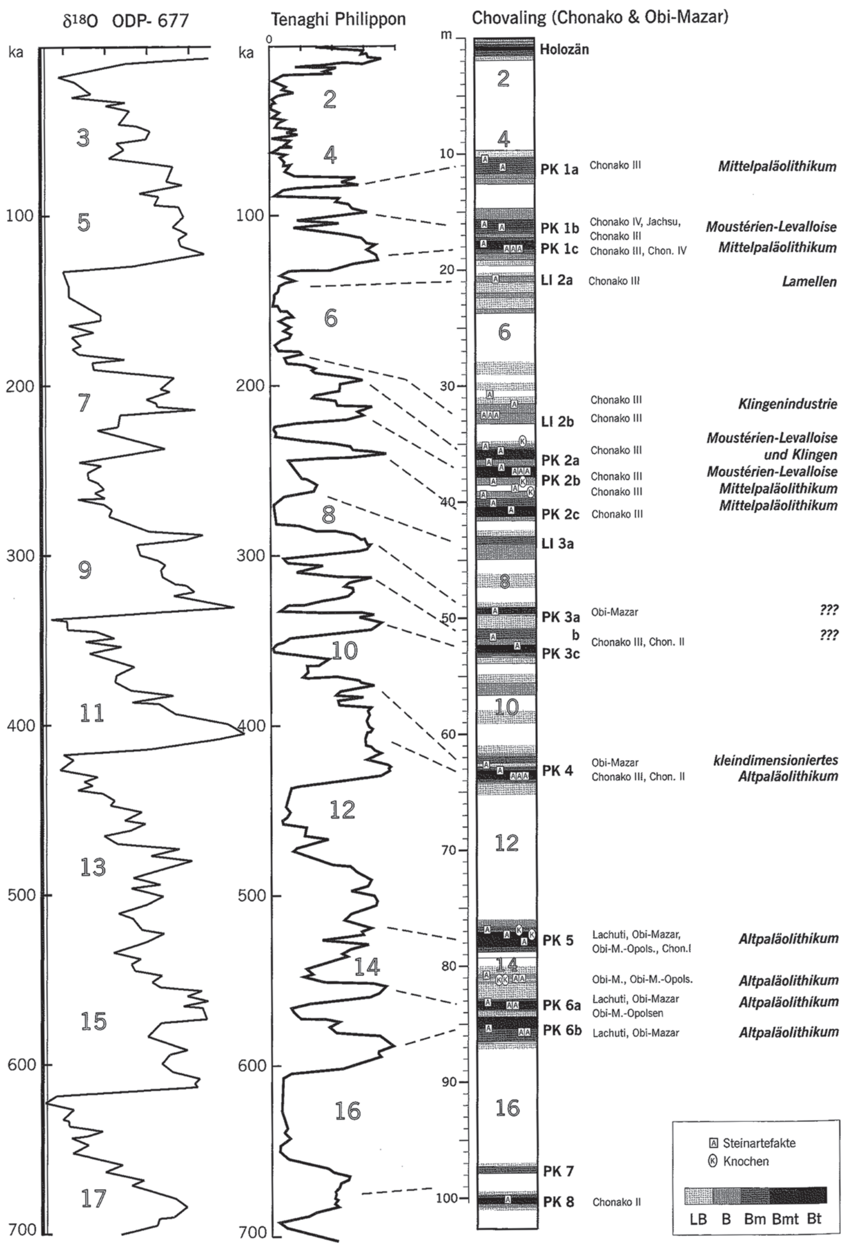

Figure 212: Chrono-climatic reconstruction from Chonako and Obi-Mazar loess sequences, Tadjikistan (after Schäfer *et al.*, 2003)

The site of Shugnou lies along the upper reaches of the Yakhsu River (Ranov and Karimova, 2005). The excavated surface yielded five cultural horizons associated with loessic sediments of the third Dushanbe terrace. Horizon 1 is dated to 10,700 ± 500 ^{14}C BP (GIN-590). Horizons 1 and 2 are attributed to the UP based on the presence of tools on blades and bladelet blanks but horizon 2 also includes discoidal and Levallois technology (Abramova, 1984). Although mentioned as UP assemblages, horizon 3 (N=300) and 4 (N=200) are described by Vishnyatsky (1999; 2004) as a Mousterian similar to the Khudji lower complex. This view is supported by other scholars (Schäfer and Ranov, 1998).

The main site located in the Fergana region is Sel-Ungur Cave (Islamov, 1990). The site is located along the Sokh River and was excavated by Islamov between 1982 and 1989. Five cultural layers have been recognized among 12 lithostratigraphic layers. The bulk of fauna from the two first layers and the pollen analysis indicate a permanent steppe landscape, and a 230Th/U date of 126 ± 5 ka (LU-936) provides a minimum age for the assemblage corresponding to the last interglacial. Humain remains have been reported (teeth, humerus and occipital bone?) and attributed to a local variant of *Homo erectus* (Islamov *et al.*, 1988; Islamov, 1990). The lithic assemblage is claimed to be Acheulean although it lacks proper handaxes. Some authors underline similarities with some of the LP pebble assemblages from Tajikistan (Ranov, 1995b; Vishnyatsky, 1999). In the Fergana, MP and UP sites are so far known only from surface collections.

8.1.4 TIAN-SHAN

The northwestern Tian-Shan is a mountainous area located west and north of the Fergana. It is an important area as recent excavations provide new data on MP-UP occupation of Central Asia. The sites of Kulbulak, Obi-Rakhmat and Dodekatym II will be presented in more detail as they are relevant points of comparison with the IUP and EUP from south Siberia.

Kulbulak

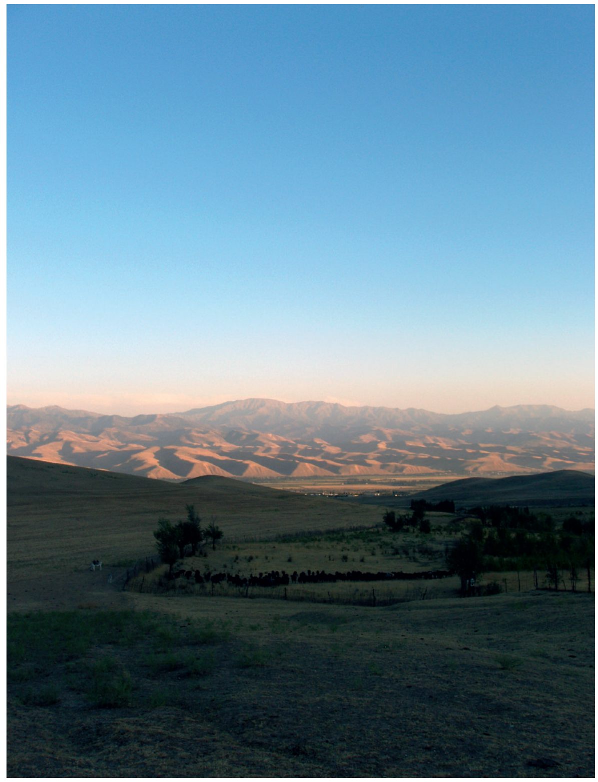

Figure 213: View on the Angren valley from the vicinity of Kulbulak (site is on the right)

The site of Kulbulak is located about 100 km northeast of Tashkent, along the western edge of the Tian-Shan range (Figure 213). Excavations in Kulbulak can be summarized in two main phases. The first phase consists of several campaigns that took place between 1964 and the early 1990s (Kasymov, 1972; Kasymov and Godin, 1984; Kasymov *et al.*, 1985; Kasymov and Grechkina, 1994; Anisutkin *et al.*, 1995). An area of circa 600 m² was excavated, including a pit of 3 m² and circa 19 m deep. During this phase, the site has yielded more than 70,000 artifacts coming from 49 archeological layers (Kasymov *et al.*, 1985; Kasymov and Grechkina, 1994). Kasymov and Godin (1984) reported that the Matuyama-Brunhes boundary has been recorded around layer 28. They attributed the bottom of the sequence to Acheulean, overlaid by MP and UP occupations. Following the publication of these results, some authors have expressed doubts regarding the integrity of the deposits (Vishnyatsky, 1999) and regarding cultural attributions or chronological issues (Ranov, 1995b). The second phase of excavation started in 2007, under the direction of Flas and Kolobova (Derevianko, Islamov, Kolobova, *et al.*, 2008; Kolobova *et al.*, 2008; Flas *et al.*, 2010; Krivoshapkin, Kolobova, *et al.*, 2010). The excavation finished in 2010, and the analysis of the material is still on going (Flas *et al.*, 2011). The following description is based on the second phase of excavation.

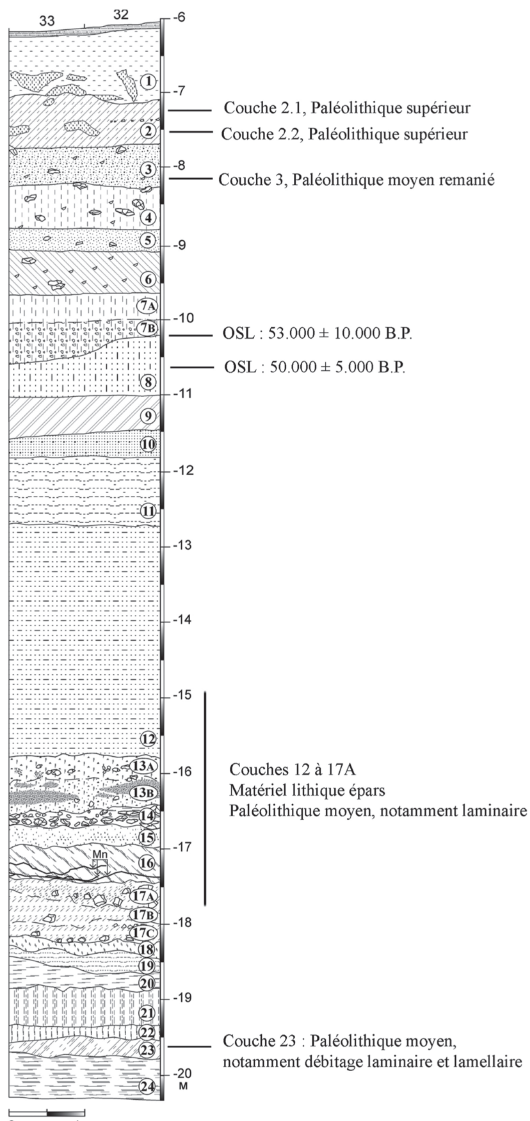

Figure 214: Kulbulak, stratigraphic log (after Flas *et al.*, 2011)

Stratigraphy

The excavation covers a total area of circa 36 m² distributed in different part of the site. The sequence is built around two main excavation areas (Figure 214). The first includes layers 1-3 and contains UP cultural layers. The second documents layers 3-24 in which MP material has been recovered. The UP levels from layer 2 were excavated in a bench of sediments left exposed by the previous investigators. The layer 2 sediment matrix consists of consolidated sandy-clay deposited near a spring, under low-energy damp conditions. During the 2007-2010 campaigns, the 19 m deep pit left by the previous excavators was reopened in order to address stratigraphic and chronological issues. 21 additional lithostratigraphic layers were described, with lithic material occurring between layers 12 and 17a and in layer 23 (Krivoshapkin, Kolobova, *et al.*, 2010; Flas *et al.*, 2011).

Chronology

No radiocarbon dates could be obtained from the sequence and the fauna is badly preserved. So far, two OSL dates have been obtained on the quartz sediment fraction from the bottom of layer 7b and from layer 8. The dates of 53 ± 10 ka (GLL-070304) and 50 ± 5 ka (GLL-070305) can be considered as minimum ages for the layers 12-17a and 23 (Flas *et al.*, 2010). A broader OSL-dating program is currently ongoing (Flas *et al.*, 2011).

Human remains

In 2009, a human tooth was found associated with the UP assemblage from layer 2.1. It has been described as an extremely worn, lower left premolar (Flas *et al.*, 2010). The fossil is currently under study.

Lithic assemblage

Two main lithic concentrations have been identified in layers 2.1 and 2.2. The collection is extremely rich (N=>40,000) and mainly illustrates primary reduction activities performed on local raw material (Kolobova *et al.*, 2008; Flas *et al.*, 2010). One of the main sources of flint is a primary outcrop located in the limestone deposit that runs along the valley. Although the lithic material is still under study, some of the main features can be described. The blade production is characterized as volumetric, with mainly unidirectional and occasionally bidirectional removals (Figure 215 :1, 2). Some of the cores are semi-turning using a broad and a narrow face as a flaking surface. The opposed platform is often initialized at the end of the reduction. Platforms are generally plain and reduced in size, with frequent occurrences of macroscopic lips along the internal platform edge and traces of thin abrasion along the external edge.

A systematic wet screening of the sediments has led to the identification of a bladelet and microblade technology (Figure 216). All elements of the reduction sequence are documented. Cores have various morphologies but mainly include carinated and nosed-endscraper forms (Derevianko, Islamov, Kolobova, *et al.*, 2008; Kolobova *et al.*, 2008; Flas *et al.*, 2010). Core blanks are mainly thick flakes or by-products of the larger blank reduction. When the reduction takes place on a broad face, it tends to follow unidirectional and semi-turning patterns. Cores with the flaking surface on a narrow edge illustrate frontal reduction. The presence of fronto-lateral flakes indicates that carinated endscrapers were sometimes rejuvenated by the detachment of a deep notch flake from one extremity of the flaking surface. The notch turns the carinated endscraper into a nosed-endscraper. In other words, these two forms may correspond to different stages of reduction rather than to distinct technologies (*e.g.* Le Brun-Ricalens, 2005). The in-

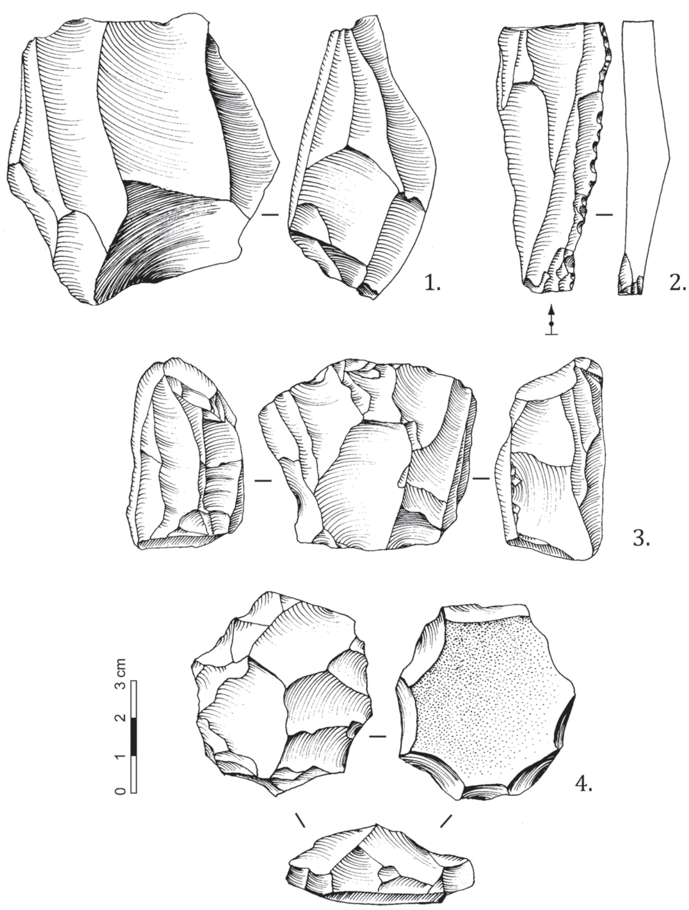

Figure 215: Kulbulak, cores from 2007 excavation. 1-2, layers 2.1 and 2.2; 3-4, layers 3 (drawings by Paquay and Zwyns)

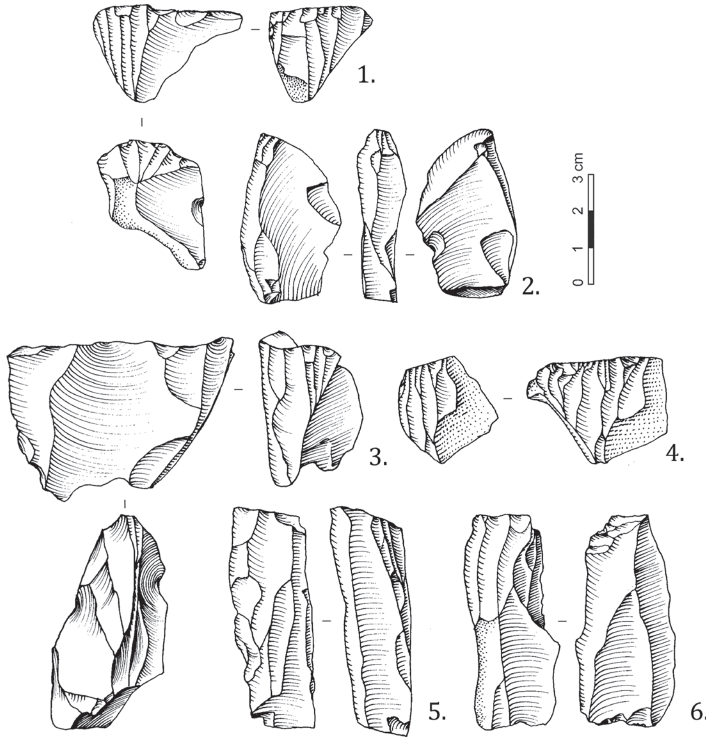

Figure 216: Kulbulak, layers 2.1 and 2.2, cores from 2007 excavation (drawings by Paquay and Zwyns)

tensity of the bladelet/microblade production is rather high judging by the frequency of core tablets and rejuvenation flakes. Cores reduced from the narrow face include bidirectional burin-like cores. Some of them are atypical BC (Figure 217: 10) produced on a small nodule also re-used as a tool *(piece esquillee).* No systematic BC production is observed in the UP collection.

The blank width ranges from bladelet down to microblade (Figure 217: 1-9). From a general point of view, it seems that the reduction is oriented toward narrow and regular blanks. The few retouched elements identified include Dufour bladelets, some having inverse retouch along the left edge (Figure 217: 3). Other types include blanks with bilateral retouch, pointed distal ends, and proximal inverse truncations (Figure 217: 2). A first geometric microlith was found in 2007, not far from the exposed ground surface (Flas *et al.*, 2010) (Figure 217: 1). Its association with the rest the assemblage was, therefore, not secured. Since, one more was found during subsequent excavation campaigns; it seems that scalene triangles are part of the typological spectrum of the Kulbulak UP. So far, no direct date is available for these layers.

The underlying layer 3 is clearly re-deposited and has yielded an assemblage with more MP features. The lithic assemblage shows different states of patina with some of the artifacts highly weathered. A size sorting of the material is observed, with the small fraction missing. The layer 3 assemblage includes elements typical of a flake reduction, such as radial cores but also laminar elements. Flat-faced bidirectional cores with an exploitation of the narrow face also occur.

The lithic artifacts found between layers 12 and 16 seem to be in secondary position, except in layer 17a. Although the excavated area is small (circa 6 m²), a flake has been refit to a core in layer 16, and a few fragments of retouched blades have been refitted in layer 17a (Flas *et al.*, 2011). In spite of the reduced

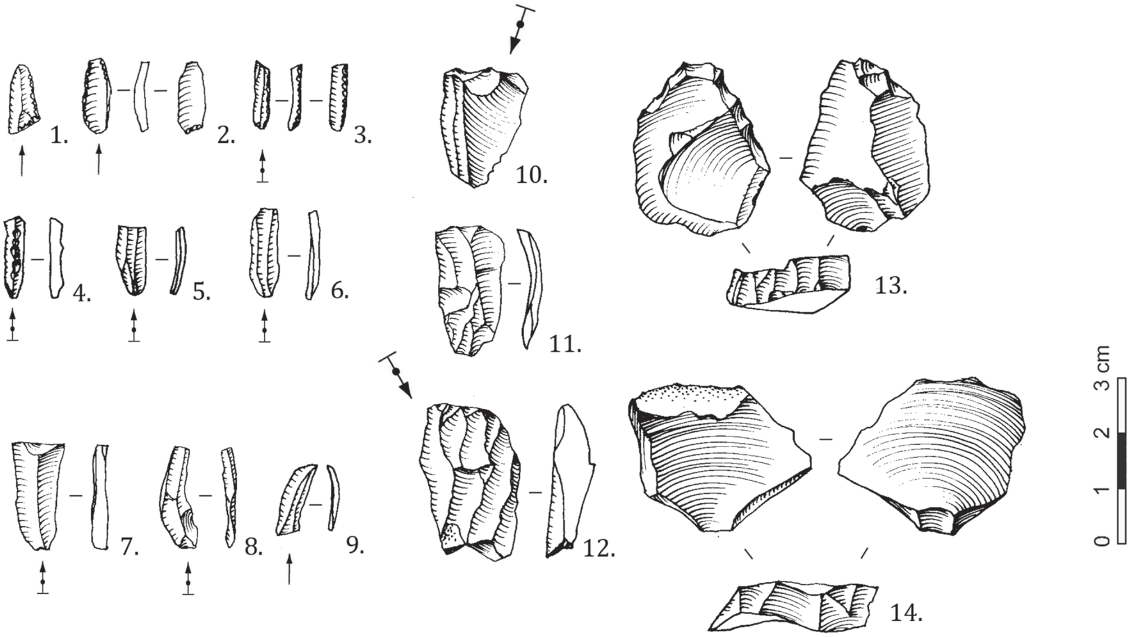

Figure 217: Kulbulak, layers 2.1 and 2.2, microblades and technological elements from 2007 excavation (drawings by Paquay and Zwyns)

sample size, evidence for bladelet technology is rather convincing. Of particular interest is the presence of a small core that is decribed as a BC, although the original blank is hard to identify (Flas *et al.*, 2010: Fig. 5, num.6).

The material from layer 23 represents the lowermost cultural level. Small and large laminar elements are reported including a refitted fragment of retouched blade (Krivoshapkin, Kolobova, *et al.*, 2010; Flas *et al.*, 2011).

In sum, new results on the Kulbulak sequence did not confirm the high number of cultural levels originally reported by Kasymovand colleagues (*e.g.* Kasymov *et al.*, 1985). In addition, there is no evidence for the presence of Acheulean assemblages (Flas *et al.*, 2010). Instead, it seems that the lower part of the Kulbulak section illustrates the presence of a blade-based MP techno-complex in the area.

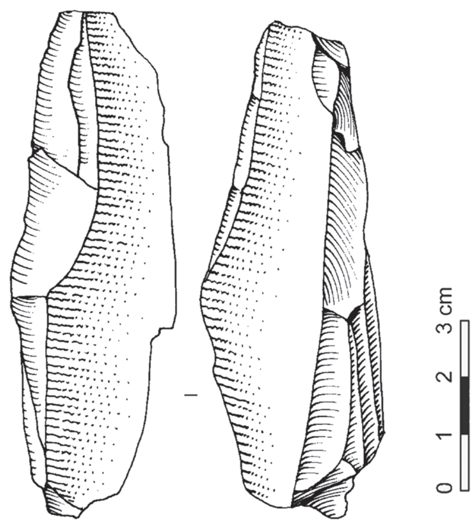

Figure 218: Kyzil-Alma II, second horizon, BC-like (undetermined blank), from 2007 excavation (drawings by Paquay and Zwyns)

Discovered by De Dapper in 2007, not far from Kulbulak, Kyzil-Alma II is a section of re-deposited loess (Derevianko *et al.*, 2008). A first cleaning of the section revealed at least three artifact horizons. The site is located along the raw material source and may represent evidence of primary reduction. The lithic assemblage has not been described in detail yet and is under study. Among the first artifacts uncovered from the second horizon, a BC has been published. Personal observation suggests that the blank is an elongated cortical slab (Figure 218). Removals are short and fragmentary.

Obi-Rakhmat

The Obi-Rakhmat Grotto lies about 100 km northeast of Tashkent, in the western Tian-Shan range. The cave opens at the bottom of a small ravine, on the right bank of the Paltau river valley, a tributary of the Chatkal River (Figure 219). It lies at the limit of the Karatut-Bashi Mountain at an approximate elevation of 1250 m asl. The chamber is 9 m long with a maximum height of the ceiling of 11.8 m. The 20 m width entrance faces south, opening in a Paleozoic limestone massif. Following its discovery in 1962, Obi-Rakhmat was first excavated in 1964-1965 by Suleimanov under the supervision of Gerasimov and Nasretdinov (Suleimanov, 1972). Between 1966 and 1986 the site was sporadically excavated by Omanzhulov and Krakhmal. Starting in 1998, a joint research team from the Institute of Archeology and Ethnography from the Siberian Branch of the Russian Academy of Sciences and the Institute of Archeology of the Uzbekian Academy of Sciences carried out new excavations under the supervision of Derevianko (Derevianko, Islamov, Petrin, *et al.*, 1998; Derevianko, Islamov, *et al.*, 1999).

Stratigraphy

The 10 m deep stratigraphic sequence is divided into 22 strata (Figure 220). It shows alternations of pale-yellow and grey sandy loam horizons. Pale-yellow horizons are generally 50-60 cm thick and display a relatively low artifact density. Compared with the 15-25 cm thick gray horizons, they bear more lithic artifacts, bones and charcoal fragments. The strata are rather horizontal, dipping slightly to the south-

Figure 219: Obi-Rakhmat site

west in the direction of the entrance and toward the western wall of the cave. Eboulis occur in very low density in the upper part of the sequence. They are more frequent in stratum 15, with big elements up to 40cm in diameter. In highly saturated areas, the soft sediments are cemented by carbonaceous water, mainly in the vicinity of the western wall (see also Derevianko, 2004).

Based on soil micromorphology (Mallol *et al.*, 2009), Mallol and colleagues suggest that the deposition of sediments occurs in two distinct environments, namely karstic and spring systems:

- Strata 21-19.3, 19.1-15: gravitational and low-energy deposition of a sediment rich in clay in a karstic environment. Stratum 19 has a pronounced anthropogenic component, including burned bones and ashes. These elements are affected by surface water. The rate of sedimentation is hard to assess and some part of the layers might be missing due to erosion.

- Strata 19.2, 18, 16, 14-2: sedimentation linked with spring activity and with the development of wet vegetation. These layers do not have a steady sedimentation. Layers with a relatively long subaerial exposure (*e.g.* stratum 7) accumulate more detrital material. Travertine occurs in these strata.

In other words, the karstic sedimentation in the lower part of the sequence is interrupted by two layers of spring sediments. The middle and upper part of the sequence testify to a spring environment with a varying sedimentation. In general, the sedimentation reflects a low-energy autochthonous process and does not originate, as previously thought (Novikov, 2004), from the Paltau River. The only exceptions are strata 17 and 15 as the former displays some features typical of exogenous sediments and the latter represents successive roof-fall events (Mallol *et al.*, 2009).

Fauna

The main identified faunal remains (NISP=1,758 in 2004) are found in association with the archeological material. The main species (90%) are ungulates (*Capra sibirica* and *Cervus elaphus*)(Suleimanov, 1972; Wrinn, 2004). The infrequent occurrence of other taxa gives the spectrum an overall homogenous appearance except for the presence of roe deer in layer 16-20. Except for layer 19, the faunal assemblage is rather poor compared to the lithic artifact density. Burned specimens and bones displaying cut-marks and percussion traces occur regularly, and evidence for carnivore activity is minimal (Wrinn, 2004).

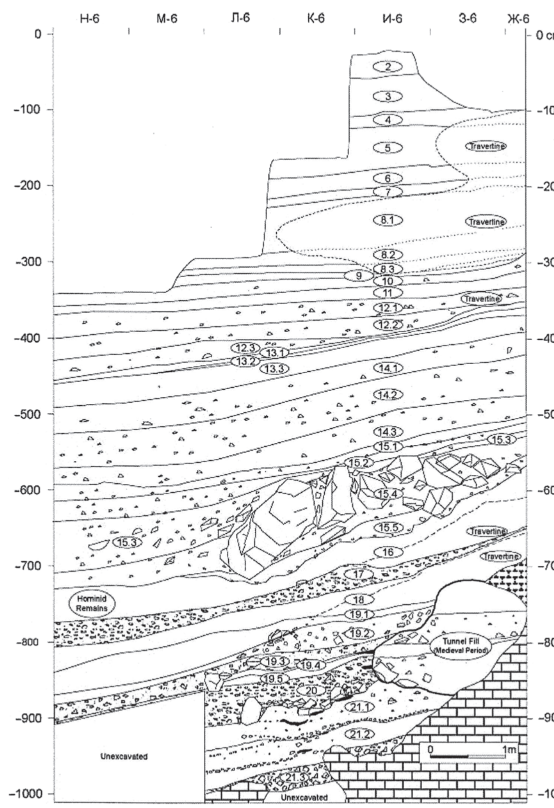

Figure 220: Obi-Rakhmat, stratigraphic column (after Mallol *et al.*, 2009)

Pollen

Palynological analyses suggest that climatic conditions at the time of the deposition were similar to present day Tian-Shan. The spectrum is almost identical over the whole sequence although displaying variability in species proportions. The bad pollen conservation allows only basic identification of herbaceous species, indicating Late Pleistocene dry steppe vegetation (Kul'kova, 2004).

Chronology

A number of different methods have been applied to the sequence in order to bracket the time of its deposition, but the results do not give a coherent pictures. Radiocarbon dates obtained on charcoal samples collected in strata 7, 8.1, 8.2, 13.2, and 14.1 indicate an age between 40 ka ^{14}C BP to around 50 ka ^{14}C BP, close to the limits of the method (Krivoshapkin, Kuzmin, *et al.*, 2010). In addition, U-Series dates performed on travertine from the upper part of the sequence (strata 5-12) show significant discrepancies with the radiocarbon results, indicating roughly an age between 70-100 ka (Wrinn *et al.*, 2004). ESR dates have been performed on 8 ungulate teeth samples (*Bovidae, Cervidae* and *Capra*) collected from strata, 12.3, 13, 14.3 and 21.2. The results range between 57 ± 2 ka BP to 87 ± 4 ka BP (Skinner *et al.*, 2007; Shoer *et al.*, 2008). As suggested by infinite ages, radiocarbon dates exceeding 40 ka ^{14}C BP could reflect minimum ages (e.g stratum 14). Krivoshapkin and colleagues argue that the upper part of the sequence, starting circa stratum 14, remains in the range of radiocarbon (Krivoshapkin, Kuzmin, *et al.*, 2010). Whereas some of the outliers are rejected due to low C values, other finite radiocarbon ages are validated. The dates obtained on charcoal samples collected from strata 7 and 8 indicate an age between 45 and 50 ka cal BP. The results would then fit with the ESR results. Preliminary results of OSL dating seem to indicate overlapping ages between 52 ka and 65 ka from strata 5 to 21. These results are not fully published, but Krivoshapkin and colleagues (2010) consider that they are not conclusive (Krivoshapkin, Kuzmin, *et al.*, 2010).

Human remains

In 2003, six isolated permanent maxillary teeth and 121 cranial fragments were uncovered in stratum 16 (Glantz *et al.*, 2004, 2008; Glantz, 2010). They are assigned to a single juvenile individual, OR-1, whose age is evaluated to between 9-12 years old based on the examination of the relative root development and of the degree of dental wear (Glantz *et al.*, 2008). In the initial description and in more recent analysis, authors underlined the mosaic of morphological features observed on OR-1. As the dentition shows archaic traits, portions of the temporal regions and the left parietal were interpreted as similar to MH specimens from the same age (Glantz *et al.*, 2004, 2008). If the cranial fragments remain ambiguous, a detailed study of the dentition seems to clarify the picture. According to the authors, the comparison of discrete attributes (28 non-metric dental traits scored from Neandertals, UP, and MP Modern Humans) together with a morphometric analysis of the first upper molar strongly support the attribution of the OR-1 dental remains to Neandertal (>99 % of a posteriori probability) (Bailey *et al.*, 2008). Moreover, the left bony labyrinth and the semi-circular canal are preserved and clearly indicate Neandertal affinities (Glantz *et al.*, 2008).

Lithic assemblage

Artifacts collected in 1963, 1968-1970, 1978, 1979 and 1986 have been analyzed and published for strata 2-14 (*e.g.* Krivoshapkin and Brantingham, 2004; Krivoshapkin *et al.*, 2007). Regarding the bottom of the profile, the excavation is still on-going and only preliminary observations will be mentioned here. Most of the raw material consists of silicified limestone that occurs in natural outcrops in the west vicinity of the site and along the riverbeds (Mallol *et al.*, 2009). This material occurs as angular slabs offering natural crested edges that facilitate initial reduction. A very large number of lithic artifacts have been uncovered along the sequence (in 2004, the number of finds was >60,000) coming from a surface of circa 25 m² (Mallol *et al.*, 2009). The general character of the lithic assemblages does not vary throughout the sequence and will be summarized here as a whole. All levels testify to a developed blade technology with a usual frequency of more than 40%. Blades are produced from various types of cores (Figure 221). The core reduction is mainly unidirectional and convergent, with the occurrence of broad and narrow face cores. Some of the cores display evidence of reduction on both the narrow and flat face (Slavinsky, 2004; Krivoshapkin *et al.*, 2007). As mentioned in previous studies, burin-like cores are produced on large flakes or blades (Krivoshapkin and Brantingham, 2004). The flaking surface either follows the longitudinal axis (BC) (see also Derevianko, 2011: Fig. 44 num. 3) or is perpendicular to the blank. In-

Figure 221: Obi-Rakhmat, cores. 1. stratum 7; 2, 3, 8. stratum 11; 4-7, 9. stratum 14; 10. stratum 15; 11, 12. stratum 19 (drawings by Paquay and Otte)

termediate forms are observed, such as lateral burins *(burin plan)* with a flaking surface expanding toward the ventral face of the blank. Some of the platforms are reshaped by partial tablet removals. Bidirectional removals seem to represent distal management of the core or a change of platform that follows a long unidirectional sequence.

Small volumetric bladelet cores occur starting from the lowermost part of the sequence. Large/medium laminar blanks can be classified within two main categories. Blades with parallel or sub-parallel edges show mainly unidirectional scars (Figure 222). In some cases, a short opposed removal is observed on the distal part of the blank. Orientation of the removal indicates that blanks with parallel edges are produced by a rather convergent reduction system. Platforms are usually thick (>4 mm) and plain, but facetted and dihedral types also occur. Prepared crests are not frequent.

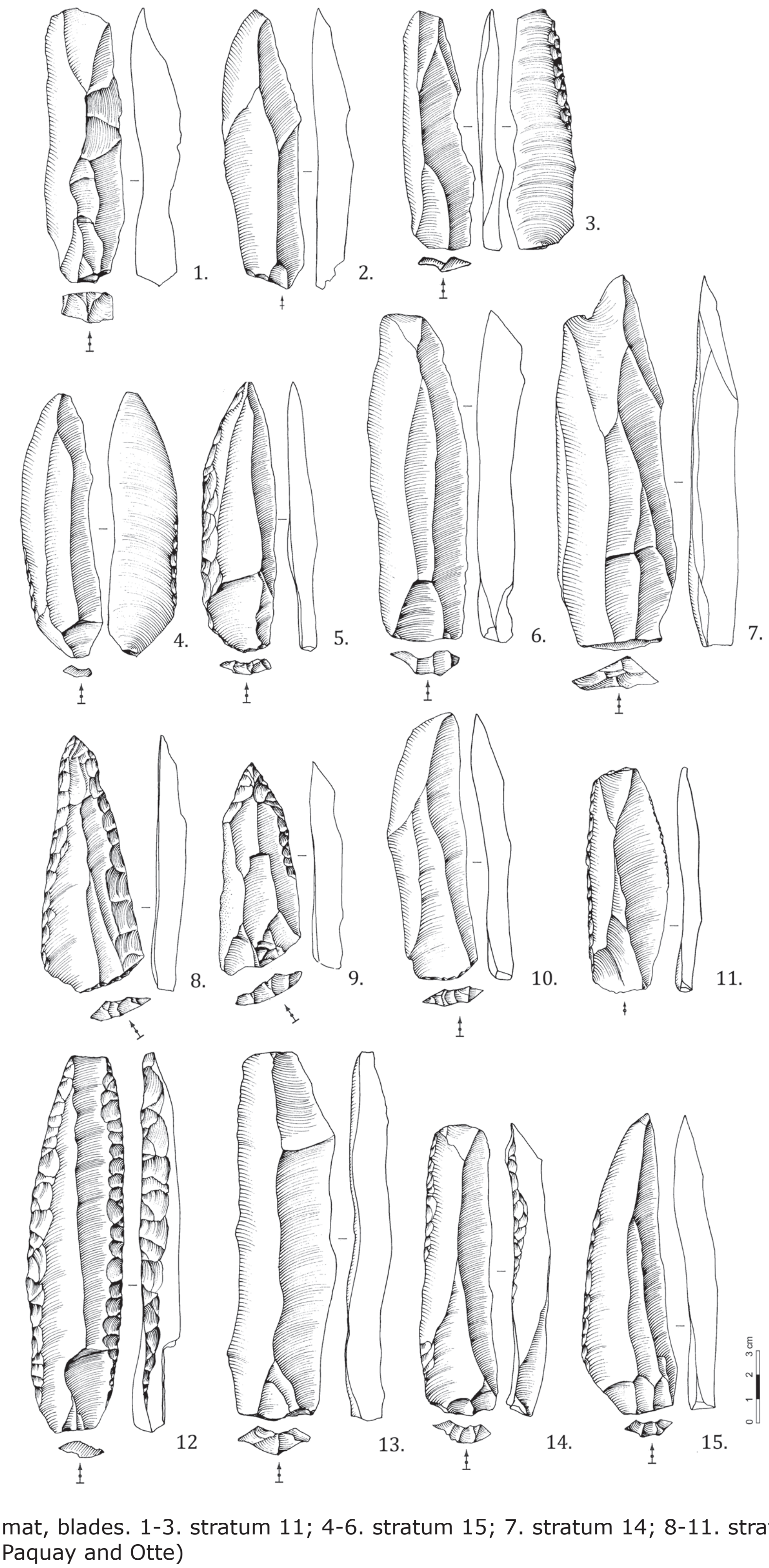

Figure 222: Obi-Rakhmat, blades. 1-3. stratum 11; 4-6. stratum 15; 7. stratum 14; 8-11. stratum 19; 12-15. stratum 20 (drawings by Paquay and Otte)

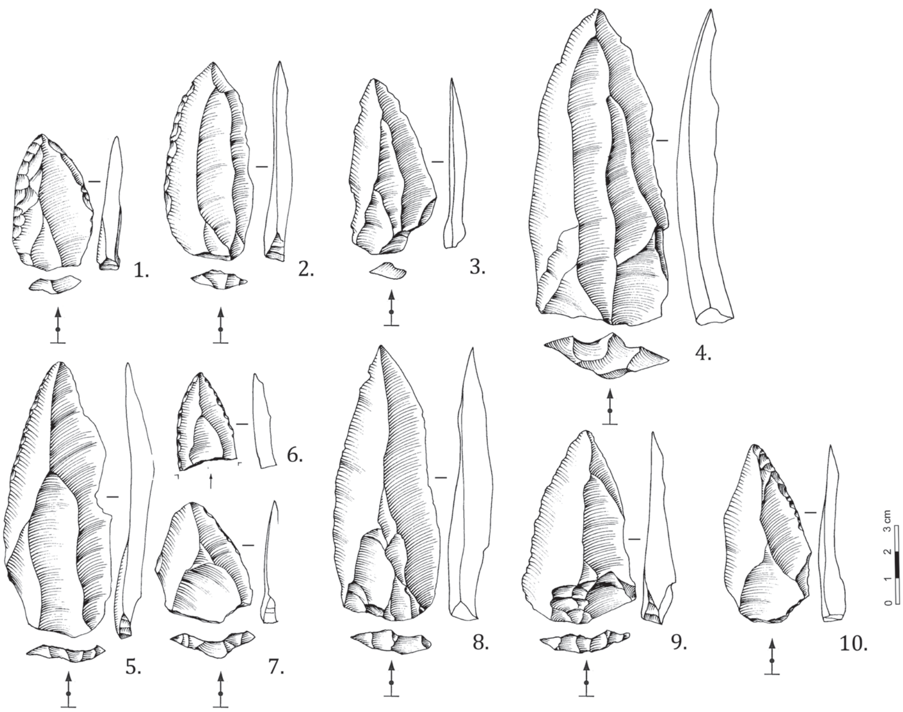

Figure 223: Obi-Rakhmat, convergent blanks. 1. stratum 2; 2. stratum 7; 3. stratum 15; 3, 4. stratum 17; 5-7. stratum 19; 8-9. stratum 21; 10. stratum 20 (drawings by Paquay and Otte)

Some retouched blades are pointed by a bilateral semi-steep, steep or scalar retouch. Other blade blanks bear marginal retouch that is sometimes thin. The second main category of blank is represented by artifacts with convergent edges (Figure 223). This category includes classic and atypical Levallois points. The dorsal patterning is usually unidirectional and convergent, although some blanks may occasionally present a distal opposed removal.

Platforms are plain, dihedral or facetted, the latter being sometimes slightly *débordant*. Some of these convergent blanks bear bilateral mesio-distal retouch; others have thin and scalar marginal retouch along one edge. When marginal retouch is thin, semi-steep and steep, it can take the form of a truncation (Figure 224). In fact, truncations are rather abundant in some strata (*e.g.* stratum 19). Some of them are similar to small Levallois blade cores and can be typed as truncated-facetted pieces, while others seem to be truncated tools on blade fragments. A few rare specimens seem to suggest a basal thinning by inverse retouch, starting in layer 21 (Derevianko, Krivoshapkin, *et al.*, 2004).

From a general point of view, blade platforms are mainly plain. Based on the definition of Nehoroshev (1999), Slavinsky (2004) underlines the lack genuine 'platform reduction' in the upper part of the sequence (stratum 14-3). It is then assumed that partial faceting is uncommon, if present at all.

During the 2008 campaign, squares M-6 to M-8 were excavated in strata 21.1, less than (60 cm from the bedrock), along the eastern profile (Krivoshapkin, in press). Among the finds uncovered, numerous elements illustrate different types of bladelet production, following distinct reduction sequences. The sample presented below only provides a preliminary view of the assemblage as the excavation is still ongoing.

Cores are of various types, including cores on flake ridge, prismatic and sub-prismatic forms. They

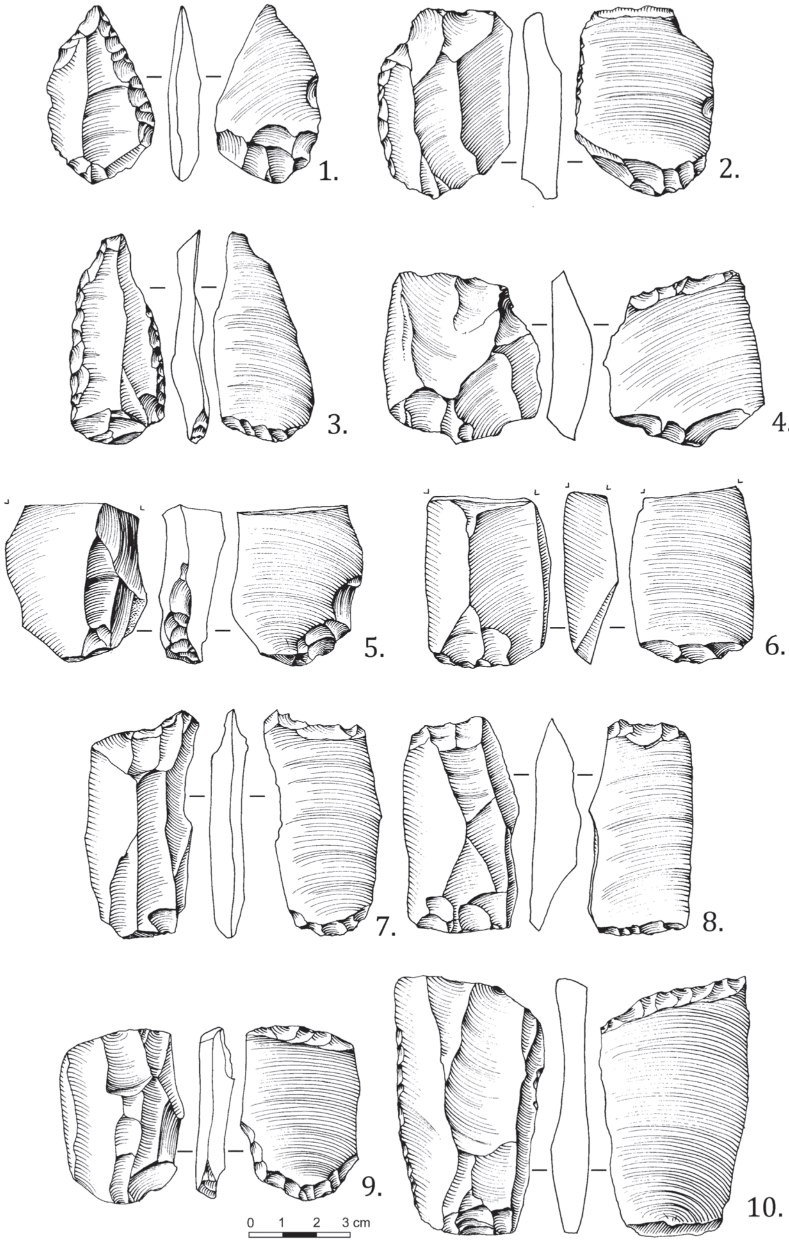

Figure 224: Obi-Rakhmat. Blanks with truncation and/or inverse retouch. 1. stratum 18; 2-4, 6, 8-10. stratum 19; 5. stratum 21; 7. stratum 17. (drawings by Paquay and Otte)

sometimes display a posterior crest or the remains of an antero-lateral crest. Some specimens clearly document volumetric and semi-turning reduction and are rather close to wedge-shape forms (Figure 225). All stages of the reduction sequence are represented, including blanks, rejuvenation blanks, overshot, and core tablets (Figure 226). Of note is the presence of a single retouched small blank, namely a backed bladelet with direct abrupt retouch along the left edge (Figure 226: 7). The retouch is continuous but

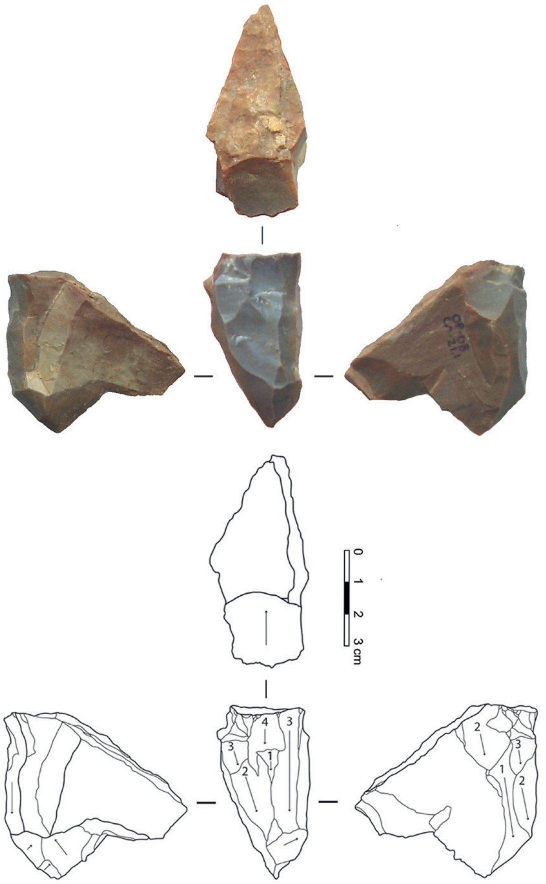

Figure 225 : Obi-Rakhmat, stratum 21, bladelet core from 2008 excavation

the proximal left end is still unretouched. Along with this technological set a small hammer stone (sandstone?) was found that displays traces of percussions on both narrow ends (Figure 226: 5). The absence of abrasion on the platform external edges does not contradict an association between hard hammer and bladelet reduction; however, platforms are mainly plain and are sometimes very small.

To summarize, the Obi-Rakhmat site is characterized by a long sequence of human occupation that probably corresponds to repeated use of the site as a hunting camp (Wrinn, 2004; Mallol *et al.*, 2009). According to previous studies, blade reduction and knapping activities took place primarily outside of the site judging by the reduced number of cores and the high frequency of retouched tools. While it has been argued that Obi-Rakhmat represents a gradual evolution toward UP technology (Derevianko, 2001; Derevianko *et al.*, 2001; Krivoshapkin and Brantingham, 2004; Krivoshapkin *et al.*, 2007), it appears that the main technological and typological features remain the same throughout the whole sequence. Some authors have suggested that it could represent laminar MP assemblage (Vishnyatsky, 2004) With respect to the sample size and to the occupation intensity, differences might be subtle and their interpretation would require a detailed technological attribute analysis. Nevertheless, the assemblage illustrates a coexistence of parallel edge and convergent blades produced mostly by unidirectional convergent reduction. Blades with parallel edges can easily be produced from narrow-faced cores and some of the Levallois laminar points may have been

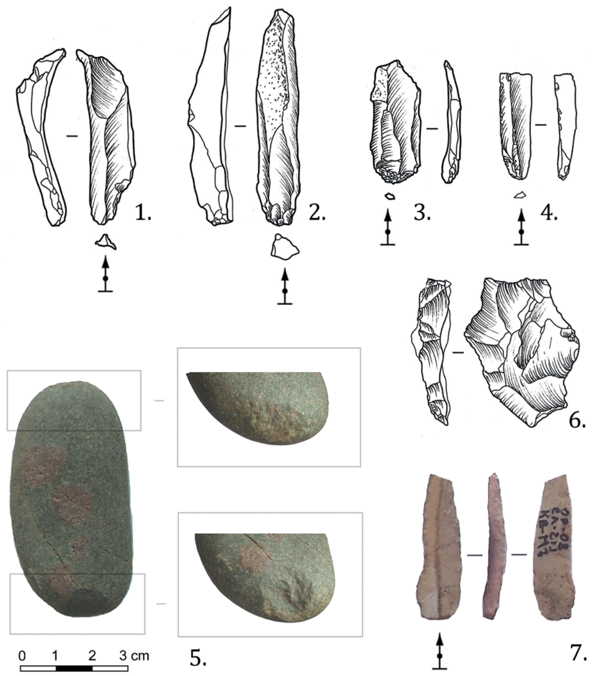

Figure 226: Obi-Rakhmat, layer 21, bladelet technology form 2008 excavation. 1, 2. Burin spall-like blanks; 3. flaking surface management flake; 5. hammer stone; 6. core tablet; 7. backed bladelet (drawings by Vavilina and Zwyns).

detached from somewhat larger flaking surfaces. Small laminar blanks are produced in various ways, including BC, burin-like cores, cores on flake edges and truncated-facetted pieces. It is noted that UP core forms occur starting in the lowermost archeological levels. The presence of all elements of the reduction sequence is exceptional and no matter whether the long or short chronology is considered, these are among the oldest examples of the kind in Central Asia and are associated with Neandertals.

Dodekatym II

The site of Dodekatym II is located along the Paltau River, circa 3 km upstream from Obi-Rakhmat. The site is located along the edge of a small plateau in a mountain depression (Figure 227).

It was excavated between 2005 and 2010 by an international team under the field direction of Krivoshapkin (Krivoshapkin *et al.*, 2005; Derevianko *et al.*,

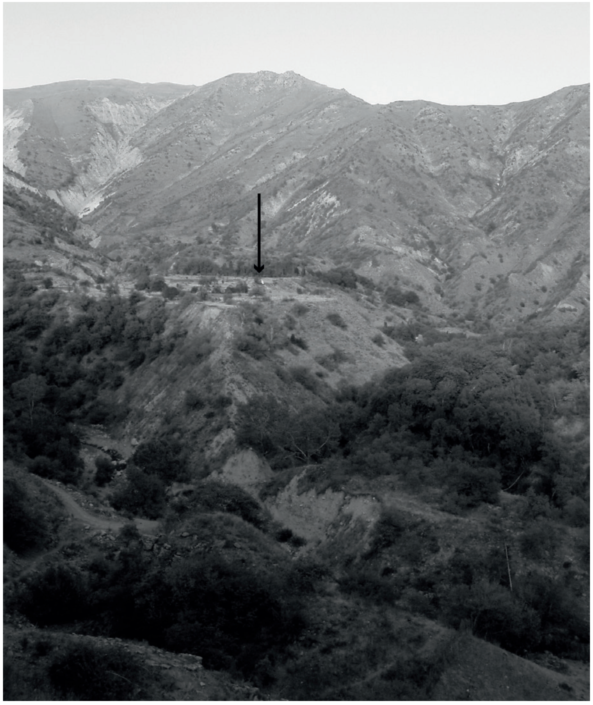

Figure 227: Dodekatym II, view from the Paltau valley

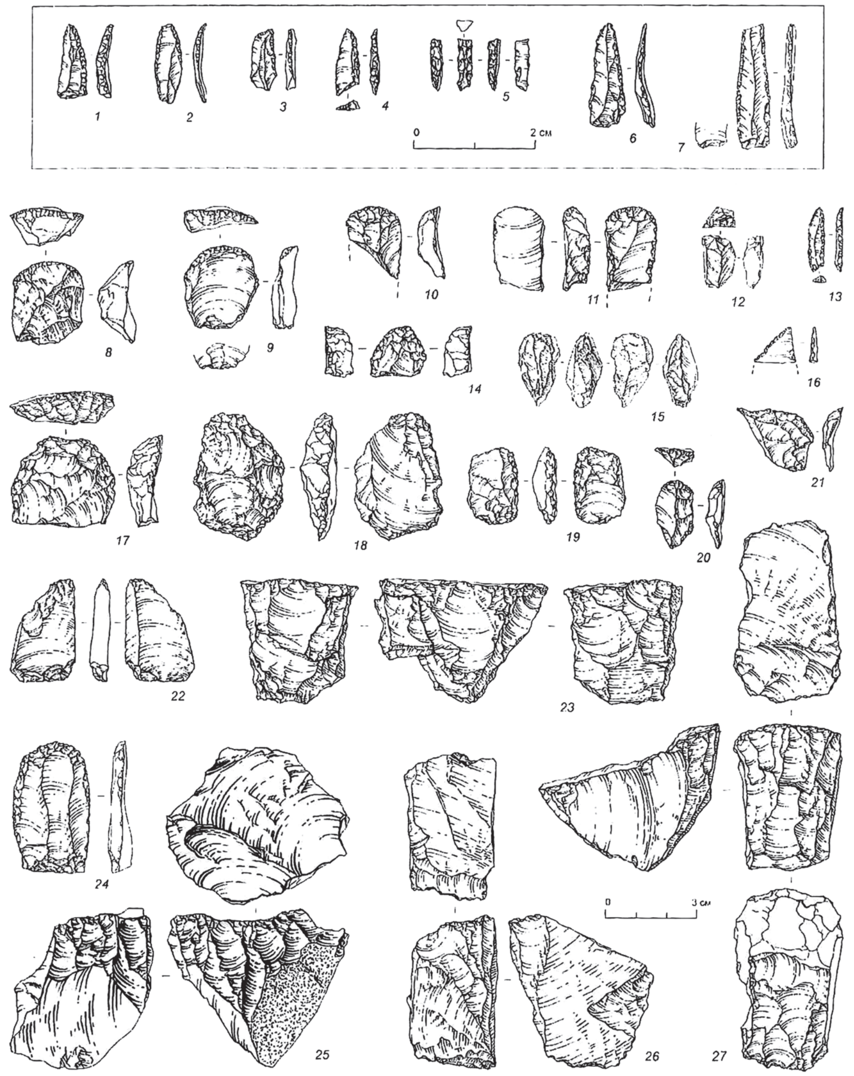

Figure 228: Dodekatym II, lithic assemblage (after Derevianko *et al.*, 2010)

2010; Kolobova *et al.*, 2011). The site has yielded a sequence of five archeological layers over an excavated surface of less than 10 m². The main concentrations are in layers 2, 4 and 5. Layer 4 has yielded AMS radiocarbon dates of 23,800 ± 190 ^{14}C BP (AA-69073) and 21,850 ± 180 ^{14}C BP (AA-69074) on charcoal and 23,600 ± 330 ^{14}C BP (AA-69075) on a bone sample. The fauna is badly preserved, and almost no identifiable bones have been recovered.

The lithic assemblages are similar across the sequence (Figure 228). Blades specimens are of medium/small size, with plain and small platforms, and unidirectional dorsal patterning. Thin abrasion is observed on the external edge of the platform, and the technique of percussion is likely organic hammer. Small wedge-shape prismatic cores testify to the production of bladelets and microblades (Zwyns and Flas, 2010). The obtained blanks have bilateral or lateral thin retouch, with some rare example of an inverse notch on the proximal end. In addition, layer

2 has yielded a series of geometric microliths with mainly scalene triangles (Derevianko *et al.*, 2010). A few of them are also reported in layer 4. Small endscrapers and splintered pieces are also typical of these assemblages. The Dodekatym II assemblages are similar to layers 2.1 and 2.2 of Kulbulak (Derevianko *et al.*, 2010).

Little is known about the north and central Tian-Shan where almost exclusively surface collections have been located (Salamat-Bulak, Tossor, Georgievsky Bugor) (Vishnyatsky, 1999).

8.1.5 KAZAKHSTAN

As noted by Vishnyatsky (1999), Kazakhstan is relatively rich in sites, but they are mainly poorly studied surface collections. In the region between the southern border of Kazakhstan and the Karatau range, small assemblages from surface collections (Borykazgan, Tanirkazgan, Akkol, Kemer I-III, Tokaly I-III) are attributed to Acheulean although they lack of genuine handaxes (Alpysbaev, 1979; Derevianko *et al.*, 1998; Vishnyatsky, 1999). MP sites are mentioned in the Chimkent province, with the Koshkurgan I and Shotkas I sites. These sites are located in a spring environment described as an artesian well surrounded by travertines. Three bone samples from Koshkurgan I dated by EPR have yielded ages of 501 ± 23 ka, 487 ± 20 ka and 427 ± 48 ka (Derevianko *et al.*, 1998). Although lithic assemblages are said to belong to the Mousterian with very few or no blades, a BC-like artifact made on what appears to be a thick laminar blank is illustrated (Artykhova, 1994, Fig. 6, num 17).

The site of Karasu is one of the few stratified sites with cultural horizons yielding flake-based assemblages, some with carinated endscrapers, and it has a direct date of 24,800 BP ± 1,100 (no lab number) for the upper layer (Taimagambetov and Aubekerov, 1996; Vishnyatsky, 1999, 2004).

In central Kazakhstan, the Tuemainak I collection is classified by Voloshin (1990) as ranging from the Mousterian to the UP, and the toolkit includes leaf-points (Voloshin, 1990; Vishnyatsky, 1999). Handaxes are reported in various locations, along the southern shore of Lake Tengiz or near Djezkazgan, in central Kazakhstan. In the northeast, LP, MP and UP artifacts are reported along the Ishim River and from the Irtish River, near Pavlodar or Ekibastuz. In the east, so-called Late Acheulean sites such as Semizbugu are mentioned along the northern and western shore of the Lake Balkash with the presence of handaxes (Derevianko *et al.*, 1993; Deom *et al.*, 2010) .

In the southeast, about 40 km from the city of Almaty, the site of Maybulak is one of the rare stratified sites attributed to UP (Taimagambetov, 2009; Deom *et al.*, 2010). Three main cultural horizons are described. The lowermost third horizon includes remains of fire and burned artifacts. The lithic assemblage (N=1,029) is characterized by the presence of microblades (N=84) and thick endscrapers are also reported (N=13). The assemblage of the second horizon (N=930) includes Levallois-like elements and prismatic cores. Thick endscrapers (N=8) and microblades (N=14) are mentioned. These assemblages show an association of Levallois elements and microblade production likely from carinated endscrapers (Taimagambetov, 2009, Fig.1 and 2). A radiocarbon date of 34,970 ± 665 has been obtained on cultural horizon 3 and of 30,062 ± 415 ^{14}C BP (?), 29,116 ± 329 ^{14}C BP (?) and 27,880 ± 280 ^{14}C BP (?) from horizon 2. A date of 24,330 ± 190 ^{14}C BP (?) was obtained on horizon 1, which presents a similar assemblage partly destroyed by a Bronze Age occupation. These dates are presumably uncalibrated ages, but the nature of the samples and the laboratory where they have been dated are not reported.

Chlachula (2010) recently reported surface finds from the Zaisan basin, in eastern Kazakhstan. Artifacts were collected from a gravel formation and attributed to eroded early Pleistocene surfaces. The Narym site would be one of the earliest evidence of human occupation. It consists of a few artifacts spotted in a colluvium deposit on the top of the Bukhtarma terrace. Artifacts are said to be flakes produced by hard-hammer percussion and bear a strong wind polish. This collection is assigned to the Middle Pleistocene (Chlachula, 2010).

Some of the surface collections found in the Kazakh steppe, such as Camp Lake site, yielded laminar artifacts. The Dzhambul and the Bere'l sites are located at the top of colluvial deposits and under a loess cover. The artifacts show UP features and are tentatively attributed to the final Paleolithic (Chlachula, 2010).

8.2 SIBERIA

A selective overview of the Paleolithic record is proposed for western and eastern Siberia. As previously stated, this summary focuses mainly on MP and UP sites that are relevant in the frame of this study. Less attention will be paid to the LP and post-LGM UP.

8.2.1 WESTERN SIBERIA

Western Siberia is a vast plain where the maximum elevation is circa 200 m asl. It is bordered by the Russian plain and the Ural range to the west, the steppe from Kazakhstan to the south, the Siberian mountain range in southeast and the Yenissei River in the east (Figure 211: 3). Starting with the discovery of the Tomskaya site in 1896, western Siberia now includes more than 30 Paleolithic localities. This number is rather small when one considers the region corresponds to an area of about 3 million km² and represents a third of Siberia.

The Byisk site is located along the Biya River in the Ob river basin. It is a stratified site and artifacts have been collected from a sandy gravel deposit underneath a succession of four loess and three paleo-soil formations. The cultural horizon is at a depth of 20 m into a 50 m thick loess section. The upper part of the loess reflects climatic fluctuations of the late Pleistocene (Evans *et al.*, 2003). These artifacts are strong evidence of human occupation prior to OIS4 (Chlachula, 2010). In the plain north of the Altai, numerous Mousterian sites (Gora Kukushka, Ust-Mashinka 3, Davidovka 1, Ust-Berezovka 3 and Ust-Boutochnyi 2) are reported (Kungurov, 2002), although none of them have been fully published yet.

In the Chulym basin, the Aryshevskoe 1 site is a workshop that is characterized by radial, convergent and parallel flaking with a toolkit mostly composed of sidescrapers, denticulates and notch tools. UP types are almost absent although artifacts with burin spall negatives are mentioned (Zenin, 2002). Radiocarbon dates were obtained on humic soil samples from the lowermost cultural layer and yielded minimum ages of 40 ka ^{14}C BP (SOAN-4178; SOAN-4179). A younger date of 33,630 ± 995 ^{14}C BP (SOAN-4180) was obtained on a charcoal sample collected in the upper layer. The assemblage is tentatively considered as MP (Zenin, 2002).

The Voronino-Yaya site is attributed to the Late Pleistocene, and a minimum age is provided a by a radiocarbon date of 28,450 ± 850 ^{14}C BP (SOAN-3837) obtained on a bone sample from the overlying horizon. The assemblage is composed of a few quartzite sandstone artifacts (Zenin, 2002).

The open-air site of Malaya Sya is also located in the Chulym river basin in the Krasnoyarsk krai. The site was discovered by Ovodov in 1974 and was excavated by Ovodov an Okladnikov in 1975 (Muratov and Ovodov, 1982). Subsequent excavations by Larichev are only partially published (Goebel, 1994, 2004). The stratigraphy is divided into five layers: layer 1 is the modern soil, layer 2 is a thick pack of loess with cryogenic wedges, layer 3 is laminated clay matrix with traces of re-deposited soil and layer 4 is a clear paleo-soil formed on a gley. The latter marks the top of a thick accumulation of loess from layer 5. A single archeological level is associated with the paleo-soil from layer 4. The available radiocarbon dates for this layer are 20,370 ± 340 ^{14}C BP (SOAN-1124), 34,500 ± 450 ^{14}C BP (SOAN-1286), 34, 420 ± 360 ^{14}C BP (SOAN-1287) and 29,450 ± 420 ^{14}C BP (AA-8876) (Muratov and Ovodov, 1982; Larichev *et al.*, 1988; Larichev and Khol'ushkine, 1992; Goebel, 1994, 2004). The first and the last dates (SOAN-1124, AA-8876) have been obtained on samples collected by Ovodov. The first one is from a charcoal sample from a disturbed area (Larichev *et al.*, 1988), and the second one is a bone dated by Goebel (1994, 2004). As pointed out by Goebel (1994), there is a disagreement between Larichev and other authors regarding the SOAN-1287 date as Larichev reports a date of 33,060 ± 300 ^{14}C BP (Larichev *et al.*, 1988; Larichev and Khol'ushkine, 1992). The reduction system includes radial and Levallois flake cores and flat-faced bidirectional blade cores. According to Goebel (1994), most of the cores are simple unidirectional flake cores and most of the tools bear irregular or unidirectional dorsal patterning. The high frequency of cores and the low frequency of tools suggest rather expedient technology. Some authors, however, have interpreted the association of flake cores with blade blanks as illustrating a genuine UP technology resulting from a local transition (Larichev *et al.*, 1988; Otte and Derevianko, 1996). Bone and antler tools such as points or *retouchoir* are part of the toolkit (Goebel, 2004). Mobile art on a lithic flake or on tools is reported by Larichev *et al.*, (Larichev, 1978; Larichev *et al.*, 1988) including a fragmented stone pendant originally published by Okladnikov and Kirilov (Okladnikov and Kirilov, 1980). The objects are supposed to be shaped as animals, such as mammoth, eagle or tortoise, and some of them are also interpreted as instruments for paleo-astronomical observations. (Larichev *et al.*, 1988) These intepretations are controversial and, according to Goebel (2004), none of the described specimens are undisputable. According to the published material, Malaya Sya is difficult to characterize. It appears close to the Altai EUP but lacks many of the diagnostic technological elements, such as the microblade cores and blanks.

Most of the other sites, such as Gari, Lugovskoe, Shikaevka II, Novyi Tartas, Vengerovo 5, Mogoshino I, Chernoozerie II, Volchia Griva or Tomskaya, are attributed to the Sartan period (OIS2) (Derevianko, Shimkin, *et al.*, 1998; Zenin, 2002). A few of them are relevant for the discussion as they slightly overlap with the EUP technology from the Altai sites. Achinskaya is located near the city of Achinsk and documents a single cultural horizon containing a lithic assemblage, combustion features and fauna (horse, mammoth, saiga, wolf, polar fox and various birds). Although most of the cores are exhausted, wedge-shaped, discoidal and conical forms were recognized. Among the endscrapers, simple and double carinated forms are the most numerous (Anikovich, 1976), and Dufour bladelets are present (Abramova, 1984; Larichev *et al.*, 1988). A carved mammoth ivory baton with spiral decorations is associated with the assemblage (Larichev *et al.*, 1988). Achinskaya remains undated but it is generally assumed that it is posterior to the LGM (Larichev *et al.*, 1988; Derevianko, Shimkin, *et al.*, 1998; Zenin, 2002). From a techno-typological point of view, these asemblages seem to overlap with the Altai EUP.

The Shestakovo site is located along the Kiya River, a tributary of the Chulym River. The stratigraphy is divided into 25 lithostratigraphic layers that include 13 cultural horizons belonging to the Late Pleistocene and to the Holocene. Following Zenin description (2002), the lowest cultural layer, OH8, lies in the loess sediment of the stratum 24. Radiocarbon dates are 24,590 ± 110 ^{14}C BP (GrA-13329) on a horse bone and 25,660 ± 200 ^{14}C BP (GrA-13328) on a mammoth bone. Only two artifacts were recovered from this horizon: a reduced prismatic core and a blade with a straight back opposed to a crescent-shape edge. Horizon 7a corresponds to layer 22. Radiocarbon dates on mammoth bones are 22,400 ± 185 ^{14}C BP (SOAN-3612), 22,290 ± 125 ^{14}C BP (SOAN-1380), 22,500 ± 280 ^{14}C BP (SOAN-4177), 22,750 ± 160 ^{14}C BP (GrA-15880), 22,990 ± 170 ^{14}C BP (SOAN-1386), and 23,330 ± 110 ^{14}C BP (GrA-13325). The uppermost part of the layer has been washed out and is dated to 21,300 ± 420 ^{14}C BP (SOAN-3611). The associated artifacts (N=233) include carinated forms, a wedge-shaped core, microblades, bladelets and blades. This assemblage has been compared to the Altai EUP from UK1-2 (Zenin, 2002). The horizon 6 has yielded similar dates ranging between 23.5 and 20 ka ^{14}C BP produced on mammoth, reindeer and horse bones. A larger lithic assemblage (N=1,449) includes a series of asymmetric segments (N=49) with a retouched straight back opposed to crescent-shape edge. The distal part sometimes bears an oblique truncation (Zenin, 2002).

Although dated to circa 15 ka ^{14}C BP, the Chernoozerie II site is worth mentioning. It illustrates the association of Dufour bladelets with composite tools, such as grooved bone spear points with hafted lateral microliths. Carinated endscrapers are also mentioned although this assemblage seems more oriented toward pressure flaking (Derevianko, Shimkin, *et al.*, 1998).

8.2.2 CENTRAL SIBERIA

The Yenissei basin displays one of the richest concentrations of Paleolithic sites in Siberia (Figure 211: 4). Most of them are located along the left bank of the Yenissei River and can be grouped into three main clusters. The first group is located around the city of Krasnoyarsk. Afontova Gora (I-IV), Druzhinika, Korovii-log (I-III), and Kacha I-III belong to the Sartan period (OIS2) with the earliest dates around 23 ka ^{14}C BP (*e.g.* Kurtak IV) (Vasil'ev, 1992; Graf, 2009a) and are assigned to the final UP of Afontova Gora type. The second cluster is located to the south in the Minoussinsk depression and includes sites such as Tarachikha, Schlenka, Kokorevo-I-VI, Afanaseva Gora, Kurtak (I-VI), Novoselovo (I-XIII), etc. They mainly belong to the final UP Kokorevo tradition although some seem to predate the LGM (*e.g.* Tarachikha, Schlenka) (Larichev *et al.*, 1988; Vasil'ev, 1992; Astakhov *et al.*, 1993; Graf, 2009a, 2009b). The third group is located further south and to the north of the west Sayan range. Sites such as Oznachennoe I, Bolshoi Karak, Maininskii Lesozavod, Maina, Ui (I-II), Sizaya (I-XVI), Golubaya (I-VIII), Dzhoi, and Kantegir also belong to the Sartan period (Vasil'ev, 1992, 1993; Vasil'ev and Semenov, 1993; Vasil'ev *et al.*, 2002; Kuzmin, 2008).

The earliest phases of human occupation are poorly known. Only a few lithics are mentioned at Kashtanka by Drozdov and Chekha (2003) from a cryoturbated and re-deposited layer with radiocarbon dates between 32 and 29 ka ^{14}C BP (Drozdov and Chekha, 2003). The Kurtak IV UP assemblage is dated to between 24-23 ka (Vasil'ev, 1993; Drozdov and Chekha, 2003; Graf, 2009a). The site of Kamennyi Log has yielded radiocarbon dates from combustion features providing an age between 34-31 ka ^{14}C BP (Drozdov and Chekha, 2003). MP artifacts with Levallois features are reported from the Kamennyi Log II (section 9-11, excavation 2-4), Berezhekovo sites (excavation 1-2) and at Verkhnyii Kamen. At Ust-Izhul (site 1), artifacts are associates with dates of >42,190 ^{14}C BP (AECV-2034C), obtained on dispersed charcoal samples, >40,050 ^{14}C BP (AECV-2033C) and >41,810 ^{14}C BP (AECV-2032C) on charcoal sample collected from two distinct combustion features, and a mammoth bone yielded a date of > 42,100 ^{14}C BP(AECV-1939c) (Drozdov *et al.*, 1999). The human occupation is bracketed by luminescence dates, with a date of 125 ± 5 ka BP obtained on the pedogenic matrix and a date of 105 ± 10 ka BP obtained on the overlying silty/clay sediments (Chlachula *et al.*, 2003). The lithic assemblage is flake-based (N=53 *in situ* finds and N=220 including the artifacts found next to the excavation area), and some of the flakes have been refitted on cobbles. The fauna display occasionally human modifications, including flaked mammoth tusk, mammoth scapula with percussion traces and fractured deer bones (Chlachula *et al.*, 2003).

Dvuglazka Cave was discovered by Abramova in 1974 and was, for a long time, the only site illustrating pre-Sartan human occupation in the region (Abramova, 1981). Located 50 km from Abakan along a tributary of the Yenissei, the cave was excavated in 1975, 1978 and 1979 over a surface of 38 m². The 8 m thick stratigraphy is divided in 8 lithostratigraphic levels, with a small sample of (N=<100) Mousterian artifacts associated with layer 5-7 (Davis, 1998; Derevianko, Shimkin, *et al.*, 1998). The assemblage is classified as Levallois Mousterian with features such as Levallois points and Levallois blade cores, discoidal cores and retouched tools such as notches and sidescrapers (Davis, 1998; Derevianko, Shimkin, *et al.*, 1998). A single radiocarbon date of 27,200 ± 800 BP (LE-4811) is associated with layer 7 underneath the MP layer (Lisitsyn and Svezhentsev, 1997; Goebel, 2004), and a date of 26, 580 ± 520 (LE-4808) was obtained on a bone samples from layer 4 associated with the UP (Lisitsyn, 2000). Three additional dates on bone sample are available, but they are without provenience and with a single lab number (single sample?) (LE-1333): 22,500 ± 600 ^{14}C BP, 20,190 ± 140 ^{14}C BP, and 19,880 ± 200 ^{14}C BP (Arslanov *et al.*, 1981; Vasil'ev *et al.*, 2002). Given these young ages, additional data on the deposition processes are needed.

Among the sites known in the Tuva region, Late UP and EUP artifacts have been reported from the Sagliy locality. Massive blades are described at Mugur, carinated endscrapers and flat-faced bidirectional cores are found associated with bone awls in Kantegir I, layer 4i. Pressure flaking microblade technology is well documented among these assemblages. MP 'of the pebble tradition' is defined by S. N. Astakhov (1986), however, most of these sites are surface collections and none of them sites has been dated (Astakhov, 1986).

8.2.3 CIS-BAIKAL

The Cis-Baikal area corresponds to the western shore of the lake Baikal (Figure 211: 4). Numerous sites have been reported in this region, some being relevant for comparisons with the Altai material. The present review focuses on the sites of Makarovo IV and Arembovsky. Malta (Gerasimov, 1958; Cauwe *et al.*, 1996; Medvedev *et al.*, 1996) and related sites (*e.g.* Buret, Ust-Kova) belong to the Sartan period (Vasil'ev *et al.*, 2002) and will not be discussed here. It is, however, interesting to mention the presence of archaic technological features at Malta. Small and mainly unidirectional flat-faced cores, discoidal cores, or even isolated BC-like cores (mode C3 of Kimura's classification) occur in the variability of the laminar reduction (Kimura, 2003). Medvedev observed a comparable polish (see below) as on the Makarovo IV artifacts (Derevianko, Shimkin, *et al.*, 1998) and suggests that older artifacts would have been brought to the site by humans (N=48). During the 1995-1997 excavations of the Russo-Belgian collaboration (Cauwe *et al.*, 1996; Medvedev *et al.*, 1996), the lowest cultural layer has yielded dates circa 39 ka but cryogenic disturbances were observed throughout all 5 archeological layers (Cauwe, personal communication) underlining the need for further taphonomic studies.

Makarovo IV

The Makarovo complex refers to a cluster of six sites located on the Upper Lena River near the village of Kachug. This region has been studied intensively since the second half of the last century (*e.g.* Okladnikov, 1953; Aksenov, 1970, 1978; Medvedev *et al.*, 1990; Goebel, 1994, 2004; Goebel and Aksenov, 1995; Sitlivy-Escutenaire and Sitlivy, 1996). The site of Makarovo IV was discovered in 1975 by Aksenov and excavated over a surface of more than 1100 m² until 1982 (Goebel, 2004). The stratigraphy is divided into 4 sedimentary units (Vorobieva, 1987; Goebel and Aksenov, 1995) (Figure 229). The lithic assemblage (N=4,119) is derived from stratigraphic sub-unit 3a, a 5-10 cm thick horizon of sand and rock debris (Goebel and Aksenov, 1995). The underlying sub-unit 3b is composed of compact loess containing a paleo-soil in its upper part. The unit 2 is an alternation of cemented loess and sands and is crossed in some parts by deep ice-wedges. Unit 1 includes a paleo-soil that may represent the Holocene and a modern surface. Sub-unit 3a is considered as a strongly deflated surface with sediment grain-size sorting. The polish observed on artifacts and fauna is associated with sand abrasion caused by exposure to intense and strong wind (Goebel and Aksenov, 1995; Derevianko, Shimkin, *et al.*, 1998).

Unit 2 is interpreted as Sartan deposits (OIS2) and the cryogenic features are assigned to the LGM. Tseitlin (1979) and Vorobieva (1987) suggest that strong eolian processes are likely associated with a glacial phase during OIS4. According to Medvedev (*e.g.* in Derevianko, Shimkin, *et al.*, 1998), the sand blast occurs during the middle Zyriansk period, and frost-cracks from unit 2 should pre-date the Sartan period. He argues that the Makarovo 4 assemblage is circa 20 ka older than other known UP sites. Aksenov pointeds out that the unit 3 cold snap may have occurred during OIS3 (Goebel and Aksenov, 1995). Three radiocarbon dates have been obtained on bone samples collected from unit 3a, and although having a well-preserved collagen, provided a minimum age of 39 ka ^{14}C BP (Goebel and Aksenov, 1995). The fauna associated with the assemblage (N=509) includes *Coelodonta antiquitatis, Cervus elaphus,* and *Capreolus sp.* Although the presence of woolly rhino would indicate a cold phase, its association with the human presence is not clear given the taphonomy of the layer.

Vorobieva and Aksenov (1990) suggest the coexistence of radial, sub-parallel and parallel reduction and the existence of Levallois-Mousterian features. Their sample includes a large number of cores (N=133) and blanks (N=>3,000). Based on a smaller sample of tools (N=280) and cores (N=45), Goebel (1994; 2004) describes the technology as a production of

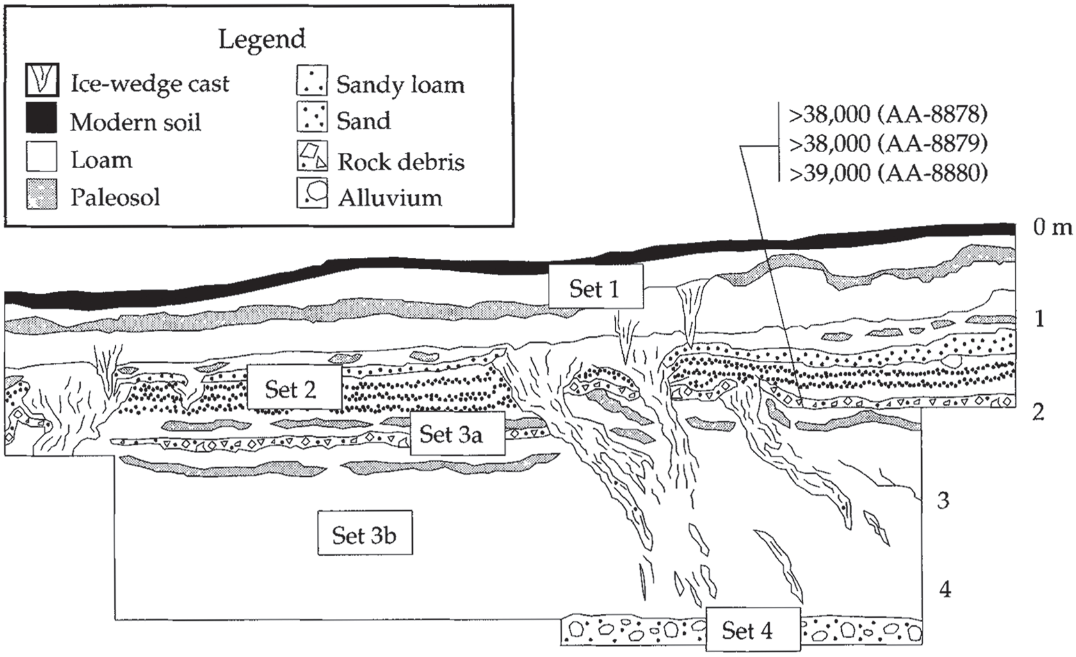

Figure 229: Makarovo IV, section and dates (after Goebel and Aksenov, 1995)

elongated spalls and blades from uni- (N=16) and bidirectional (N=14) flat-faced cores and from unidirectional sub-prismatic cores (N=6). Flake production is also represented by mono-frontal cores (N=5). Facetted and dihedral platforms co-exist with a majority of plain platforms, and it seems that unidirectional dorsal pattern dominates. Goebel (1994), however, acknowledges the difficulty of reading the direction of the scars and to identify retouch due to the sand blasted polish.

Sitlivy-Escutenaire and Sitlivy (1996) worked on large sample comparable to the one use by Vorobieva and Aksenov. They argue that the main activity taking place at the site is lithic reduction based on the low frequency of tools. They describe a coexistence of two main technological systems related to flake and blade production. For the blade production, the core performs are unidirectional and volumetric and the flaking surface is located on the narrow side of the core. As reduction continues, the flaking surface shifts to the broad face. The core reduction ends with a sub-volumetric form. They note that there was no preparation of the flaking surface prior to the reduction, the latter using the natural convexity of the pebble surface. Although crested blades are rare, some *débordant* blades are associated with a sub-volumetric approach 'close to Rocourt-type', as described by Cahen (1984), Otte (1990), Chabay and Sitlivy (1993) or Boëda (1990). It is noted that on the illustrated material, some cores show mainly removals on a single narrow face in addition to a broad one (*e.g.* Sitlivy-Escutenaire and Sitlivy, 1996, Fig. 1), suggesting the presence of a 'Roc-de-Combe method' (Boëda, 1990) analogous to the Altai IUP system. 'Microlithic cores' are reported as infrequent elements, with a flaking surface located on a narrow side of pebble blanks (Sitlivy-Escutenaire and Sitlivy, 1996). These cores have bidirectional removals and have a BC morphology (*e.g.* Sitlivy-Escutenaire and Sitlivy, 1996, Fig. 4 num. 4). The second technological system consists of slicing pebbles producing more opportunistic flakes with cortical backs ('citrus flakes'). Lateral preparation of the core is rare and may be confused with radial cores. So according to these authors, there is convincing evidence of Levallois technology although the Makorovo IV laminar technology described by Sitlivy-

Escutenaire and Sitlivy (1996) appears very similar to Altai IUP blade technology.

According to Rybin (2000), some typological markers of the Altai IUP are also present. Small points with continuous bilateral retouch or some retouched blade fragments displaying proximal inverse and direct retouch (*e.g.* Goebel and Aksenov, 1995, Fig. 3, s-t), similar to Kara-Bom, UK1-1, Kara-Tenesh, or Maloyalomenskaya Cave specimens, are present. Some appear close to the truncated-facetted type, such as in Kara-Tenesh or Kara-Bom (*e.g.* Goebel and Aksenov, 1995, Fig. 3, q).

To summarize, Makarovo IV appears technologically, typologically, and maybe chronologically analogous to the Altai IUP. Other sites of the region, such as Shishkino VIII, Sosnovyy Bor (Horizon VI), Melikithui II or Cheriomushnik are said to belong to the same tradition, known as the 'Makarovo stratum' (Derevianko, Shimkin, *et al.*, 1998).

Arembovsky

Arembovsky was discovered in 1938 by an instructor from Irkutsk who gave his name to the site. It is located in the outskirt of the city of Irkutsk, on a terrace of the Angara River and near a raw material outcrop. Between 1947-1949, material was collected from the surface until a rescue excavation was organized in 1989 (Semin *et al.*, 1990; Goebel, 1994). As described by Medvedev et and colleagues (Medvedev *et al.*, 1990), the stratigraphy includes a main cultural horizon within the first meter of sediments, in layer 2. Goebel (1994) describes it as a 'massively bedded loam' matrix. Artifacts mentioned in the underlying level 3 are presumably intrusive due to various cryogenic disturbances. Although it is attributed to the Karginian period (OIS3), no direct dates could be obtained.

Due to this problematic context, only general trends of the assemblage (N=>10,000) are considered. Vorobieva and Aksenov (1990) mention the presence of bidirectional cores with facetted platforms, convergent cores and cores with irregular removals. Goebel (2004) mentions a majority of flat-faced blade cores with radial flake cores. Blades with mainly plain platforms are produced with a tool kit rich in retouched blades (Goebel, 1994). Sitlivy-Escutenaire and Sitlivy (1996) classify the collection into three main reduction types. The first one is classic Levallois, producing irregular flakes, represented by a few cores and flakes. The second is Levallois lineal recurrent, also called 'Biache method' (Chabay and Sitlivy, 1993). What characterizes it is the radial preparation of the core that needs to be reproduced after that the recurrent removals flattened the convexities. This method is said to be used following the longitudinal axis of the core to produce blades or transversally to produce flakes. The third one is said to be similar to the so-called 'Rocourt method' (Cahen, 1984; Otte, 1990, 1994; Otte *et al.*, 1990). It is described as starting from a narrow end and extending toward the broad face, and it shows successive re-preparation and reduction (Sitlivy-Escutenaire and Sitlivy, 1996). This method is oriented toward the production of long blades. No crested blades have been found, and the authors conclude that UP technology is absent. They also acknowledge that the Biache and Rocourt methods are highly similar but that in Europe their coexistence in a given assemblage is unusual. The three described methods are also found in combinations in the Altai, in IUP context, but with frequent crested and convergent elements. Tools are not very diagnostic nor numerous, the fauna is almost absent and no combustion features have been discovered. This assemblage is interpreted as a workshop (Goebel, 2004).

Technological differences between the early and subsequent phases of UP have been underlined by Generalov and Sitlivy (1999) based on a comparison of layers VI and V from Sosnoyi Bor. The layer VI is assumed to be part of the Makarovo stratum and to represent the oldest UP in the area. The layer VI assemblage (N=488) is characterized by flake production from quartzite pebbles, by slicing, or by diagonal removals with or without platform preparations. The latter is more oriented on the removal of elongated flake blanks. Blades are fragmented and due to the absence of cores, their production is not well documented. Bifacial pieces are interpreted as either core preforms or tools. The presence of a Dufour bladelet, (Generalov and Sitlivy, 1999: Fig. 2, num 14, num.

9) and of a BC-like burin is notable (Generalov and Sitlivy, 1999: Fig. 2, num 14). The layer V assemblage appears quite different as different stages of preparation and reduction of 'cuneiform' and wedge-shaped cores are documented, along with some flat-faced Levallois-like blade cores. These two assemblages are interpreted as unique and do not find clear analogies in the region. Layer VI is reported as heavily reworked, and Tseitlin (1979) evaluates that the sedimentation took place between 19-16 ka ^{14}C BP. Other authors propose assigning layer VI to OIS4 (Vorobieva and Medvedev, 1984). As noted by Goebel (1994), the age of the lower layers remains uncertain since, they have not been directly dated. The overlying layers IIIb and 4 are dated with bone samples. A conventional date of 12,060 ± 120 ^{14}C BP (GIN-5328) (Vorobieva, 1991) was obtained for layer IIIb, and an AMS date of 12,090 ± 110 ^{14}C BP (AA-38038) is associated with layer IV (Vasil'ev *et al.*, 2002).

8.2.4 TRANS-BAIKAL

The Trans-Baikal area starts from the eastern shore of lake Baikal and extends eastward (Figure 211: 5). Sites are mainly located between the cities of Ulan-Ude and Chita, in the lower Selenga basin. The region is rich in Paleolithic sites and only some the most relevant sites, such as Tolbaga, Podzvonkaya, Varvarina Gora, and Kamenka are described in the following section.

Kamenka

The site of Kamenka is located 60 km southeast of Ulan-Ude. It is in the Selenga river basin and the Bryanka river valley. Like other UP sites in the area, it lies on a relatively high topographic relief, the Kamenka hill. Kamenka was excavated by Lbova between 1990 and 1995 (Lbova, 1996a). She divided the stratigraphy is divided in 7 layers (Lbova, 1996a, 1999), with layers 1-3 associated with Holocene and modern soil and layers 4-7 associated with the Pleistocene. Two cultural layers have been described within the lithostratigraphic layer 6, namely complexes A and B. The latter is described as a colluvial deposit composed of three sub-units, the lower one being in sandy-clay deposits with lenses of re-deposited paleo-soil, the middle one being a carbonate rich layer of clayey sand, and the upper one a brown sand with clay and gravels. Complexes A and B are associated respectively with the lower and the upper part of layer 6 and are separated by one meter of sterile sediment. Complex C was found during the 1992 campaign and is in similar stratigraphic position as complex A, although in a slightly different sand matrix (Germonpre and Lbova, 1996). Complex B conventional radiocarbon dates on bone samples are 28,815 ± 150 ^{14}C BP (SOAN-3032), 28,060 ± 475 ^{14}C BP (SOAN-2903), 28,000 ± 475 ^{14}C BP (SOAN-2903), 25,540 ± 300 ^{14}C BP (SOAN-3355) and 24,625 ± 190 ^{14}C BP (SOAN-3031). Kamenka complex A has yielded conventional dates on bone samples of 26,760 ±265 ^{14}C BP (SOAN-3353), 30,460 ± 430 ^{14}C BP (SOAN-3354), 35,845 ± 695 ^{14}C BP (SOAN-2904) and one AMS date of 40,500 ± 3,800 ^{14}C BP (AA-26743). In addition, a date 31,060 ± 530 (SOAN-3133) on a charcoal sample and a RTL date of 49,000 ± 6,000 (GN SOAN-340) are also available for the Complex A (Lbova *et al.*, 2010). Complex C has a single associated date of 30,220 ± 270 ^{14}C BP (SOAN-3052) (Lbova, 2000, 2008; Orlova *et al.*, 2005). Lbova (2000, 2008) notes that in spite of the observed discrepancy among the dates of Kamenka A-C, the expected age based on stratigraphic data is circa 35-40 ka ^{14}C BP.

The fauna as studied by Germonpre is mainly composed by Mongolian gazelles *(Procapra gutturosa)* and by horses *(Equus caballus)*. Both species bear traces of human activity and some of the bones are burned. Woolly rhinoceros fragments *(Coelodonta antiquitatis)* show a taphonomy that differs from the human accumulation with no cut-marks or breakage, suggesting that their presence is not directly linked with human activity but rather with carnivore activity. Seasonality is deduced from a few skeletal elements indicating that human occupations took place between mid-August and December in a dry steppe landscape (Germonpre and Lbova, 1996).

Although never fully published, the Kamenka A lithic assemblage (N=1328) (Buerachny and Lbova, 2000) is characterized by bidirectional mono-frontal blade cores with some occasional sub-prismatic forms and a single Levallois flake core (Goebel, 2004). Large bidirectional blade blanks are retouched and sometimes pointed. Some pieces described as cores appear similar to BC (Lbova 2000, Fig. 17 num. 4). Neo-crested blades testify to lateral core management during the production of large blades (*e.g.* Lbova, 1999, Fig. 4, num. 6-8). Levallois-like convergent blades with facetted platforms, partial faceting or *débordant* faceting are part of the assemblage (*e.g.* Lbova, 1999, Fig. 4, num. 11,2, 4, 5, 13). Some of the convergent blanks bear bilateral direct retouch (*e.g.* Lbova, 1999, Fig. 4, num. 1, 2, 4). Bone tools have been described associated with the complex A, (Lbova, 1999) including chisels and awls, but also non-utilitarian objects (N=34) such as beads of stone and mammoth ivory and bone objects with parallel incisions (N=22) (Lbova 1999, 2000). In sum, this assemblage presents techno-typological similarities with the IUP and also includes a rich collection of bone tools and ornaments.

Podzvonkaya

The site of Podzvonkaya is located on the first terrace of the left bank of the Tamir River, a small tributary of the Selenga River. The topography of the site consists of a natural amphitheater formed by the hills and the valley. The site was excavated between 1991 and 2000 by Tashak with the collaboration of a Belgian team in 1993 (Cauwe *et al.*, 1993; Tashak, 2002, 2005). Several thousand square meters were excavated and the few publications available do not provide clear data regarding stratigraphic successions. Three main sectors were excavated. Sectors A, B and C and several units have been defined on stratigraphic basis but also on the basis of material concentrations. According to several authors, some of the artifact clusters are in secondary position, in slope deposits or in small channels (Cauwe *et al.*, 1993; Derevianko and Rybin, 2003). The oldest human occupation belongs to the so-called lower complex which has yielded radiocarbon AMS dates of 38,900 ± 3,300 ^{14}C BP (AA-26741) and >36,800 ^{14}C BP (AA-26742) on bone samples and conventional dates of 26,000 ± 1,000 ^{14}C BP (SOAN-3404) and

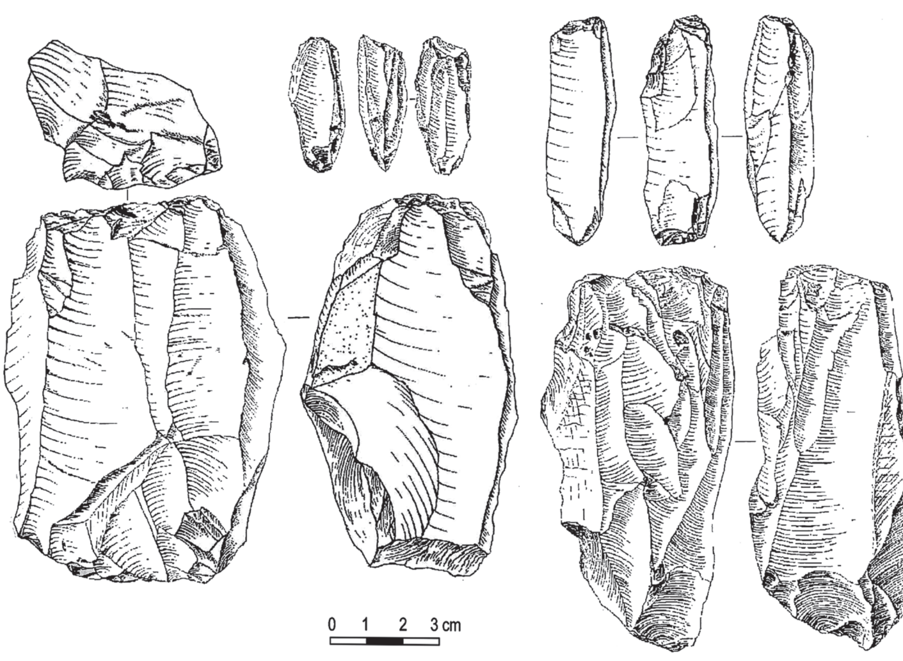

Figure 230: Podzvonkaya, cores (after Tashak, 2009)

22,675 ± 275 ^{14}C BP (SOAN-3350) on bone samples. Numerous ornaments were recovered from the eastern and southeastern units, including pendants made of ostrich eggshell (N=14), a stone pendant and a perforated mammal phalanx (Derevianko and Rybin, 2003). The raw material is relatively coarse-grained. The lithic technology is mainly oriented toward the production of wide and massive uni- and bidirectional blades from flat-faced cores, with the occasional use of crests and a high frequency of facetted platforms (Cauwe *et al.*, 1993; Tashak, 2009). The reduction likely starts from a narrow face and then expands onto a broad face. Crested and *débordant* blanks are removed from the corner between the two surfaces. Small cores are mentioned together with poorly standardized bladelets (Cauwe *et al.*, 1993; Tashak, 2007, 2009).

The illustrated material shows at least two typical BC on laminar blanks (Tashak, 2009) (Figure 230). The association of an IUP reduction system for large laminar blanks with a BC reduction system for small blade/bladelets is a technology diagnostic of the IUP. If confirmed, the available radiocarbon ages support this comparison. Taphonomic analysis and/or direct dates on the ostrich eggshells could be used to confirm the association between the ornaments and the IUP lithic assemblage.

Varvarina Gora

The site of Varvarina Gora is located along the left bank of the Bryanka River in colluvial deposits located at the foot of the Varvarina Mountain. The site was discovered in 1964 and excavated between 1973 and 1975 by Okladnikov (Okladnikov and Kirilov, 1980). The stratigraphy was revised starting in 1992 by Lbova who correlated the newly exposed profiles with the former excavations (Lbova, 1996b, 2000). The stratigraphy is 2 m thick and is described as a succession of reworked colluvial deposits (layers 2, 4) and aeolian sands and loam (layers 1, 3) (Goebel and Aksenov, 1995; Lbova, 2000; Goebel, 2004). Human occupation is associated with layer 3. Conventional radiocarbon dates of 34,900 ± 780 ^{14}C BP (SOAN-1524) and 30,600 ± 500 ^{14}C BP (SOAN-850) were obtained on bone samples associated with the human occupation during the early excavation (Bazarov *et al.*, 1982; Vasil'ev *et al.*, 2002). AMS dates were obtained on bison and wooly rhinoceros bone samples, yielding minimum ages of 35.5 ka (Goebel and Aksenov, 1995) (Figure 231). Two more conventional dates on bones are available for layers 2 and 1, with respectively 29,895 ± 1,790 ^{14}C BP (SOAN-3054) and 17,035 ± 400 ^{14}C BP (SOAN-3053) (Lbova, 1996b; Vasil'ev *et al.*, 2002).

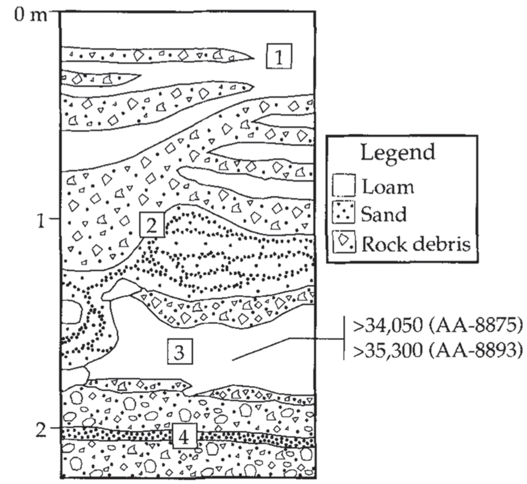

Figure 231: Varvarina Gora, section and dates (after Goebel and Aksenov, 1995)

As stressed by Goebel (*e.g.* 2004), the lithic assemblage (N=1,451) has never been published in detail. However, the main technological features described can be summarized as a coexistence of uni- or bidirectional flat-faced cores and sub-prismatic blade cores with the presence of Levallois flake cores (Lbova, 2000). Truncated-facetted pieces are present and some illustrated cores appear technologically similar to BC forms (Lbova, 2000, Fig. 35, num. 5, Fig. 34, num. 4). Formal bone tools such as awls (N=2), a *retouchoir*, and a tool made of ivory are associated with the assemblage, and a possible stone pendant is described (Goebel, 2004).

Tolbaga

The Tolbaga site is located not far from the eponymous village, on the top of hill, along the right bank of the Khilok River. The site was discovered and excavated by Konstantinov between 1972 and 1979 (624 m²) and by Vasiliev in 1985 and 1986 (340 m²). The cultural remains are associated with layer 4 and in a sandy-loam matrix. This layer is interpreted as a succession of quick slope-wash events. Bulk bone samples from the bottom of the overlying layer 3 have yielded a conventional date of 15,100 ± 520 ^{14}C BP (SOAN-810). Several unidentified bones collected during various excavations have a conventional date of 27,210 ± 300 ^{14}C BP (SOAN-1523), and a wooly rhinoceros bone from layer 4 has a conventional date of 34,860 ± 2,100 ^{14}C BP (SOAN-1522). An additional conventional date on a bone sample from stratum 4 is 26,900 ± 225 ^{14}C BP (SOAN-3078) (Sinitsyn *et al.*, 1997). Two more AMS dates 25,200 ± 260 ^{14}C BP (AA-8874) and 29,200 ± 1,000 ^{14}C BP (AA-26740), were produced on bone samples from the same layer 4 (Goebel and Waters, 2000). These dates appear inconsistent and Goebel and Waters suggest that the assemblage should be regarded as a palimpsest of occupations taking place between 35 and 25 ka ^{14}C BP.

The lithic assemblage (N=>10,000) is rich and the main technological and typological features are summarized by Goebel (1994). The lithic reduction is mainly oriented toward the production of blades and laminar flakes with a more expedient production of flakes. Blades are detached from flat-faced cores with cortical or plain platforms. Goebel also notes that cores frequently display trimming and grinding preparations. The retouch is mainly unifacial although bifaces (N=3) occasionally occur. Based on the Bazarov and colleagues sample (1982), Sitlivy-Escutenaire and Sitlivy (1996) describe two main productions. At the periphery of the main concentrations, large blades and elongated flakes with facetted platforms and with prominent bulbs are produced following a uni- or bidirectional Biache method (Chabay and Sitlivy, 1993). Within the concentrations, the methods are similar to the blade reduction from Makarovo IV but with a rare occurrence of the Rocourt method, no crest and some *débordant* blanks. In sum, the reduction is mainly flat-faced cores with radial preparation outside of the main occupation area and no preparation inside. Sitlivy-Escutenaire and Sitlivy (1996) note, however, that the Biache-type cores can be transformed into Makarovo-like cores subsequently. Vasiliev and Rybin (2008), based on a sample of lithics (N=3184), consider that the main pattern of flaking on flat-faced cores is bidirectional. By quantifying the frequency of negatives on the core surface, they suggest the dominance of one platform over the other. As the core becomes smaller, the second striking platform plays a role in flaking surface management with the removal of shorter flakes. This reduction effect has been previously identified by Pelegrin (1995) in another context. Pelegrin stressed that genuine bidirectionality is problematic in the case of small size cores and a system with the predominance of one platform over the other is used in order to avoid overshots. As opposed to Sitlivy-Escutenaire and Sitlivy (1996), Vasiliev and Rybin (2008) note the presence of crested blades (N=24).

All in all, although Tolbaga presents some similarities with the IUP, the assemblage appears technologically and chronologically to fall outside of this tradition. The composition of the assemblage with significantly high frequencies of cores, cores with cortical surfaces, and retouched tools, may represent a base-camp functional facies. This is reinforced by the composition and treatment of the fauna that includes cut-marks (N=693), fire treatment (N=82) and bone tools (N=9) (Vasiliev and Rybin, 2008). The dominance of wooly rhinoceros *(Coleodonta antiquitatis)* is unusual but in this case clearly linked with human activities. Some of the remains are transformed into bone tools (Vasiliev *et al.*, 1999; Vasiliev and Rybin, 2009). The nosed-endscrapers described by Goebel (1994) cannot be associated with a microblade production of UP type, the latter being apparently absent or not documented. The taxonomical attribution of Tolbaga remains, therefore, unclear.

Other assemblages not discussed in this section display clear technological, typological or chronological affinities with the IUP as defined in this study such as the layers 3 and 4 from Khotyk (Lbova, 2000, 2002, 2008, 2011; Lbova *et al.*, 2010), Barun-Alan I and Suka-Padi (Tashak, 2009), Arta II layer 4 (component 4), Masterov Gora (Goebel, 1994) and Sapun (Goebel, 2004), or Kutakh (Cauwe *et al.*, 1993).

8.3 MONGOLIA

South of the Trans-Baikal, the Selenga River crosses the eastern part of the Sayan and Yablonoviyi ranges. Numerous Paleolithic sites have been discovered in the region, mainly along tributaries of the Selenga River. Sites from the Tolbor and the Dorolj river valleys are among the most recently investigated areas and will be briefly described here. The Orkhon valley has also yielded sites such Orkhon 1 and Orkhon 7, known since the 1960s. Further south, in the central Gobi desert, caves and rockshelters such Chiken-Agi and Tsagaan-Agui document IUP technology (see also Derevianko and Petrin, 1995; Gladyshev, Olsen *et al.*, 2010).

8.3.1 NORTHERN MONGOLIA

In 2002, a joint Mongolian-Russian-American team spotted not less than 19 locations along the Tolbor River. Sites, such as Toblor 15, were mainly found in sections exposed along the main road. Some others were spotted a little higher in the hills, such as Tolbor 4 (Derevianko *et al.*, 1996, 2007; Gladyshev, Olsen, *et al.*, 2010).

Tolbor 4

The site of Tolbor 4 is located about 300 km northwest of Ulaanbaatar and about 100 km from the Russian border. It lies on a hillside at the confluence between a small stream and the Tolbor River 6 km from its confluence with the Selenga River and at an altitude of 1044 m asl. This location is strategic as it lies next to a fresh-water spring and on a fine-grained riolite outcrop (Figure 232). It is exposed to the southeast and offers an open view of the entire valley. The stratigraphy was divided into 14 lithostratigraphic strata in which 6 cultural layers separated by sterile sediments were identified (Derevianko, Tseveendorj, Olsen, *et al.*, 2005; Kolomiets *et al.*, 2009). The site was excavated between 2004 and 2007, but so far, only the material from OH4, OH5 and OH6 from the 2005 excavation has been extensively published (Derevianko *et al.*, 2007; Rybin *et al.*, 2007). A single AMS radiocarbon date is available for OH6 with an age of 37,400 ± 2,600 ^{14}C BP (AA-79314). It was obtained on a bone tool that is still unpublished (Gladyshev, pers. comm.). OH5 has yielded an age of >41,050 ^{14}C BP (AA-79326) on a bone (?) sample (Gladyshev, Olsen, *et al.*, 2010). As it is often the case in the Tolbor area, the fauna are badly preserved.

OH6 and OH5 have similar techno-typological features that will be summarized here as a whole. The lithic assemblage (>12,000 from 2005 collection) (Derevianko *et al.*, 2007; personal observations) is mainly oriented toward blade blank production. Cores are mainly flat-faced sub-volumetric or volumetric, reduced by uni- or bidirectional removals (Figure 233). On flat-faced cores, the reduction starts from the corner made by two surfaces and then extends from the narrow to the broad face. Cores frequently display posterior crests prepared along a cortical narrow face. This preparation is somehow similar to the preparation of a Levallois core in the sense that it enhances the convexity of the flaking surface. The other narrow face bears negatives of removals, creating an angle between the two surfaces close to 90°. These features are typical of a sub-volumetric approach.

Thick *débordant*, naturally backed or crested blades are common and reinforce the idea of a frequent sub-volumetric and volumetric reduction. Negatives observed indicate either successions of unidirectional sequences from two opposed platforms or frequent platform switches. The assemblage also includes genuine volumetric cores with a flaking surface located on the narrow face indicating a frontal reduction. Occasionally, the back of the core is prepared by a single- or two-sided posterior crest. Platforms are shaped by the removal of large flakes, complete or partial tablets, and sometimes by faceting of the edge. Some of the cores are massive, with a length of over 20 cm and are classified by Derevianko *et al.* (2007) as 'macro-cores'. A few cores display preparations of the back similar to Levallois blade cores.

Figure 232: Tolbor 4, raw material outcrop

Some of the cores testify to the production of small laminar blanks. The occurrence of typical BC, as defined in this study, is attested to (Figure 234: 1) (see also Derevianko *et al.*, 2007). They are on thick blade blanks with a flaking surface parallel to the core blank long axis, and they display bidirectional removal negatives with plain or facetted platforms.

Other cores are very similar, although the core blank cannot be identified (Figure 234: 2, 4). It is assumed that some of them could have been BC or flat-faced cores, but may also represent adaptive strategies related to the original narrow and elongated shape of the nodule. The preparation of posterior crest is observed, and some attempts of lateral crest removals are still visible. Large blanks are mainly blades with parallel edges and convergent blades (Figure 235). The border between these two categories is not clear-cut and naturally pointed blades are frequent, reaching circa 20% in OH6 (Derevianko *et al.*, 2007). Some are particularly massive (Derevianko *et al.*, 2007, Fig.7 num. 8).

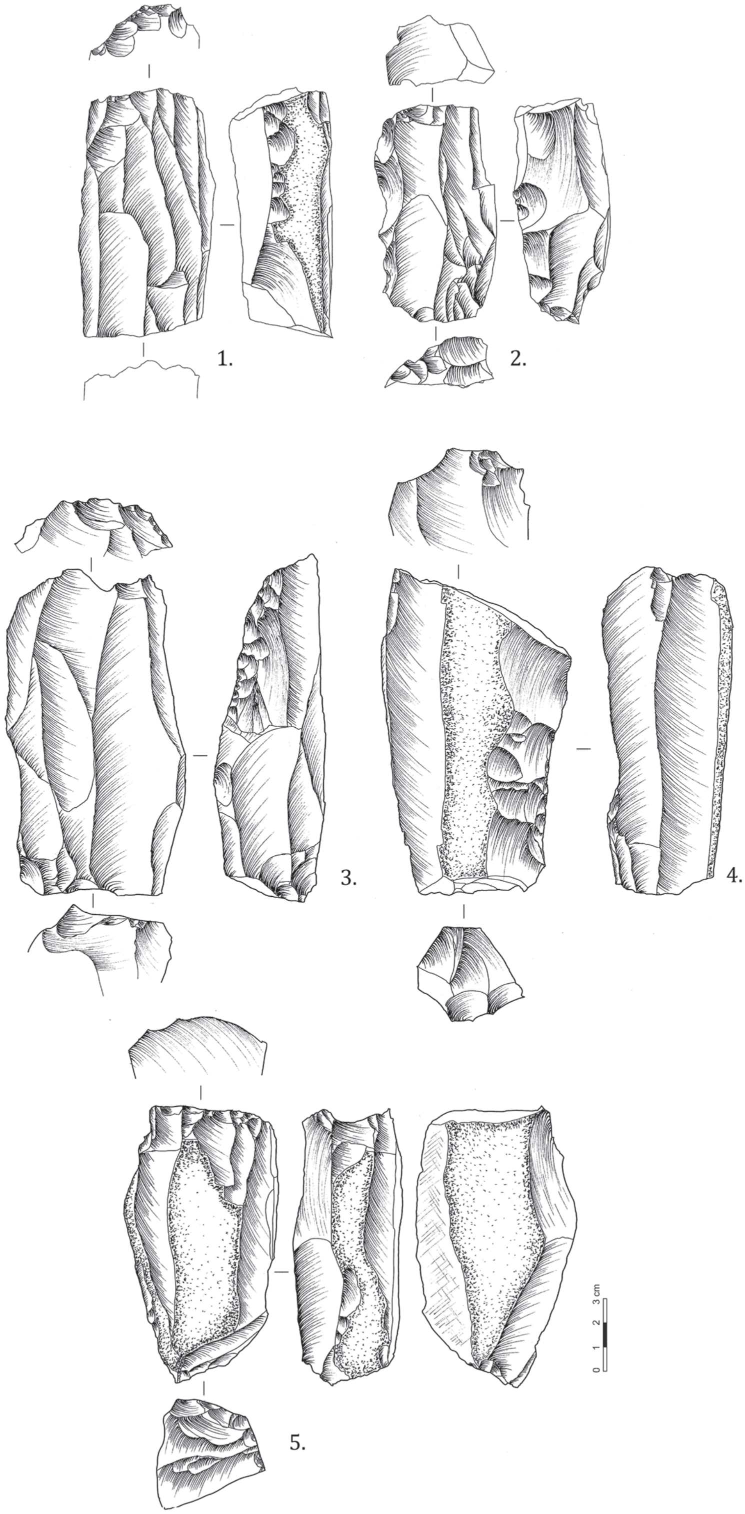

Figure 233: Tolbor 4, OH5-OH6, blade cores

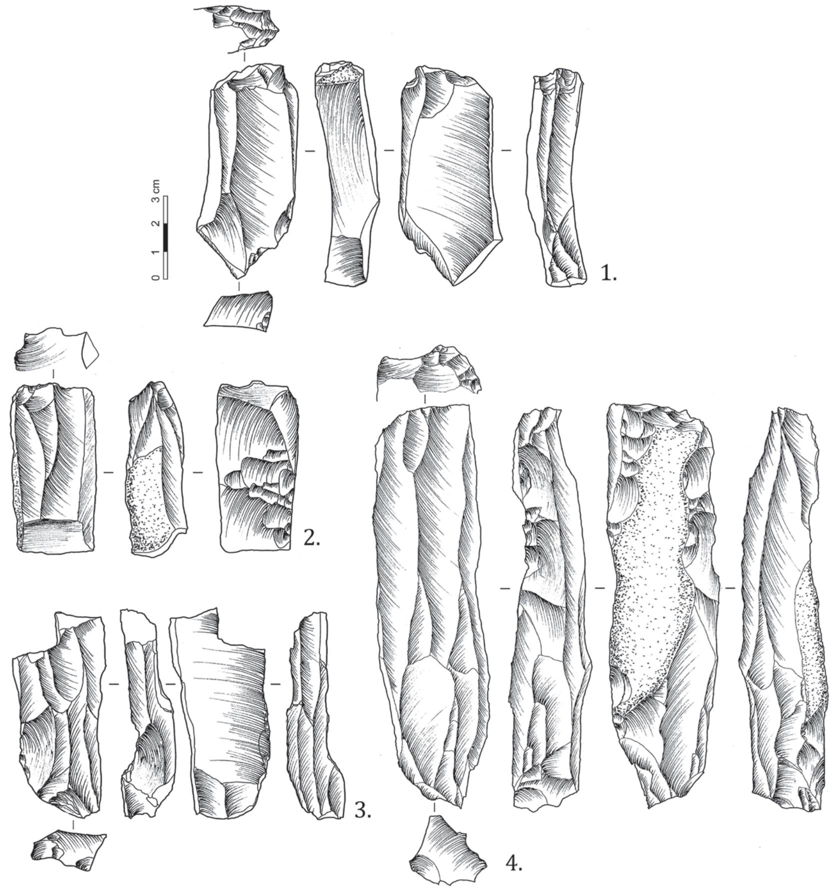

Figure 234: Tolbor 4, OH5-OH6, small blade/bladelet cores

Based on the complete artifacts, it seems that the proportions of uni- and bidirectional blanks are even (Derevianko *et al.*, 2007). As illustrated by the cores, orthogonal preparation of flat-faced cores is also reflected on the dorsal face of blanks. Crested and neo-crested elements appear in various sizes testifying to regular convexity management during the reduction process. Platforms are mainly plain and dihedral but facetted specimens are well represented especially in OH6. Notable is the occurrence of *débordant* facetted platforms (Figure 235: 7) and of partial faceting, sometimes combined with a dihedral shape. The occurrence of strong and moderate abrasion of the external platform edge is also observed.

Among the retouched tools described, the presence of diagnostic elements is stressed here as they also occur in IUP assemblages from Altai. For example, according to previous reports and to personal observation blades with direct bilateral or marginal retouch are noted. Some of these may appear morphologically similar to *débordant* artifacts. This proximal retouch is also present on small pointed blades (Figure 235: 4). Bifacial tools are rare and not standardized. Points with inverse proximal retouch, considered as one of the most typical elements for the Altai IUP, are documented in the assemblage (Derevianko *et al.*, 2007). A blade with an inverse proximal truncation from OH6 was identified among the unpublished material from the 2004 excavation (Figure 235: 6). Thick endscrapers are part of the toolkit. The short removals observed on their front are not lamellar. These artifacts are, therefore, typed

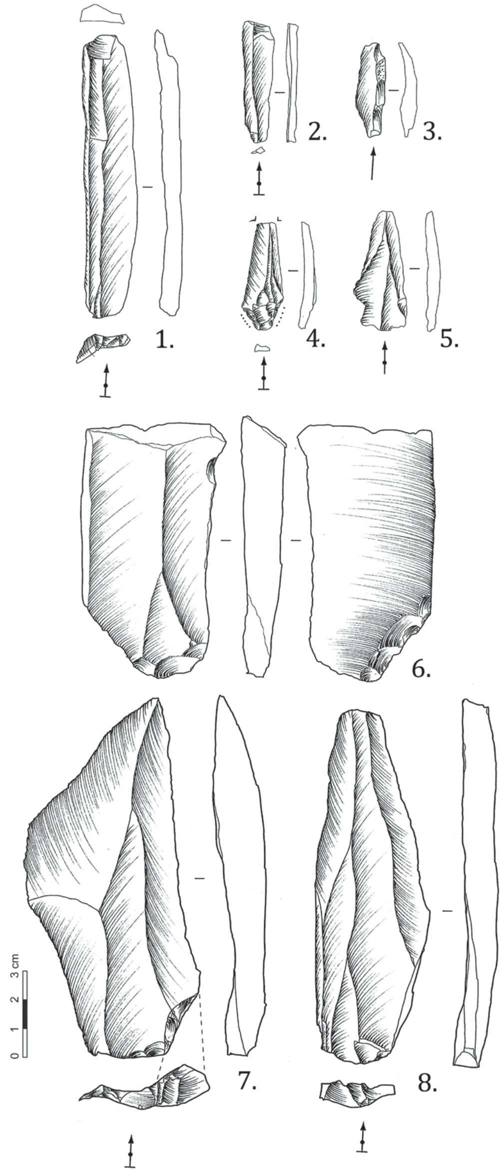

Figure 235: Tolbor 4, OH5-OH6, laminar blanks and retouched tools

as atypical carinated endscrapers (de Sonneville-Bordes and Perrot, 1954).

All in all, Tolbor 4 OH5 and OH6 show a high degree of technological and typological similarities with the Altai IUP. It also show a presence of bone tool directly dated to circa 37 ka.

The OH4 assemblage (N= 4,966 from 2005) represents a different technology. The blade reduction is less developed (Rybin *et al.*, 2007) and is almost exclusively characterized by medium/small blades produced from unidirectional flat-faced cores (Derevianko *et al.*, 2007). Blades become considerably shorter and are not naturally pointed. Microblade cores of carinated endscraper morphology are elusive in OH5-OH6 but clearly present in OH4 (Derevianko *et al.*, 2006, Fig. 7, num 1; Rybin *et al.*, 2007 Fig. 2 num. 1) together with small-sized wedge-shaped cores (Rybin *et al.*, 2007 fig .2 num. 19) and cores on a flake ridge (Derevianko *et al.*, 2007 Fig. 8, num 5). Small flat-faced cores are also present (Derevianko *et al.*, 2006, Fig. 7, num. 2; Rybin *et al.*, 2006, Fig. 2, num. 11). Pseudo-BC with unidirectional frontal reduction on small elongated slabs are rare (Derevianko *et al.*, 2006, Fig. 7, num. 3). Whereas most retouched blanks in OH5 and OH6 are blades, the frequency of retouched flakes and cortical blanks is higher in OH4 (Rybin *et al.*, 2007).

Tolbor 15

The assemblage of Tolbor 4 OH4 is not yet dated, so a comparison with the neighboring site of Tolbor 15 may provide insights on its the chronological position. The site of Tolbor 15 is located about 2 km upstream, along the Tolbor River (Gladyshev, Bolarbat, *et al.*, 2010). The study is still on-going and it will be briefly described here. The sequence is divided into 7 layers, each of which has yielded archeological material. The lowermost layers 6 and 7 consist of a single occupation level (Gladyshev, pers. comm.). A radiocarbon date of 29,150 ± 320 ^{14}C BP (AA-84138) was obtained on layer 7 and 28,460 ± 310 ^{14}C BP (AA-84137) was obtained on an ostrich eggshell fragment from layer 5. Layer 4 is dated to 26,700 ± 300 ^{14}C BP (AA-84135) but has also yielded younger dates such as 14,680 ± 70 ^{14}C BP (Beta-263744) and 14,820 ± 70 ^{14}C BP (Beta-263745). Layer 3, dates of 14,056 ± 81 (AA-84136) and 14,930 ± 70 ^{14}C BP (Beta-263742) (Gladyshev, Bolarbat, *et al.*, 2010; Gladyshev, Olsen, *et al.*, 2010).

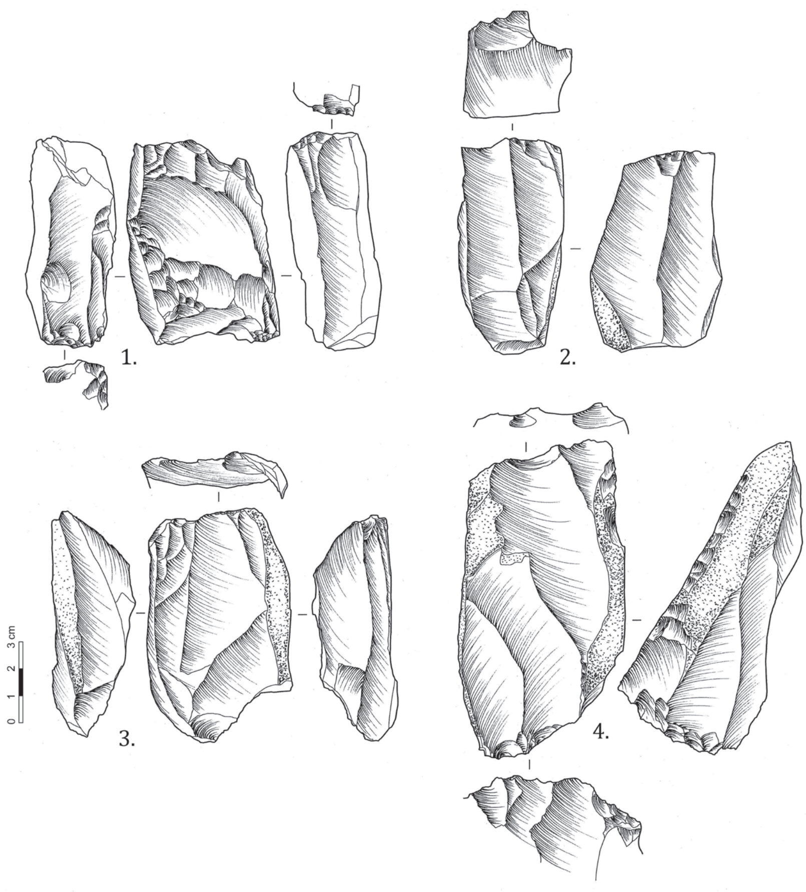

Figure 236: Tolbor 15, layers 6-7, blade cores

The following preliminary personnal observations are based on the cores and laminar blanks (N=285) from the assemblage collected through 2010. Layer 6-7 has yielded a lithic assemblage characterized by unidirectional blade reduction mainly from volumetric cores (Figure 236). Some of the cores may display sub-cortical bidirectional removals in the early stages of reduction. Platforms are mainly plain and thin (less than 4 mm thick) and the thin abrasion frequently observed on the external edge seems to suggest organic percussion. Facetted platforms are rare. Small blades, bladelets and microblades are produced from unidirectional, small flat-faced cores that sometimes resemble truncated-facetted pieces (Figure 237: 1, 2). Some flat-faced cores are flaked from a narrow face following a re-orientation of the reduction and appear as carinated endcrapers (Figure 237: 4). Genuine carinated endscrapers are also present but are rather uncommon (Figure 237: 3). Bladelet cores are produced on small slabs, blocks or thick cortical flakes and, therefore, represent a distinct reduction sequence starting from the selection of the raw material. The fronto-lateral flakes have straight profiles (Figure 238: 5-7). When slightly overshot, they may provide indirect evidence of the presence of small, prismatic cores. Microblades with pressure flaking occur in layer 5 (N=1) but are clearly documented starting from layer 4 (Gladyshev *et al.*, in press).

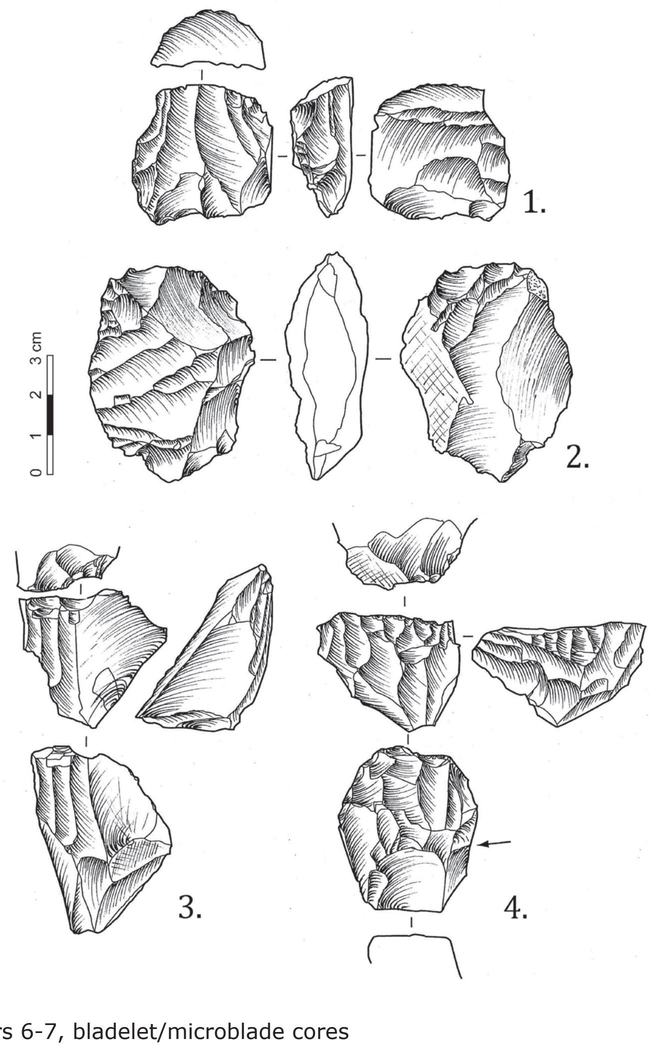

Figure 237: Tolbor 15, layers 6-7, bladelet/microblade cores

The number of bladelets observed is relatively small. The observed specimens are regular but poorly standardized and do not show signs of pressure flaking. Small blanks with trapezoidal sections are likely detached from a narrow flaking surface and are similar to burin spalls (Figure 238: 3). Among the retouched laminar blanks, some small blades display inverse lateral notches (Figure 238: 8, 9). A single Dufour bladelet has been identified (Figure 238: 4). It bears continuous, inverse, thin retouch extending along the left edge until the mesio-distal part, where a small truncation may have cause a break. The blank is cortical and shows a perpendicular removal coming from the left side.

As suggested by Gladyshev and colleagues (Gladyshev, Olsen, *et al.*, 2010), it is reasonable to consider this assemblage as analogous to the Tolbor 4 OH4 assemblage. The techno-typological and chronological information at hand would mean that both assemblages are EUP and distinct from the IUP.

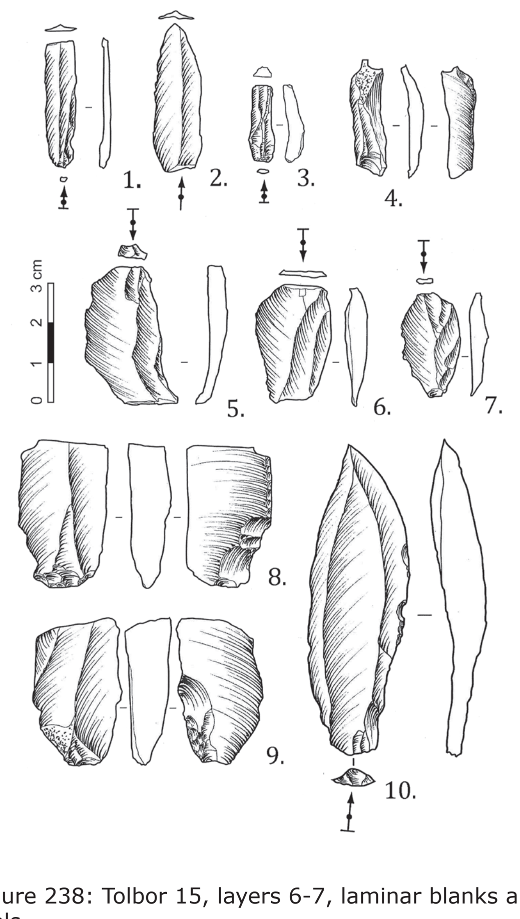

Figure 238: Tolbor 15, layers 6-7, laminar blanks and tools

Dorolj 1

Similar assemblages are documented in Dorolj 1 along the left bank of the Eg River. The site is located a few km from the confluence with the Selenga, along the east flank of the Khangai range. It was excavated between 1999 and 2001 by a Mongolian-French team at a time when the archeology of the Egin-Gol was threatened by the construction of a dam (Jaubert *et al.*, 2004). Although the sedimentary sequence is 12 m thick, it has yielded a single layer with cultural remains. It is in a colluvial deposit covered by 2-3 m of loess. The latter are disturbed by cryogenic processes and solifluction attributed to the Heinrich 2 event, circa 21 ka (Bertran *et al.*, 2003). Two AMS radiocarbon dates have been obtained on charcoal samples from combustion features with ages of 29,910 ± 310 ^{14}C BP (Gifa-99560) and 29,540 ±390 ^{14}C BP (Gifa-99561) (Betran *et al.*, 2003). Three more dates, 31,880 ± 800 ^{14}C BP (Gifa-11664), 21,820 ± 190 ^{14}C BP (Gifa-102451) and 22,030 ± 180 ^{14}C BP (Gifa-102453) have been obtained on ostrich eggshell samples. The two latter dates are younger but samples were collected from an excavation sector other than the combustion feature sector (Jaubert *et al.*, 2004). Pollen analyses have yielded inconclusive preliminary results. The fauna are badly preserved and are mainly composed of small-sized equids *(Equus sp.)*.

The lithic assemblage (N=1791) comes from an excavated surface of circa 40 m². The raw material consists of pebbles of metamorphic rocks collected in the alluvial deposits of the Eg. Levallois and discoid technologies are attested to but rare with the main reduction sequences being laminar. Blades are mostly of medium size and produced from unidirectional cores with the bidirectional blades being interpreted as a succession of two alterning unidirectional sequences. Blanks are poorly standardized, have plain platforms prepared by abrasion and likely correspond to organic hammer percussion. Large blades are present, and although they bear bidirectional removals, the dorsal patterns are said to suggest the use of a second platform for the management of distal convexities (Jaubert *et al.*, 2004). Laminar flakes are produced using cores with two opposed platforms. The bladelet production is mainly attested to by the occurrence of cores on flakes, probably byproducts of blade production. The reduction is described as rather expedient and among the cores (N=11) a single typical carinated endscraper is mentioned (Jaubert *et al.*, 2004). The latter elements are mentioned by these authors to compare Dorolj with assemblages from the Altai such as UK1-2. Based on the present study, chronological and techno-typological analogies suggest an attribution of the Dorolj material to EUP.

Orkhon sites

In the Orkhon valley, layers 3 and 4 from the site of Orkhon 1 have yielded assemblages associated with the first occurrence of the UP. The technology is oriented toward the production of convergent laminar blanks by unidirectional and bi-directional flaking on flat-faced cores. Some of these cores are sub-volumetric (Kandyba, 2009 quoted after Gladyshev, Olsen, *et al.*, 2010) and some of the unidirectional cores are reduced without the use of natural or prepared crests (Slavinsky and Tsybankov, 2006). Orkhon 1 and 7 have yielded numerous radiocarbon and EPR dates, but these show significant problems. Due to methodological issues (Kuzmin, 2000) (see previous Chapters 3 and 5), EPR dates are not taken into account here. A recent study (Kandyba, 2009 quoted after Gladyshev, Olsen, *et al.*, 2010) retains the conventional date of 33,785 ± 300 (^{14}C BP?) (SOAN-2885) on a bone sample for the first occurrence of the UP. This date is also reported by Gladyshev and colleagues (Gladyshev, Olsen, *et al.*, 2010) but associated with layers 3 and 4 from Orkhon 7. Derevianko (Derevianko, 2011a) reports a date of 40,000 ± 700 (^{14}C BP?) (SOAN-2882) for the same layers at Orkhon 1.

These inconsistencies underline the difficulty of assessing the chronological attribution of these layers. Further confusion occurs in the published material. For example, a date of 45,100 ± 1,700 BP for earliest human occupation at the site of Orkhon 7 is associated with the layer 10 but the lab number is unknown. Similar problems occur with the reported radiocarbon age of 62,500 ± 4,500 BP which, although produced in the early 1990's, falls beyond the normal limit of the method (Astakhin *et al.*, 1993; Derevianko, 2011a). The earliest reliable age would then be associated with layer 7 with a conventional radiocarbon age of 37,100 ± 580 ^{14}C BP (SOAN-2881) on a bone sample (Orlova *et al.*, 2005), but Derevianko (2011a) associates this same date with layer 6.

Gladyshev and colleagues (Gladyshev, Olsen, *et al.*, 2010) consider the material from layers 3 and 4 from Orkhon 7 as similar to the Dorolj 1 assemblage. However, due to the above-mentioned confusion with the SOAN-2885 date, it is not clear if the description of the lithics corresponds to Orkhon 1 or Orkhon 7. Derevianko and Kandyba (2009) compare the technology and the typology of the uppermost UP layers from Orkhon 1 and Orkhon 7 to the Anuy II material. These phases would then correspond to EUP as defined in the present analysis. The earliest occupation of Orkhon 7 is attributed by Derevianko (2011a) to a Late MP, and he describes two variants of subsequent UP after a transitional phase. From a general point of view, layers 3 and 4 from Orkhon 1 show some similarities with IUP technology, and although having a crude aspect, the underlying assemblages could correspond to a similar tradition.

In sum, the Orkhon sites show techno-typological affinities with both IUP and EUP but significant problems remain regarding the chronology of the sequence.

The material from the Moltyn-Am site from 1985-1986 excavations (directed by Derevianko) is described by Derevianko and Kandyba (2009b) as two distinct assemblages attributed to Middle and Upper Paleolithic. A direct date of 20,240 ± 300 ^{14}C BP (Gif-10857) is associated with the so-called 'tongue horizon' and with an archeological assemblage (Bertran et al, 2003). It is not clear wheter this layer correspond to the assemblages described by Derevianko and Kandyba (2009b) in which case the date would be surpisingly young.

8.4 SOUTHERN MONGOLIA

Further south, sites such as Tsagaan-Agui have been mentioned as evidence of IUP in the north-central Gobi (Derevianko *et al.*, 2004, 2005). The chronology is based on radiocarbon ages and on ESR dates but shows some discrepancies (*e.g.* in layer 4). Radiocarbon dates on charcoal samples from layers 3 provide results between 34 and 31 ka ^{14}C BP. For the same layer, ESR provide results with large standard deviations, between 37 and 27 ka BP (early uptake) and between 50 and 35 ka BP (recent uptake). It seems to provide some of the youngest ages for such a technology when considering the early uranium uptake model. When considering the the recent uptake, the chronology overlap with the expected range IUP in Altai, in the Baikal and in Northern Mongolia. It is noted that the only date on bone sample provided an age of 37, 540 ± 930 ^{14}C BP (AA-31869) and is derived from the overlying layer 2. This date is, however, 10 ka older than dates on charcoal from the same layer. RTL-dates (Derevianko *et al.*, 2000) from layer 5-12 provided ages betwee 650 and 150 ka are judged too old and unreliable due to sediment transports in the cave system (Derevianko *et al.*, 2004). In other words, if IUP technology seems present in southern Mongolia, the young ages obtained are still difficult to interpret.In south-western Mongolia, surface assemblages from the Hoit Tsenker Gol terrasses and from the Takhiliin Hotgor plateau (province of Hovd) have yielded cores oriented on the bidirectional production of laminar flakes (Jaubert *et al.*, 1997) but clear evidence for systematic blade production are lacking.

8.5 SUMMARY

In Central Asia, current evidence supports a long chronology for the emergence of volumetric laminar technology. As documented in the loess from Tajikistan, prismatic and even pyramidal blade technology occurs starting from OIS7. Evidence is scarce but seems to indicate that blade assemblages last until the interglacial, with a first occurrence of small laminar elements around 150 ka. After the interglacial, this technology is not well documented. MP assemblages such as Teshik-Tash illustrate a classic Mousterian associate with laminar elements in Kuhdji. Further evidence of MP laminar technology is found in Uzbekistan. The Obi-Rakhmat sequence displays intriguing similarities with the IUP but also shows a certain degree of variability that could be related of the large size of the collection. Although sub-volumetric cores are present, it seems narrow-faced cores are particularly well represented. The chronology is problematic as the different methods do not match. For now, it is considered as younger than the Tadjik blade assemblages. Recent discoveries from Kulbulak may bring some new chronological data, as early blade technology has been identified in the sequence, with a minimum age of circa 50 ka. IUP blade technology is not yet documented in Kazakhstan or in western Siberia, but these vast territories remain only partly explored. In the eastern Altai foothills, only limited evidence of human occupation could be possibly attributed to the last interglacial. Moving further east, between the Yenissei and the Angara rivers, IUP technology is not clearly recognized. Sites such as Ust-Izhul clearly testify of a human occupation as early as OIS5e, but the small lithic assemblage is not laminar and not diagnostic. In the Cis-Baikal area, whereas assemblages such as Tolbaga remain difficult to characterize, the Makarovo group presents some clear technological, typological and possibly chronological analogies with the IUP. On the other ridge of the lake Baikal, numerous sites have yielded assemblages that show significant similarities with the Altai IUP. They are located in the Selenga river delta, and it appears that the Trans-Baikal region is likely connected with northern Mongolia since at least the beginning of OIS3. With respect to taphonomic problems and to functional and economic differences expected when comparing assemblages over a distance of more than 1000 km, technological and typological differences between IUP assemblages from Altai to Mongolia are trivial. This technology seems to be present since at least the beginning of OIS3.

EUP technology appears in Central Asia in the north-east of Afghanistan possibly circa 30-35 ka ^{14}C BP. Nearby Uzbekian sites are for the most part not dated, but new results from Kulbulak and Dodekatym indicate that bladelet and microblade technology obtained by direct percussion could be associated in a subsequent phase with geometric microliths as early as 22-23 ka ^{14}C BP. If confirmed, these results could lead to the reassessment of numerous assemblages associated to the Mesolithic on typological basis. It would then partly fill the existing gap between MP and Holocene occupation of Central Asia. In Kazakhstan, sites such as Karasu and Maybulak could be assigned to the EUP on a technological and chronological basis. Maybulak is particularly relevant as it is located on the southeastern edge of the Altai and dated to circa 32 ka. It appears contemporaneous with the earliest phases of EUP in the Altai. In western Siberia, the EUP appears clearly at the end of OIS3 and the beginning of OIS2 and would partly overlap with the end of Altai EUP chronological range. North of the Altai, Malay Sia could also represent one of the oldest occurrences of the EUP, although no clear bladelet or microblade technology has been described yet. Between the Yenissei and the lake Baikal, bladelet and microblade technology seem to belong for the most part to the Sartan period and overlap with the first occurrence of pressure flaking. In Mongolia, EUP assemblages are attested to starting from circa 32 ka ^{14}C BP. They show technological, typological and chronological similarities with the Altai EUP.

When addressing the research question 3, clear inter-regional similarities emerge from the present overview. As developed in the next chapter, it is suggested that the available body of data does not support scenarios of human development in isolation. Instead, the data set strongly suggests long distance population movements starting from the earliest phases of OIS3.