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Title: Laminar technology and the onset of the Upper Paleolithic in the Altai, Siberia
Date: 2012-06-06

9 – Discussion, conclusion and perspectives

In the previous chapters, three main research questions were addressed. In addition, a regional chrono-cultural model was proposed. The first section of this chapter summarizes the questions and issues tackled in this study, the results obtained and an interpretation of these results. Comparisons with the regional records and with the neighboring regions were presented in the previous chapters. In this discussion, broader technological analogies with the European and the Levantine records are briefly discussed in order to underline the defining characters of the assemblages. Keeping in mind that the current archeological record appears to be rather fragmentary given the size of the area considered, implications for MH dispersal scenarios in Asia are discussed. Following the conclusions, future directions of research are briefly suggested.

9.1 DISCUSSION

9.1.1 IUP: DEFINING THE DISTINGUISHING FEATURES

IUP human groups selected relatively large blocks or pebbles with a tabular form and produced massive and elongated pointed blanks or blades. The reduction starts following a minimum of preparations as the selected block already has a suitable shape. Blocks are heavily reduced using a standardized method. This method is similar to what Pelegrin (1990, 1995) described for the Chatelperronian and to what Boëda (1990) has defined as the 'Roc-de-Combe layer 8' reduction system. Two flaking surfaces are interconnected in order to create convexities as described by Boëda (1995) in the 'Hummal type Volumetric Construction'. The reduction starts and is resumed from one of the narrow faces of the block, but some of the cores show transversal removals from the opposed narrow edge that indicate the shaping of a postero-lateral crest. Roussel (2011) recently underlined that in a Chatelperronian context the narrow face of the core is not only involved in the management of convexities but also in the production of blanks. This latter point could not be observed here in an IUP context, in other words, the IUP reduction is not a surface conception and does not fall in Boëda's definition of Levallois technology (Boëda, 1995).

This technology differs from the Rocourt method (Cahen, 1984; Boëda, 1990; Otte, 1990) which is described in MP assemblages from Belgium (e.g Rocourt) and northern France (*e.g.* Seclin, Riencourt-les-Bapaumes) assigned to OIS5 (*e.g.* Revillon and Tuffreau, 1994; Tuffreau, 1993; Revillon, 1995; Goval and Herisson, 2006; Goval and Locht, 2009) In the Altai IUP, the section of the core is assymetrical with sometimes two flaking surfaces separated by a 90° angle. The Rocourt method implies that the broad flaking surface is reshaped by *débordant* removals from both narrow faces giving the flaking surface a dome-shape. These side removals are the only way to continue the reduction. The cores often exhibit a symmetrical section close to a semi-turning type instead of an assymetrical section with two clear-cut flaking surfaces. Analogies with the Altai IUP reduction system can be found in the Late Crimean Mousterian of Kabazi II (layer II, horizon 1-4a), although the latter is described as a Rocourt reduction method (Chabay and Sitlivy, 1993; Cabaj and Sitlivy, 1994; Chabai *et al.*, 2006; Sitlivy and Zieba, 2006). Nehorochev (2004) described similar technological features in the layer 8 of Shlyakh, in the lower Don basin, dated to between 50 and 43 ka ^{14}C BP (see also Nehoroshev and Vishnyatsky, 2000). Schlyakh has been tentatively associated with the Bohunician techno-complex (Hoffecker, 2009).

Bohunician technology as described in Stranska Skala, Czech Republic (Svoboda and Bar-Yosef, 2003; Nigst, in press), is oriented toward a production of elongated Levallois points detached from bidirectional narrow-faced cores that tend to switch to unidirectional at the end of the reduction (see also Skrdla, 2003a). The cores are prepared by a frontal initial crest, and *débordant* blade removals shape the lateral convexities as the reduction continues. Skrdla (Skrdla, 2003b) notes that the reduction starts as UP, but finishes as MP. In other words, the reduction starts from the narrow face but the exhausted cores appear as flat-faced. These combined features have been interpreted as a conceptual fusion between Levallois and volumetric approaches (Svoboda and Skrdla, 1995). *Débordant* blades are detached from both sides of the flaking surface and the cross-section appears roughly symmetrical. It has been noted that the Bohunician technology is very similar to the Kara-Bom one (Svoboda and Skrdla, 1995; Skrdla, 2003b). The initialization of the reduction, the bidirectional reduction and the morphology of the end products are indeed similar. However, it appears that the reduction method is closer to a Rocourt-type technology than to the Altai IUP. Moreover, in the Bohunician from Central Europe, blades are considered as byproducts whereas in the Altai IUP the technology is mainly oriented towards blade production. If one accepts Shlyakh as a Bohunician assemblage (*e.g.* Hoffecker, 2009), Altai IUP technology could then be considered part of the Bohunician technological variability. However, Schlyakh technological affinities are so far not clear (Sitlivy and Zieba, 2006).

Altai IUP platform preparation often includes a combination of facetted and plain forms. In addition, specific forms have been identified, such as partial faceting. This latter is defined as a faceting located along the external edge the platform. The remaining part of the platform, including the point of percussion, becomes usually more prominent and remains plain or dihedral. Similar preparation was described as a core platform reduction by Nehorochev (1999) in layer 8 of Shlyakh. The purpose of partial faceting is not clear; however, two main hypotheses can be formulated. On the one hand, this could be seen as a form of faceting to obtain thicker and/or larger blanks by increasing the platform thickness. The relationship between thick platforms and thick blanks has been repeatedly observed in flake production during controlled experiments (Dibble and Whittaker, 1981; Dibble and Pelcin, 1995; Pelcin, 1997a). The second possibility is to see partial faceting as a way to remove an overhang prior to the detachment of the blank. Although thin abrasion does not occur in Altai IUP assemblages, a strong abrasion is observed among the blanks and, according to Pelegrin (2000), could correspond to the use of a soft hammerstone. Partial faceting could be seen as a similar preparation to obtain a bevel-shaped platform that allows for the removal of a robust blank.

Small laminar elements are obtained by reusing unstandardized by-products, namely the *débordant* and crested blades, detached from the intersection of the narrow and broad flaking surface (see also Zwyns *et al.*, 2011). Core blanks are not predetermined but rather anticipated and are selected according to size attributes such as their thickness and also probably for their length. In the classic Roc-de-Combe technology, some of these thick blades with natural backs are used as blanks for Chatelperron points (Pelegrin, 1995; Roussel, 2011). The burin-cores (BC) are defined here as cores on blade blanks that are reduced by uni- and bidirectional removals along the longitudinal axis of the core blank. The technique of percussion is mostly hammerstone and hinge fractures are frequent. Similar core technology is observed in the Near-East among MP laminar assemblages such as Hayonim lower E and F (Meignen, 2007). BC also occur among OIS5e MP assemblages from northern France such as Riencourt-les Bapaumes (Tuffreau, 1993; Ameloot-Van der Heijden, 1994). Some examples from Temnata sector I and II are illustrated by Tsanova (2008) but the best known occurrence of BC during the UP is represented by the polyhedral burin-cores *(nucléus burin polyédrique)* in Late Gravettian assemblages such as Le Blot, in central France (Klaric, 2006, 2007, 2008; Klaric *et al.*, 2009) or Mainz-Linsenberg, Germany (Hahn, 1969; Klaric *et al.*, 2009). This type of core produces elongated and narrow blanks with straight profiles that are often transformed into Gravette and Microgravette points by abrupt and semi-abrupt retouch. Although they appear identical to the IUP examples, Gravettian polyhedral burins are reduced by a succession of independent unidirectional sequences rather than by alternating bidirectional removals (Klaric, 2006).

It is noted that the emergence of BC technology reflects the appearance of sub-volumetric or volumetric blade technology. The volumetric approach, however, does not *a fortiori* imply a BC reduction. Various MP and UP technological systems produce thick crested and *débordant* blanks but only a few reuse them as cores.

Considering the BC from a blank production point of view does not rule out that some of them were used as tools; however, use-wear analysis on this type of artifact tends to suggest that it is not often the case. In a Gravettian context, a recent study has shown that artifacts classified as core-like burins (including BC forms) on technological-typological basis do not bear use-wear as opposed to burins with thin and sharp chisels that are used on soft material (de Araujo Igreja and Pesesse, 2006). At Riencourt-les Bapaume, use-wear was observed on burins produced on flakes but not on the burins on blades (including the described BC forms) (Beyries, 1993; Ameloot-Van der Heijden, 1994).

The Altai IUP toolkit is quite variable and includes both MP and UP elements. The most typical tools are pointed blades with an inverse proximal thinning. This thinning is generally unifacial, although one example from Kara-Tenesh and one from UK1-1 seem to bear some proximal direct retouch. These are highly recognizable and are not found in other technocomplexes in the Altai. Similar thinning on blades is known in northwestern Europe as Jermanowizce points. They are usually retouched on both faces, but the proximal retouch can be unifacial. They are considered typical of the Lincombian-Ranisian-Jermanowizcian (LRJ) techno-complex (Flas, 2008). Stratigraphically, the latter occurs below the Aurignacian, but chronologically it overlaps with European late Mousterian assemblages. It is roughly contemporaneous with the directly dated Neandertal remains in Belgium and in the Caucasus (Semal *et al.*, 2009; Pinhasi *et al.*, 2011) but also with the earliest known dates for the Early Aurignacian in Central Europe (Haesaerts and Teyssandier, 2003; Nigst and Haesaerts, 2011). In the Levant, Emireh points are defined as a relatively short convergent blank with a bifacial proximal thinning (Garrod, 1957; Volkman and Kaufman, 1983; Copeland, 2000). Volkman and Kaufman's definition (1983) considers that the blank should be bidirectional. Emirean occurs after the Nubian and prior to the Ahmarian technocomplexes and corresponds to the Late MP/transitional industries represented by Boker Tachtit layers 1-2 (Marks and Volkman, 1983), Tor Sadaf A-B (Fox, 2003) or other assemblages (Copeland, 2000). In Syria, sites such as Jerf-al-Ajla (Schroeder, 1969, 2007) have yielded convergent blanks with inverse truncations. The Umm-el-Tlell points differ as the thinning corresponds to convergent bladelet removals observed on the dorsal face (Boëda and Muhesen, 1993; Bourguignon, 1996, 1998).The bladelet blanks show some usewear and the process is considered as a reduction sequence (Boëda and Bonilauri, 2006) or as a preparation for removing convergent blades (Bourguignon, 1998). Artifacts similar to the Umm-el-Tlell points also occur within IUP assemblages from Kara-Bom (Figure 55) and are combined with retouch at Kara-Tenesh (Figure 195). They but do not clearly appear as standardized as a tool-type nor as a bladelet reduction sequence. Instead, Kara-Tenesh examples suggest that the lamelar thinning technique correspond to a preparation for hafting.

In Central Asia, a few examples of basal unifacial thinning on points are observed at Obi-Rakhmat in various levels. Whereas Obi-Rakhmat is a rich laminar assemblage, such artifacts are rare and produced on convergent flakes and convergent blades. It is also noted that, like in Jerf-al-Ajla (Schroeder, 2007), they occur among a broader variability of truncated pieces, such as blades with oblique truncations and truncated-facetted pieces. Further east, Makarovo IV yielded similar typological elements but on short laminar flakes with bilateral retouch, including bifacial thinning of the proximal part (Goebel, 1994, 2004; Derevianko, Shimkin, *et al.*, 1998). They seem to occasionally occur in northern Mongolia were blades with parallel edges and inverse proximal truncations are reported.

The examples of leafpoints clearly associated with the IUP are rather poorly standardized. They seem to represent infrequent elements and are seen as a typical IUP feature. Nevertheless, they differ from bifaces found in Mousterian contexts such as Chagyrskaya or Okladnikov cave (Derevianko and Markin, 2011).

Although it was attributed to the MP, the attribution of Anuy III stratum 19 is still unclear given the small size of the assemblage and the lack of chronological data. If confirmed, it would represent the only clear association of leafpoints with the MP in this region. Some peculiar tool-types, such as the sickle-like blades, could be interpreted as specific to the Altai IUP, although it could also reflect an aspect of the variability of retouched blades.

9.1.2 IUP: THE ASSIGNMENT

Although typological Levallois elements such as blades and points are associated with the IUP, evidence of strict Levallois technology is infrequent. Levallois flake cores or elongated recurrent Levallois cores occur, but the main reduction system is laminar. Although no long refit sequences could demonstrate this, it appears that a portion of the convergent blades are produced by a blade reduction from the broad face of the core. This aspect differs from the classic Roc-de-Combe technology in which convergent blanks are uncommon. Meignen (2007) notes that in the Near-East, the coexistence between Levallois and blade production appears around 220 ka with the Tabun-D assemblages. Pre-Aurignacian and Acheulo-Yabrudian include laminar systems but no Levallois component. In the Near-East IUP, at sites such as Boker Tachtit layers 1-4 (Marks and Volkman, 1983), Ksar Akil layers XXI-XXIV (Bergman, 1988; Ohnuma and Bergman, 1990), and Üçagizli layers F-H (Kuhn *et al.*, 1999, 2009), Meignen (2007) observes a higher frequency of elongated blanks and an emphasis on laminar technology at the expeFig.nse of strict Levallois reduction strategies.

The Altai IUP shows a combination of technological features that occur in various chronological contexts starting from the MP. The attribution of the Altai assemblages to the IUP as defined by Kuhn (2004) and by Marks (1990) is preferred over the term 'transitional' as it does not imply a local transition process. Moreover, it is supported by several other arguments. The definition is rather broad, as it considers assemblages with a coexistence of volumetric and parallel blade reduction and the production of convergent elements (Kuhn *et al.*, 1999; Kuhn, 2003). Strict Levallois technology is present but rather infrequent. Laminar technology chiefly dominates the assemblages and falls in the definition of the Near-East IUP (Meignen, 2007). The presence of ornament has been reported at Kara-Bom in the Altai (Derevianko and Rybin, 2003; Zwyns *et al.*, 2011), and bone technology has been found associated with similar assemblages from the Trans-Baikal region (*e.g.* Khotyk, Podzvonkaya) some of which have a single cultural component (*e.g.* Varvarina Gora)(Lbova, 1996). An unpublished bone point has been found associated with the IUP (Tolbor 4, OH6) in northern Mongolia and is directly dated to circa 38 ka. From a general point of view, stratigraphic and chronological data indicate that IUP would occur early OIS3 (Gladyshev, Olsen, *et al.*, 2010). Keeping in mind that these divisions are arbitrary (Kuhn, 2003), the IUP assignment remains so far the most appropriate. Additional chronological and taphonomic support is necessary to assess this attribution and to clarify the status of these assemblages.

9.1.3 IUP: THE ORIGINS

Derevianko (2011a) argues for a local origin of the Altai IUP which evolves from a Levallois-Mousterian background. Rybin (2004) suggested that the Altai IUP evolved locally from an intrusive Levallois-Mousterian. He notes numerous similarities between Boker-Tachtit layer 1 and the Kara-Bom Levallois-Mousterian and suggests an original migration from the Near-East. Both scenarios argue that a gradual transition from MP to IUP is illustrated by the Kara-Bom sequence. Although they appear partly contemporaneous, non-Levallois Mousterian assemblages (*e.g.* Okladnikov, Chargyrskaya) (Derevianko and Markin, 2011) differ significantly from the IUP and are not relevant for the following discussion.

According to the present analysis, the few arguments in favor of a transition at Kara-Bom are mainly technological. As described in Chapter 3, the status of the Kara-Bom MPH1 assemblage is unclear due to its small sample size. In fact, almost all technological and typological elements described can occur in the variability of IUP assemblages. A possible IUP attribution for this assemblage is, therefore, not excluded. The lowermost MP assemblage (MPH2) shows a production of short Levallois points from a reduction system that is mainly unidirectional and convergent but that also includes a surface management from the narrow face by the recurrent removal of side or crested blanks. This management of convexities stretches the definition of Levallois technology and is one of the defining characters of Northeast Asian IUP. The presence of blades is mentioned but cores are missing. MPH2 blade technology is, therefore, difficult to characterize given that some elongated blanks might be linked with the production of points. Moreover, most of the MPH2 assemblage seems *in situ,* but downslope the distinction with the overlying MPH1 is unclear (Derevianko, Petrin, *et al.*, 1998). Thus, the idea that some of the material is intrusive cannot be excluded. In this situation, the presence of BC-like forms is not interpreted as meaningful. Furthermore, significant technological differences with the IUP are observed. As opposed to the MPH2 assemblage, genuine blade technology chiefly dominates the MPH1 assemblage. The reduction is not unidirectional convergent but bidirectional parallel. Convergent blanks occur, but are mainly associated with a bidirectional reduction system. The systematic occurrence of BC technology underlines the importance of the small laminar blanks in the IUP. MPH2 and OH6-OH5 technological systems are, therefore, not only different in terms of technology but also in terms of blanks produced. This is in contrast to the few examples where a local transition is documented. In the Near-East, the transition from layer 1 to layer 4 at Boker Tachtit is technological. In other words, the blanks produced do not change (even if the retouch may vary) but the technology to produce them gradually shifts from volumetric bidirectional on a narrow face to a unidirectional semi-turning reduction system (Marks and Volkman, 1983). At Kara-Bom, the situation is reversed with MPH2 being mainly unidirectional and the IUP being bidirectional. Moreover, the technological systems are oriented toward the production of convergent flakes whereas in the IUP the main technological system produces blades. At Kara-Bom, MPH2 is characterized by a surface approach and the IUP is sub-volumetric whereas at Boker Tachtit the lowermost layer 1 cores are volumetric on narrow face.

Furthermore, chronological data are not consistent with an in-situ transition scenario that strongly relies on the assumption that human occupation in the region was continuous. The chronological data indicate a minimum age circa 44 ka for MPH1. The EPR ages are not considered reliable, but it cannot be ruled out that MPH2 is considerably older than OH6. In fact, scholars tend to assign this layer to OIS4-OIS5. Given the apparent low intensity of occupation at Kara-Bom, it is not realistic to suggest that the sequence would represent minimum 20 ka of continuous occupation. Instead, it more likely represents episodic occupation during different periods that could be separated in time by thousands of years. It cannot be excluded that IUP assemblages and MPH2 share a common Levallois-Mousterian background that originated in Central Asia or even in the Near-East. According to the present study, however, the gradual transition is not documented at Kara-Bom.

Rybin (2004) suggests that Kara-Bom Levallois Mousterian is similar to Tabun D assemblages based on a comparison with the lower assemblages from Boker Tachtit dated to circa 46 ka. According to Marks (1992), the Boker Tachtit lower levels are technologically and typologically closer to Early than to Late Levantine Mousterian assemblages. Tabun D assemblages and Hayonim lower E and F, however, have been dated in Tabun (layer IX) and elsewhere between circa 260 to 160 ka (Mercier *et al.*, 1995; Rink and Schwarcz, 1999; Mercier and Valladas, 2003; Rink *et al.*, 2003, 2004). Like for the Bohunician (Skrdla, 2003), Boker Tachtit blades are considered as byproducts of the production of points (Marks and Volkman, 1983; Demidenko and Usik, 1993). The period between 120 to circa 60-50 ka is marked by the absence of MP laminar assemblages (Meignen, 2007). But the major chronological gap between the two suggests that, in the Levant, these technocomplexes are not directly related. In Central Asia, volumetric blade reduction has been identified in PC2a of Chonako III, Tadjikistan, starting at around 220-200 ka (Schäfer *et al.*, 1998). These assemblages seem to be a relevant comparison with the Levantine Tabun D phase or with laminar assemblages such as Hayonim lower E and F (Meignen, 2000) or Rosh-ein-Mor (Marks and Monigal, 1995) which have a less pronounced Levallois component.

Like in the Near-East, blade MP assemblages seem to disappear from the Tadjik sequence prior to or during OIS5e (Schäfer *et al.*, 1998) and reappear circa 50-40 ka in Kuhdji (Ranov and Schäfer, 2000). As the first occurrence of Levallois Mousterian in the Altai is documented during OIS5e, a link between the early Central Asian blade MP and the Altai cannot be excluded. The key-sequences of Kulbulak and Obi-Rakhmat in Uzbekistan could perhaps fill this gap, but for now their precise chronology remains unclear.

While the Obi-Rakhmat assemblages appear as the clearest analogy with the IUP in Central Asia, some significant issues remain regarding the lithic technology and the chronology. Up to now, the blade technological systems have not been described in detail. The reduction systems appear mostly unidirectional and if a more detailed analysis confirms these observations, it would then appear closer to a Hayonim E type of industry rather than to the Altai IUP. Blade cores are infrequent but some appear as sub-volumetric. It will be necessary to determine if they are analogous to the sub-volumetric IUP reduction or if they represent exhausted semi-turning cores. Moreover, a systematic study of the small laminar elements should help to determine the degree of technological variability of this assemblage which seems to be higher than among IUP assemblages from Altai but also from Baikal and Mongolia. BCs have been illustrated among various types of core including UP forms such as narrow-faced cores, lateral burin or microblade cores. So far, the latter are rare or non-existent among IUP assemblages, but some have been described among the laminar MP assemblages in the Levant (Hayonim E and F) (Meignen, 2007). Depending on the methods, chronological issues are significant and the earliest occupation at Obi-Rakhmat could be assigned to OIS5-OIS4. Some authors have argued that the top of the sequence is within the range of radiocarbon dates (Krivoshapkin, Kuzmin, *et al.*, 2010), but this requires confirmation as, so far, the assemblage cannot be chronologically attributed either to the MP or the IUP.

It is suggested that the scenario of local transition in the Altai lacks support in several areas. One key point is whether the the Altai was permanently occupied during the critical time period. Based on his analysis of the fauna and on the frequency of lithics, Wrinn (2010) considered that the Altai shows a very low intensity of human occupation and was not permanently occupied during the Late Pleistocene. Instead, it appears that the Altai shows successive incursions of human groups starting from the last interglacial. Whether human occupation takes place during warm or cold intervals cannot be determined due to the lack of precise and reliable chronological or paleoenvironmental data. Starting from OIS5e, multiple incursions probably from northwestern Tian-Shan brought to the Altai region assemblages of Levallois-Mousterian type. These population movements have probably contributed to the appearance of IUP in the region. It is not clear yet if the IUP represents rapid population dispersals straight from the Near-East or if it emerged from a longer transitional process initiated in Central Asia. The timing and the nature of its development are still unknown, and if a transition toward IUP occurred in the Altai, it is not yet convincingly documented in the regional archaeological record.

9.1.4 IUP: DISPERSAL FURTHER EAST

Based on some preliminary comparisons, some assemblages from the Baikal and from northern Mongolia show a high degree of similarity with the Altai IUP. Several arguments suggest a quick dispersal of the IUP techno-complex rather than for a technological convergence. The first argument, which has been put forward by several authors, is the absence of laminar MP traditions prior to the appearance of IUP assemblages in these areas. The presence of Mousterian groups east of the Altai central plain is reported starting from OIS5e (*e.g.* Ust-Izhul) but is rather elusive (Chlachula *et al.*, 2003). Assemblages are small and technologically non-diagnostic or show some contextual (Flint Valley in Mongolia) (Derevianko *et al.*, 2000) and chronological problems (*e.g.* Dvuglazka cave; Orkhon 1 and Orkhon 7) (see also, Derevianko and Petrin, 1995). The site of Priskovoe in the Trans-Baikal region was thought to represent one of the earliest occupations of the region. Based on a recent and detailed geoarcheological study and on new radiocarbon and OSL dates, the assemblage is now assigned to the beginning of OIS2, circa 26 ka ^{14}C BP (Buvit *et al.*, 2011). This suggests that undated lithic assemblages showing archaic features have to be dated before they can be used to argue for a MP presence in the region. In other words, there is currently no convincing evidence for a local transition in any of these regions.

The second argument is linked with the geographic distribution of the sites. Goebel (2004) notes that none of the Siberian MP sites are located north of 55° latitude. In fact, a similar observation applies to IUP sites as opposed to later OIS2 UP occupations which extend further north. Although this may be a taphonomic bias, it suggests movements/contacts following a west-east axis. Sites show similar settlement patterns and usually are found at the confluence between small tributaries of a larger river and on a prominent topographic location. When preserved, the associated fauna show similarities, with the occurrence of Mongolian gazelle, Siberian goat and horse.

The third argument is related to the chronology, which although being rather coarse-grained, suggests a simultaneous appearance of IUP assemblages. Oldest dates indicate a first appearance starting from the beginning of OIS3, circa 50-45 ka ^{14}C BP.

Finally, assemblages show a high degree of technological and typological similarity despite the distance between them. These similarities include the earliest occurrence of bone tools and ornaments reported within each of the regions. Some authors (*e.g.* Goebel, 1994, 2004, 2006; Brantingham *et al.*, 2001; Rybin, 2005) have already suggested the existence of a unified techno-complex at the beginning of the UP. The present set of evidence suggests a relatively high degree of complexity particularly expressed in terms of standardized technological procedures. From a regional point of view, it is reasonable to assume that the Altai IUP reflects a single population. Following Byrne's approach (2007), it implies that the IUP shows the required combination of intricate complexity and near ubiquity that would illustrate cultural transmission processes. If the same reasoning is extrapolated to the Baikal and Mongolian assemblages, the current evidence strongly supports the hypothesis of techno-complex dispersal through north Asia (Goebel, 1999) at the beginning of OIS3.

9.1.5 IUP: THE MAKERS

In the Altai, Neandertals are clearly associated with Mousterian assemblages at Okladnikov cave and at Chargirskaya cave. Levallois-Mousterian, IUP and EUP are not yet assigned to a hominin taxa, and the remains of the so-called Denisovans derive from a problematic stratigraphic context. Layer 11 at Denisova cave includes three distinct technological features some of which are similar to the underlying layers and represent the archaic component. IUP and EUP typical features also occur, and radiocarbon dates indicate a certain degree of sediment reworking. Moreover, carnivore activity is attested to in this part of the cave. In the absence of direct dates on the Denisovan fossils, the question of their cultural attribution remains open.

In spite of the absence of reliable fossil associations with IUP assemblages, several elements can be discussed. At Obi-Rakhmat, a lithic assemblage showing intriguing similarities with the IUP is associated with Neandertal remains. The lithic assemblage is relatively homogenous from the bottom to the top, and the fossils are found in the middle part of the sequence in direct association with archeological material. The layer was deposited in a low-energy spring environment. Considering that Neandertals were the makers of the Obi-Rakhmat assemblage would imply that in central and Northeast Asia they may have produced significantly different lithic assemblages, ranging from the classic Mousterian to a developed blade industry that includes UP technological elements but without any formal bone tools or ornament.

Attributing to Neandertals such a diverse set of behaviors underlines the difficulty of assigning a lithic assemblage to a hominin taxon in the absence of associated fossils (*e.g.* Slimak *et al.* 2011, Zwyns *et al.* 2012). This is reinforced by the fact that assemblages tentatively attributed to the first MH in India or associated with MH in Australia are not laminar and relatively simple. It has recently been proposed that MH first spread through Europe as early as the Greenland Interstadial 12, circa 45 ka ^{14}C BP, along with the Bohunician techno-complex (Hoffecker, 2009). In Southeast Asia, the first indisputable evidence of MH is dated circa 45 ka ^{14}C BP. This chronological range matches with the first appearance of the IUP in Northeast Asia dated to circa 45 to 40 ka. Based on the available radiocarbon dates, OH6 and OH5 in Kara-Bom would fit with the Chani I or Chani II climatic events as identified in the Kurtak loess-paleosoil succession. The Chani I event has been correlated with the Bohunice soil and, therefore, could match with the chronological range of the Bohunician dispersal. In this sense, the Altai IUP could be seen as a one of the 'road signs' (Bar-Yosef and Belfer-Cohen, 2011) which would illustrate MH dispersal. The association of the IUP with MH would imply a possible chronological overlap with the Neandertals directly dated to circa 37 ka ^{14}C BP.

To summarize, given the considerable variability in lithic production that could be associated with either MH or Neandertal and given the recent identification of a third hominin in the Altai, it is currently not possible to associate the IUP with a specific hominin taxon. If confirmed, the presence of bone tool technology and ornaments associated with the IUP might suggest that an association with MH is the most parsimonious. The available chronological data could support this hypothesis which, in the absence of associate fossils, still remains speculative. The archeological data have been previously used to suggest the absence of long-range migrations and to support a model of a local emergence of MH. Using the same data set, another interpretation can be proposed in which the late Pleistocene human occupation in the Altai is seen as the result of multiple incursions from the western lowlands and from Central Asia. These population movements may have been facilitated by favorable environmental conditions (Derevianko *et al.*, 2005). At the beginning of OIS3, one of these incursions leads to the rapid dispersal of a techno-complex across the southern part of Siberia, to the Cis-Baikal area, and then to Mongolia via the Selenga river basin. As opposed to a continuous and local evolution scenario, the proposed model implies significant population movement. This model is consistent with the Out-of-Africa paradigm.

9.1.6 IUP-EUP: THE SHIFT

The disappearance of the IUP from the Altai region is problematic for two main reasons. The first reason is the difficulty of assigning assemblages such as Kara-Bom OH4 to either the IUP or to the EUP. The technological analysis suggests IUP affinities, but most of the main diagnostic elements could not be found in the sample analysed. The second major difficulty is linked with the chronological data. Sample contamination rarely ages radiocarbon dates, but it often tends to provide younger results. New pre-treatment methods help minimize these problems, but they have yet to be widely applied to the Altai record. Thus, it is difficult to evaluate the reliability of young dates. From a general point of view, evidence of IUP presence after Heinrich 4 event is scarce. It seems that it overlapped with the end of the Mousterian, but due to large standard deviations and to some inconsistencies between results, the length of this overlap is difficult to evaluate. Nevertheless, Mousterian assemblages disappear prior to the Heinrich 4 event. The most reliable dates associated with the EUP indicate that this techno-complex appears shortly after the Heinrich 4 event, prior or during the Konoschelie cooling, circa 33 ka ^{14}C BP. More dates are available for the warm events of Kurtak III, circa 31-30 ka. Inter-stratifications between the two techno-complexes have not been observed and, due to the large standard deviations of some radiocarbon dates, it cannot be ruled out that the IUP and EUP are separated by a significant chronological gap. The assemblage of OH4 at Kara-Bom could represent a human occupation taking place either before or during the Heinrich 4 event. Given the current imprecision of the radiocarbon chronology and the lack of understanding of the regional environmental response to Heinrich 4 event, it is not possible to formally link climatic oscillations and shifts in human occupations. Nevertheless, the sudden appearance of a new technological tradition marks the period corresponding to the GI8.

9.1.7 EUP: LAMINAR TECHNOLOGY AND RETOUCHED TOOLS

EUP groups selected large or medium blocks for blade production of a more modest size. The method appears poorly standardized but includes genuine volumetric cores with semi-turning reduction. Slabs or small pebbles of fine-grained raw material are selected and fractured to produce bladelets and microblades. The production of blades and small laminar elements are dissociated since the earliest stages of the reduction, even if thick cortical flakes are occasionally used as core blanks.

Blade reduction seems to be less systematic than for the IUP. Although the use of crested blades is assumed, the earliest stages of reduction are not well documented. Volumetric cores are reduced mainly by unidirectional flaking and the blades obtained are generally of medium size. Crested elements occur but are not numerous. The majority of the platforms are plain and of reduced size, and facetted platforms are rare. Partial faceting is absent and regular blades have a diffuse bulb, a macroscopic lip and show traces of thin abrasion along the external edge of the platform. According to Pelegrin's definition (1995), this set of features suggests the use of softhammer, although it seems that hard hammer is occasionally used to detach crude flakes. Some cores bear removals from an opposed platform. Derevianko and Volkov (2004) suggest that this represents a management of the distal convexities of the flaking surface. In the context of Chatelperronian assemblages, Pelegrin (1995) suggests that, starting from a certain size, alternate bidirectionality combined with the use of soft hammer would increase the risk of overshot. Thus, a secondary striking platform is used to remove short flakes that shape the distal convexities with elongated blade blanks detached from the opposed primary platform. Blanks obtained may not bear clear opposed removal scars on their dorsal face making them appear as chiefly unidirectional based on the dorsal patterns. Other examples suggest that cores are reduced following relatively long unidirectional reduction sequences followed by a change of orientation with flaking surfaces being used independently.

The small laminar elements are produced from slabs following three main procedures. The first procedure starts with narrow slabs, with the reduction of narrow-faced cores displaying a flaking surface on a narrow edge. The initial flaking follows natural or prepared crest and the core is shaped by lateral preparations and/or posterior crests. The reduction suggests a continuity between small blades and bladelet blank production and appears distinct from the medium size blade reduction. The reduction is strictly unidirectional and sometimes slightly convergent, and occasional overshots combined with opposed distal preparations keep the flaking surface triangular. These cores are similar to prismatic forms described at the base of the Aurignacian sequence in Isturitz, France (Normand and Turq, 2005; Normand *et al.*, 2007), or in Proto-Aurignacian contexts like Fumane (Broglio *et al.*, 2005) or Siuren I unit G (Demidenko, 2001; Demidenko and Otte, 2001; Zwyns, in press). However, in these assemblages the reduction often tends to be semi-turning, with a relatively broad flaking surface. In the Altai EUP, the reduction seems more frontal and, except for the core management, it does not extend to the lateral sides. The keel and the triangular shape of the flaking surface are more pronounced than in the classic prismatic forms. These features are more typical of the Early Ahmarian of the Negev (*e.g.* Boker A, Nahal Nizhana XIII) and have been defined by Davidzon and Goring-Morris (2003) as narrow-fronted cores (see also Monigal, 2003; Goring-Morris and Davidzon, 2006; Belfer-Cohen and Goring-Morris, 2007). In the Zagros, the early stages of the Baradostian includes similar forms, although they show more variability (Otte *et al.*, 2007, 2011; Bordes and Shidrang, 2009; Tsanova *et al.*, 2012). Generally speaking, they represent a classic and fully developed UP technology with a volumetric approach and a frontal reduction. Blanks obtained are small blades/bladelets with straight or slightly curved profiles, and they can be naturally pointed. The strata 11-8 at UK1-2 or the OH8-12 at Anuy II also include small sized examples that may have produced microblades.

The second procedure starts with the selection of small pebbles, thick slabs or cortical flakes. Pebbles are split in two halves, likely using a hammer and anvil technique. The reduction starts from a plain striking platform by semi-turning removals. Cores appear as carinated endscrapers with a broad flaking surface. Occasionally, the flaking surface is narrowed by the removal of fronto-lateral flakes and then turned into shouldered or nosed-endscrapers. Blocks can sometimes be reduced as carinated endscrapers. The blanks produced are bladelets or microblades. This technology is well documented in European Aurignacian contexts (*e.g.* Le Brun-Ricalens, 2005) or in the Near-East (*e.g.* Bergman, 1988; Chazan, 2001; Soriano and Ploux, 2003; Williams, 2003) but also in later assemblages. Carinated burins are quasi-absent and other burin-like cores are rare.

The third procedure represents a combination of narrow-faced cores and carinated endscrapers. In some cases, it appears that, in the first phase of reduction, the core is treated as a carinated form before being turned into a narrow-face core. Orientation changes in the course of the reduction are documented in various assemblages, such as Proto-Aurignacian, Aurignacian, Baradostian or others. From the present analysis, it is inferred that the reduction processes are relatively short. The technology, although clearly oriented to the production of bladelets or microblades, is flexible enough to adapt to the morphology of the raw material nodules.

Although only a small series of blanks is preserved, a large variability of retouched blanks is observed in the EUP. It includes Dufour bladelets and microblades, backed pieces, microblades with bilateral retouch and retouched blanks with oblique truncations. The Dufour bladelets mainly show inverse retouch and in some cases fragments show alternate retouch. The Dufour of Roc-de-Combe sub-type is absent and some of the Dufour can be assigned to the Dufour subtype Dufour (Demars and Laurent, 1992). The lack of standardization of the blanks and the position of the retouch, however, suggest that this typology may be irrelevant in the case of the Altai data set. The backed pieces are usually narrow and elongated microblades with abrupt retouch. Small bifacial pieces are infrequent. A series of small end scrapers fall outside the size range of bladelet and microblade cores. Derevianko and Volkov (2004) report the emergence of pressure flaking in these assemblages. Following Tixier *et al.*'s (1984) definition, the use of this technique could not be observed within these assemblages. Instead, the technique of percussion proposed is soft hammer.

EUP assemblages are characterized by a specific selection of raw material. Part of the observed technological variability is interpreted as a response to the raw material shape, illustrating a certain degree of technological flexibility. Some of the cores suggest continuity between blade and bladelet categories, but others show reduction sequences exclusively oriented toward microblade production.

9.1.8 EUP: THE ASSIGNEMENT

According to the available chronological data, these assemblages represent the first occurrence of a fully developed UP laminar technology in the region, with a special emphasizes on bladelets. In Europe and in the Levant, the EUP is characterized by a continuous reduction from small blade to bladelets, but also by a relative emancipation of the of the bladelet reduction strategies (*e.g.*Teyssandier *et al.*, 2010). In other words, small raw material nodules are selected to produce small blanks and the bladelet technology no longer depends exclusively on the larger blank production. Since the techno-complex in question matches this description, it seems appropriate to assign it to Early Upper Paleolithic. Moreover, the lithic assemblage from stratum 9 at UK1-2 is associated with a serpentine pendant. At Denisova cave, layer 9 from the central chamber has yielded a series of bone tools and ornaments. The layer 6 from the entrance zone is associated with bone tools and, in the eastern gallery; a rib with regular incisions associated with the layer 11 has been directly dated to 30 ka. This date falls into the EUP chronological range. These associations need to be confirmed as both of these sequences have shown some taphonomic problems. At Anuy II, the OH12-OH8 assemblages' chronological range extends to the Sartan but do not illustrate major technological changes. Technological equivalents are found in Europe and in the Near-East with a similar EUP assignment. Teyssandier and colleagues have stressed that in Europe and in the Levant, the shift from Middle to Upper Paleolithic is characterized by intensification in the production of pointed elements (Teyssandier *et al.*, 2010). This trend would reflect a gradual technological development in projectile weaponry. In this view, the differences observed between IUP and EUP laminar reduction could be seen as the generalization of a new kind of composite projectile, perhaps including lateralized lithic implements.

9.1.9 EUP: THE ORIGINS

Based on the UK1-2 and on the Denisova sequences, Derevianko (2011a) suggests a local emergence of the EUP from the local MP background, and Derevianko and Volkov (2004) reconstruct a scenario of technological evolution based on the UK1-2 sequence (see Chapter 5). This model is based on core descriptions and argues for a gradual evolution from a unidirectional recurrent Levallois flake production dated to OIS5e (N=2 + in stratum 13 N=1) to a volumetric unidirectional blade production in stratum 11a (N=2) dated to OIS3, with intermediate forms in the undated strata 13 (N=1) and 11b (N=1). In other words, the model of gradual and local evolution is based on an assumption of continuous Late Pleistocene human occupation in the Altai and is described on the basis of seven cores. In addition, four of the cores are assigned to strata for which refits have shown mixing between MP and EUP layers. It is also noted that Derevianko and Volkov's reconstruction (2004) of the stratum 18 flake technology differs from the bidirectional flaking schema described by Postnov on the basis of refits. Some of their descriptions are not consistent with the present study. For example, a core from stratum 13 (UK-1.94.21/8.1.13) is supposed to represent the unidirectional Levallois recurrent method but is described here as a bidirectional Levallois blade core (see fig 193). Derevianko and Volkov (2004) acknowledge that bladelet and microblade cores occur starting from stratum 11 and are, therefore, not linked to the MP. The evolutionary reconstruction is also problematic as stage 1 and stage 3 occur in almost all EUP layers. Derevianko (*e.g.* 2011a) suggests that the Denisova sequence illustrates a similar gradual evolution; however, the MP layers 21 to 12 from the central chamber have been published by the same authors as a non-Levallois assemblage. Moreover, the lack of stratigraphic control and the uneven sample size combined with inconsistencies in the assemblage attributions do not support a local evolution scenario. It is, therefore, suggested that the EUP techno-complex is intrusive, probably from Central Asia. Preliminary reports from the site of Maybulak, in eastern Kazakhstan, indicate the presence of comparable assemblages in the Altai foothills circa 33-32 ka ^{14}C BP.

9.1.10 EUP: THE DISPERSAL

Kuzmin (2007) and Keates (2007) propose an emergence of microblade technology in the Altai through the examples of Ust-Karakol I and Anuy II. This leads to one of the most problematic aspects of the definition of 'microblade' and 'wedge-shaped cores'. As noted by Graf (2009), many definitions of microblades have been published but confusion remains between the flaking techniques. In the present study, microblades are defined based on metric criteria (width <6 mm). Following this definition, microblade reduction sequences first occur with the EUP starting from circa 33-30 ka ^{14}C BP. It is clearly stated here, however, that pressure flaking was not observed among these assemblages. Therefore, it is suggested that the main confusion is not due to the recognition of exhausted prismatic cores (*contra* Graf, 2009) but rather with the identification of pressure flaking techniques. Wedge-shape morphology is recognized since the earliest stages of the UP in Europe and in the Near-East, but also in Central Asia, where it occurs in the lowermost assemblage of Obi-Rakhmat (see Chapter 8). In the present study, such cores are described as narrow-faced cores and it is suggested that the wedge-shaped core definition should be restricted to artifacts clearly illustrating the pressure flaking technique. Regarding the origin of pressure flaking, it was suggested that this technique first emerged around 30 ka in the Sino-Mongolian region (Inizan, 1991). The present results, however, concur with previous studies (Goebel, 2002; Graf, 2009) suggesting the absence of such a technique in the Altai during OIS3.

The hypothesis developed by Otte (2004, 2007) is that while MH may have evolved biologically in Africa, the total absence of Aurignacian would indicate that modern material culture that eventually colonizes Europe was developed elsewhere. In this context, Asia is seen as a demographic reservoir and a cultural center from which Aurignacian culture developed before moving into Europe. Otte and Derevianko (2001) propose to associate the Altai EUP with an Aurignacian techno-complex *sensu-lato*, mainly due to the presence of carinated endscrapers and Dufour bladelets. Otte and Kozlowski (2001) note that the EUP appears in the Altai without antecedent but mention elsewhere the existence of an evolution in the sequence of UK1-2 (Otte and Kozlowski, 2003). They note, however, that the lower part of the sequence is significantly older than the upper one which contains the Aurignacian-like assemblages. To the west, the main points of comparison are the assemblage C3 from Kara-Kamar, in Afghanistan, and the Baradostian from the Zagros. Vishnyatsky (2004) stressed that similar assemblages are unknown in Central Asia and in fact, until recently, most parts of this region were thought to be deserted by humans during OIS3-2 (Davis, 1990; Davis and Ranov, 1999). Recent excavations at Kulbulak and Dodekatym II, in Uzbekistan, suggest that some UP assemblages combining carinated pieces, Dufour and backed bladelets and geometric microliths are present prior to the LGM. Moreover, assemblages with carinated pieces, bladelets and microblades dated to circa 32 ka ^{14}C BP have been reported at Maybulak, in east Kazakhstan, near the southwestern edge of the Altai range.

As proposed elsewhere (Zwyns and Flas, 2010), the eastern geographic extension of the Aurignacian techno-complex *sensu strictu* can be followed to the Don River at Kostenki. The Baradostian may be derived from the Early Ahmarian but also shows clear Aurignacian features prior to the emergence of the Levantine Aurignacian. In Central Asia, evidence is still too scarce to stretch the definition of the Aurignacian. As it was shown in different contexts, carinated pieces and Dufour bladelets can occur in later UP contexts and do not imply a direct link with the Aurignacian (*e.g.* Zwyns, 2004). On the one hand, it cannot be ruled out that in Asia the emergence of such technological elements corresponds to the success of a particular kind of projectile instead of representing the spread of a well defined cultural entity (Zwyns and Flas, 2010). On the other hand, it is reasonable to consider that the Altai EUP did not develop *in situ* and may represent human incursions from Central Asia or elsewhere, that could have played a role in the spread of microblade technology in China (Bar-Yosef and Belfer-Cohen, 2011). This is consistent with the view that the generalization of the bladelet-based assemblages, and perhaps of a specific composite projectile technology, reflect socio-economical changes among hunter-gatherer societies such as an increase in group mobility (Bon, 2005).

9.1.11 EUP: THE MAKERS

For now no human fossils have been found in association with these assemblages. The MH remains from Povkovka/Mali Log, although recently mentioned as associated with the Aurignacian (Higham *et al.*, 2011) were not found in archeological context. They have been directly dated to circa 29 ka and fall within the chronological range of the EUP. In Europe, such assemblages have been clearly associated with MH (*e.g.* Bailey and Hublin, 2005; Bailey *et al.*, 2009), and the same association can be reasonably assumed for the Altai EUP. During this time, MH may have already been in Southeast Asia for at least 10 ka (Bowler *et al.*, 2003; O'Connell and Allen, 2004; Barker *et al.*, 2007).

9.1.12 EUP: THE END

The timing and the circumstances of the disappearance of the EUP from the Altai sequence is not clear. At UK1-2 radiocarbon dates are inconsistent and do not match with the paleomagnetic inversions (Derevianko *et al.*, 2003). The latest date indicates an age of 26 ka ^{14}C BP and is contemporaneous with Heinrich 3 event, which as recorded in Kurtak, indicate a major climatic degradation (Haesaerts *et al.*, 2009, 2010). At Anuy II, radiocarbon dates illustrate occupations until circa 22 ka ^{14}C BP, the end of occupation roughly corresponding with the Heinrich 2 event. At that time, the climatic degradation of OIS2 and the blockage of some river systems led to the multiplication of lakes and to the formation of giant inter-connected lakes (see Chapter 1). The dramatic drainage of the Chuya depression glacial lake, circa 13 ka, may have destroyed evidence of human occupation along the Katun River and some scholars (*e.g.* Chlachula, 2001; Zolnikov, 2008) have suggested that similar events may have happened periodically between 26 ka to 13 ka. These climatic changes may have had a significant impact on the landscape and on the human occupation. Human groups may have moved into the lowlands of western Siberia or eastward along the Ienissei River as it is so far not clear if Siberia was occupied during the LGM.

9.2 CONCLUSIONS

Based on a taphonomic and technological analysis of the laminar material from the Upper Paleolithic open-air sites of Kara-Bom and Ust-Karakol, three main issues have been tested.

- 1 – the existence of two distinct UP variants in the region:

The results confirm the existence of two distinct techno-typological variants at the beginning of the Upper Paleolithic. The first variant (Kara-Bom variant) is assigned to an Initial Upper Paleolithic blade based industry that shows a standardized sub-volumetric and volumetric blade production but also a specific technology oriented toward the production of small laminar blanks. The latter is defined here as the burin-core technology. The second variant (Ust-Karakol variant) is assigned to Early Upper Paleolithic and is characterized by a fully developed volumetric blade technology associated with a microblade production from narrow-faced cores and carinated endscrapers.

- 2 – the chronological overlap between of these UP variants:

This hypothesis could not be confirmed. Based on a taphonomic revision of the Ust-Karakol 1 (UK1-1) (sector 1) sequence, a relative chronology has been established with an initial occurrence of the IUP followed by the EUP. Using a conservative selection of the available chronological data, a chrono-cultural model of succession between the two variants has been proposed and tested against the regional data set. However, due to the resolution of the chronological data, it could not be completely tested. Nevertheless, the model was not contradicted and suggests that the IUP occurs first at the beginning of OIS3, likely during a warm phase that corresponds to the Bohunice soil in Europe. It appears to overlap with the time range of the regional Mousterian and both techno-complexes seem to disappear from the region prior to the Heinrich 4 event. The EUP appears quickly after and does not seem to overlap significantly with Mousterian and IUP human occupations.

- 3 – the geographical distribution of the variants:

As some authors suggested the existence of an IUP techno-complex in north Asia, a series of comparisons have been proposed using the variants defined in the present study. The results support the existence of an IUP techno-complex present in the Altai, in the Cis-Baikal region, in the Trans-Baikal region and in northern Mongolia. By redefining the UP variants, the present study narrows the variability between assemblages, suggesting a quick and long-range dispersal of a homogenous techno-complex contemporaneous with the first indisputable evidence for MH in Southeast Asia. Some assemblages indicate that beside the lithic technology, bone technology and ornaments can be considered as part of the IUP behavioral package.

According to the obtained results, the current data set is not consistent with the idea of a local development for either of the UP variants. Instead, it is suggested that the human occupation in the Altai may illustrate multiple incursions of human groups during the Late Pleistocene, probably originating from Central Asia. Therefore, the proposed interpretations do not support a multi-regional model of for the origin of MH.

9.3 PERSPECTIVES

This section briefly summarizes a series of tests for the proposed models and their implications:

- Taphonomy, chronology and settlement dynamics:

The proposed chrono-cultural model is based on a small but reliable data set that needs to be confirmed by new chronological data. The available radiocarbon dates provide only a coarse-grained picture due to large standard deviations. Thus, it seems necessary to undertake a large dating program to test the model. The latter would benefit from the latest improvements in sample pre-treatment methods. Used consistently, these methods would provide more comparable results. In addition, RTL and EPR dates should be confirmed by TL or OSL methods. This cannot be achieved without a better understanding of the site formation processes using methods such as soil micro-morphology or sedimentology combined with systematic taphonomic studies. Together, these improvements should help our understanding of the meaning of the observed assemblage variability. Refining the chronology of human occupations would also facilitate comparisons with the paleoenvironmental data recorded in high resolution chrono-stratigraphic sequences, thus providing a better understanding of settlement dynamics. It would also help to assess the observed overlap between the Mousterian and the IUP and to obtain more accurate data on the timing and the circumstances of the appearance and disappearance of the two UP variants. As shown by the Denisova example, the association of the IUP variant with the bone tools and ornaments should be confirmed by direct dating.

- Assemblage comparisons and dispersal model:

It is understood that the present study is based on a relatively small sample size given the area considered and mainly focuses on laminar technology. The long distance comparisons are made on the basis of preliminary qualitative observations and on the published material. Quantitative analyses on additional IUP lithic assemblages, using a unified methodology, are necessary to get a more precise picture of the variability among IUP assemblages. A study of the lithic assemblages from northern Mongolia and the Trans-Baikal is on-ongoing. Only preliminary results have been presented here. A similar study is needed on the assemblage of Obi-Rakhmat. In addition, the excavation of the newly discovered open-air site of Tolbor 16, in northern Mongolia, started in 2011 will provide new lithic and chronological data. It appears that the only way to assess questions related to the makers of the IUP is to obtain human fossils associated with the lithic assemblages. Whoever the makers of the IUP were, it would represent a major discovery as this techno-complex represents a cultural bridge, bringing blade and bone technologies from Central Asia to the gates of China.

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