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1 – Introduction

This chapter is an introduction to the history of research in the Altai, to the geographical setting and to the paleo-climatic records of the region. Also, a brief summary of the human remains from Central Asia and Northeast Asia is presented although more precise descriptions are provided in the following chapters. It is followed by a summary of the recent scenarios explaining the emergence of the Upper Paleolithic behavior and the appearance and spread of MH across the Asian continent. The introduction chapter ends with a presentation of the hypotheses that will be tested and with the proposed alternative model.

1.1 A BRIEF HISTORY OF PALEOLITHIC ARCHEOLOGY IN THE ALTAI

Ethnographic studies in Siberia are known since the 18th century (Dolitsky *et al.*, 1985), but interest in Paleolithic studies in Central and Northeast Asia is deeply rooted in the dynamic context of the second half of the 19th century. In the autumn of 1871, while digging the foundation of the Irkustk Military Hospital, workers uncovered bone and stone artifacts associated with remains of extinct animal species. They were quickly recognized as such by I.D. Chersky and A.L. Chekanovskiy, who identified some bone artifacts as anthropic, probably produced with the help of the associated stone tools (Chersky, 1874). Stimulated by the Irkustk findings, I.T. Savenkov discovered in 1883 the Afontova Gora locality, along the Yenissei river banks, close to Krasnoyarsk (Savenkov, 1886). In 1892, his report in the International Anthropological Congress in Moscow (Savenkov, 1892) led G. de Baye to visit the Yenissei sites. De Baye subsequently presented a report to the French Academy of Sciences and to the Geographical Society of Paris (de Baye, 1894). A second phase of investigation in Yenissei started in 1911, and was pursued after Savenkov's death in September 1914. G. Von Merhart, an Austrian archeologist captured at the beginning of the First World War, participated in the diffusion of these results into Europe (von Merhart, 1923). In 1889, A.V. Eliseev found stone tools on the ridge of Lake Khanka and compared them with knives of the Saint-Acheul type (Eliseev, 1890). In 1918, close to Vladivostok, Joseph Forkash discovered a stone point which was later published by H. Breuil as 'Early Aurignacian' (Breuil, 1925). In the Trans-Baikal region, Savenko's students A.P. Mostits and U.D. Talko-Grintsevitch collected material during surveys along the Selenga river and tributaries (Mostits, 1896; Tal'ko-Grintsevich, 1900). In 1896, N.F. Kashchenko (1896) discovered a Paleolithic site on the outskirt of the city of Tomsk.

According to Derevianko and colleagues (Derevianko, Markin, *et al.*, 2001), the history of Paleolithic studies in the Altai started as early as 1911, when M.D. Kopytov found Paleolithic remains at the confluence of the Katun and Biya River. He gave encouragement to scholars such as A.P. Markov and S.M. Sergeev. In the 1920s and 1930s, they collected isolated artifacts and started small scale excavation at a site close to the city of Biysk. They discovered a concentration of knapped flint elements associated with a hearth (see Derevianko, Shimkin, *et al.*, 1998). After carrying out excavations in the Angara river basin, B.E. Petri created in 1919 in Irkutsk the Chair of Primitive Culture. Among his students, one can recognize future famous scientists such as G.P. Sosnovskiy, M.M. Gerasimov and A.P. Okladnikov (Figure 1) who became major contributors to the development of Siberian Paleolithic archeology during more than 30 years. In the 1930s, Sosnovsky studied the material from the Strostki site, in the Byisk area. Referring to previous work, he assigned this material to the final stages of Paleolithic, underlining similarities with assemblages from the Yenissei and Angara basins and from the Trans-Baikal area (Sosnovsky, 1941 quoted after Derevianko *et al.*, 2001).

After the Second World War, in 1954, S.I. Rudenko discovered evidence of Paleolithic human occupation in the Ust-Kanskaya Cave, along the Charysh River (Rudenko, 1961). Rudenko considers Paleolithic studies as belonging to natural sciences rather than humanities. In the study of the Ust-Kanskaya assemblage, he combined typological lithic analysis with raw material procurement strategies and tried to reconstruct environmental conditions based on large mammals remains (Vereshchagin, 1956; Rudenko, 1961). In his opinion, the discovered fauna reflects warm and dry conditions and precedes the last glaciation. As a result, Ust-Kanskaya was considered for a long time as the earliest human settlement in Altai (*e.g.* Anisutkin and Astakhov, 1970). Rudenko quickly noted Mousterian features in the lithic assemblage (Rudenko, 1960, 1961) followed by Okladnikov (1961) who emphasized similarities with Mousterian assemblages of Western Europe and Central Asia. At the end of 1950's, the Karaturuk site and Iskra Cave were discovered in the Katun basin and Anuy River valley (Kadikov, 1959; Lapshin, 1982 quoted after Derevianko *et al.*, 2001) and excavations were conducted at the Mayminskaya site (Lapshin and Kadikov, 1981 quoted after Derevianko *et al.*, 2001) and soon after, at the Ust-Soma site (Kungurov and Kadikov, 1985 quoted after Derevianko *et al.*, 2001).

In the early 1960s, sites were discovered during geological surveys and engineering works at a time when natural sciences started to play a greater role in Paleolithic studies. Among others, lithological description of deposits, study of small and large mammals, pollen analysis and malacological-faunal studies were used to assess the age of artifacts and cultural layers. According to Derevianko *et al.*, (2001), the discovery of a Levallois blade in a section near Bobkovskaya led scholars to consider the initial peopling of Siberia during the Middle Pleistocene. It was then seen as a population movement originating from either Iran or from the Near-East (Okladnikov and Adamenko, 1966). The terraces of the Anuy were assigned to the Middle Pleistocene although Tseitlin (Tseitlin, 1974) instead associated the Anuy second terrace with the beginning of the Sartan glaciation. The Ulalinka site was discovered in 1961 by Okladnikov and was intensively investigated starting in 1969. The dating of human occupation at theses sites varies depending of the authors (Maloletko, 1972; Okladnikov, 1972; Gayduk, 1973; Okladnikov and Pospelova, 1982; Ragozin and Shliukov, 1984; Tseitlin, 1986) and doubts have been raised regarding the authenticity of the lithic assemblage (Mochanov, 1976; Medvedev, 1983 quoted after Derevianko *et al.*, 2001). Okladnikov admitted that evidence of percussion is not clear (Okladnikov, 1972) but other scholars observed and described nearly a hundred artifacts (Abramova, 1989). Among other projects, Okladnikov started excavations at Strashnaya Cave (1969-1970) (Okladnikov *et al.*, 1973).

Figure 1: A.P. Okladnikov (photo credits: Institute for the History of Material Culture. Russian Academy of Sciences. St. Petersburg)

During the 1960s, the archeological historical-cultural approach prevailed. Okladnikov considered the existence of a vast Sibero-Mongolian Levallois entity marking the transition between the Mousterian and the Upper Paleolithic (Okladnikov, 1978, 1981). He noted the existence of differences between assemblages as evidence for variability within a vast Siberian-Mongolian Levallois entity, probably inspired by the Sino-Siberian cultural area defined by Zamiatnin (1951). Similar views were applied to the later UP by Z.A. Abramova to define a south Siberian cultural entity (Abramova, 1979).

In the 1970s, the multiplication of discoveries increased the variability of lithic assemblages. Kadikov and Lapshin classified assemblages according to their blank production and secondary treatment (Kadikov, Lapshin, 1978 quoted after Derevianko *et al.*, 2001). They distinguished a complex dominated by tools on blades and small size artifacts (Karaturuk, Maymanskaya, Ust-Kuyum) as opposed to another complex dominated by pebble tools (Srotski, Urozhainaya). Although these sites suffer from a lack of geo-chronological data, they were attributed to the final UP (Lapshin and Kadikov, 1981). The end of 1970s was characterized by the discovery and investigation of new sites in the central Altai. Excavations of the Tiumechin complex (I-IV) yielded evidence of Pre-UP settlements. Starting from 1974, the site of Kara-Tenesh was excavated by Kadikov and later by Okladnikov between 1979 and 1981. In the meantime, Okladnikov started excavating Denisova Cave in 1977. Surface finds were spotted in the highland zone of Chuiskaya Hollow (e.g Kubarev *et al.*, 1978). Starting in the 1980s, the piedmont yielded sites such as Tytkesken 3-5 and 7-9, Ust-Sema 2 and 3 in the Katun basin, and Cheremshanka and Ulus I along the Chumysh River. Previously known sites such as Ust-Sema and Ust-Kuyum were excavated (Kungurov, 1993). Within the Solontskaya depression, stratified and surface materials were discovered in Ushlep 1-8 site (Kiriushin and Kungurov, 1983; Kungurov, 1993, 1996) .

During this period, the typological approach prevailed and variations in toolkit composition were seen as reflecting cultural differences. Scholars distinguished two main cultures along the Katun River (Kungurov, 1993). The Nizhnekatunskaya culture (Srotski, Urozhainaya, Kamenuk, Iulchak Iogach among others) occurs in the northeast, along the Biya River and on the ridge of Teletskoye Lake. The Kuyumskaya culture (Ust-Kuyum, Ust-Sema lower strata, Tytkesken 3, Maymanskaya) extended to the Chuya River basin (Yustyd I, Boguty I) in southeastern Altai. These two cultures were differentiated by the presence/absence of pebble tools and bifacial elements.

Figure 2: A.P. Derevianko (photo credits: Institute of Archeology and Ethnography, Siberian Branch of the Russian Academy of Sciences. Novosibirsk)

In 1980, the site of Kara-Bom was discovered in the Yelo basin and excavated by Okladnikov (1983). A. P. Derevianko (Figure 2) and V.I. Molodin discovered the Anuy I open-air site in 1983 (Derevianko, Shimkin, *et al.*, 1998) and Okladnikov Cave in 1984 (Derevianko and Markin, 1992). At about the same time, the excavation at Maloyalomanskaya Cave in the Katun basin started and Derevianko discovered the site of Ust-Karakol 1 at the confluence of the Karakol and Anuy Rivers. The latter was first excavated in 1986 (sector 1) (Derevianko *et al.*, 1987) whereas excavations at the nearby site of Anuy II started in 1989 (Derevianko, Markin, *et al.*, 2001;

Derevianko and Rybin, 2003). Since the beginning of the 1990s, a few sites were discovered, such as the Lower Paleolithic site of Karama (Derevianko, Ulyanov, and Shunkov, 2001), the stratified site of Anuy III (Derevianko, Shunkov, *et al.*, 2000), and more recently, the Mousterian site of Chagyrskaya (Derevianko, Markin, *et al.*, 2009, 2010; Derevianko and Markin, 2011).

To summarize, the history of research in Siberia reflects a constant enthousiasm since the earliest stages of the discipline (for more details, see also Shunkov, 1990; Derevianko, Shimkin, *et al.*, 1998; Derevianko, Markin, *et al.*, 2001). Pioneer work was carried out since the end of the 19th century and attracted the attention of European scientists. Systematic investigations in the Altai started from the second half of the 20th century, with active researchers such as Rudenko, Kadikov or Okladnikov. The latter had a major influence in the Altai but also more generally on Central Asian Paleolithic studies with his work in Uzbekistan (*e.g.* Teshik-Tash) and in Mongolia (*e.g.* Molty-Nam). Since the 1990s the number of systematic multidisciplinary studies of Paleolithic sites has increased, mainly due to the tremendous efforts of Derevianko and his team from the Institute for Archeology and Ethnography at the Siberian branch of the Russian Academy of Science in Novosibirsk.

1.2 GEOGRAPHICAL SETTING

The Altai range is located at the cross-roads between Central and Northeast Asia, between 49 and 52° of latitude north and 32° to 88° longitude east (Figure 3). It is bordered in the north by the Altai plain and the Ob River Basin opening on the west Siberian plain. On the northwest border stand the Salair and the Alatau ranges and in the southwest, the western Sayan range. In the south, the Mongolian Altai

Figure 3: Location of the Altai range

runs east to the Gobi Desert. To the west, the Altai joins the Kazakh steppe. In the southwest, the Altai is separated from the Central Tian-Shan by the plains of eastern Balkash, the Tarbaghatay range and by the Zaisan surrounding. The plains reach the Xinjang and the Takla-Makan desert via the Turpan-Ami depression and southern and Inner-Mongolia via the western edge of the Gobi desert.

The Altai Mountains are the result of a complex and contrasted history. The Upper-Cambrian bedrock is overlaid by Ordovician, Silurian and Devonian sandstone and quartzite. Cretaceous deposits are sandy-silts and during the Mesozoic, there is an accumulation of sedimentary rocks. Several periods of complete flattening (early Mesozoic, Late Paleozoic) of the landscape have been recorded and the current setting is initiated during the late Jurassic. The formation of the Siberian Mountains is seen as a continuous process starting from the Baikal region, progressing from east to west and reaching the Altai-Sayan during the late Pliocene (Chlachula, 2001). Tectonic activity during the end of the Middle Pleistocene is said to be responsible for a deepening of the valley system (Agatova, 2005; Agatova and Nepop, 2010) of about 100 m in the Anuy valley and about 200m in the Katun valley. The earliest deposits in the Anuy river valley were attributed to the last interglacial, when karsts were then formed due to the exposure of carboniferous formations, circa 120-110 ka (Baryshnikov and Maloletko, 1997 quoted after Chlachula, 2001).

This view has been challenged on the basis of radio-thermoluminesence (RTL) dates of circa 225 ka obtained on layers of pebble and gravel at the base of the Anuy alluvial plain (Derevianko *et al.*, 2003). The large standard deviation of 40 ka, the chronological gap with the first sedimentary layers at Ust-Karakol 1 (sector 2) and the RTL date of 163 ± 40 ka (Derevianko *et al.*, 2003) obtained on a sandy layer below Denisova Cave, do not rule out the assignment of the first terraces to OIS5e. This could have major implications for understanding the chronology of Paleolithic human settlements. The Altai alpine ridges such as the Chuya, Saylugem, Katun and Kuray, include peaks with a maximum elevation of 4506 m asl. The high plateau of more than 2000 m in elevation (*e.g.* Ukok, Chulyshman, Ulugan) represents a third of the Altai territory and intermediate mountain landscapes, ranging between 800 to 2000 m asl, account for about half of it. They are mainly located in the northern and western regions and their relief is shaped by active hydrographic networks and by selective erosion. Intermediated mountain landscapes are believed to be formed by the erosion of the peneplains of large plateaus (Shahgedanova, 2003). Two main lakes, the Markakol and the Teletskoe, are located respectively in the southern and northern edges of the Altai range. The Teletskoe is currently the sixth deepest lake (circa 325 m) in the world and was formed around 36 ka ^{14}C BP. The current climate is continental with contrasting seasonal climatic inversions. The winters are generally cold with mean temperatures ranging from -16°C in the foothills to -36°C in the high mountains (Shahgedanova, 2003), with a minimum temperature recorded in the Chuya depression reaching -60°C. Precipitation is stronger in the northwestern part of the Altai, as the southeast is more arid (Chlachula, 2001).

Paleolithic sites are mostly located in the northwestern and in the central part of Gorny-Altai, between the Alpine relief and the northern plain (Figure 4). They lie in intermediate mountain zones, generally between 300-1200 m asl. In the northwest, sites of Strashnaya Cave and Chagirskaya Cave are located in the Charysh Basin. Okladnikov Cave, Isrkra Cave, Karama, Anuy I-III, Denisova Cave, Ust-Karakol and Kamminaya Cave are located in the Anuy basin and Ust-Kanskaya is located further south along the Charysh, in the Central Altai. Ulalinka was found near the city of Gorno-Altaisk, and the Biyka Cave complex and the site of Kara-Tenesh lie upstream along the Katun River. The Tiumechin complex and the Kara-Bom site are located near the Ursul river, and Maloyalomanskaya is along the Mala Yaloman, a small tributary of the Katun. Only a few sites such as Barbughazy, Torgun and Yustid are found in the southeast, and they are mainly assigned to the Final Paleolithic.

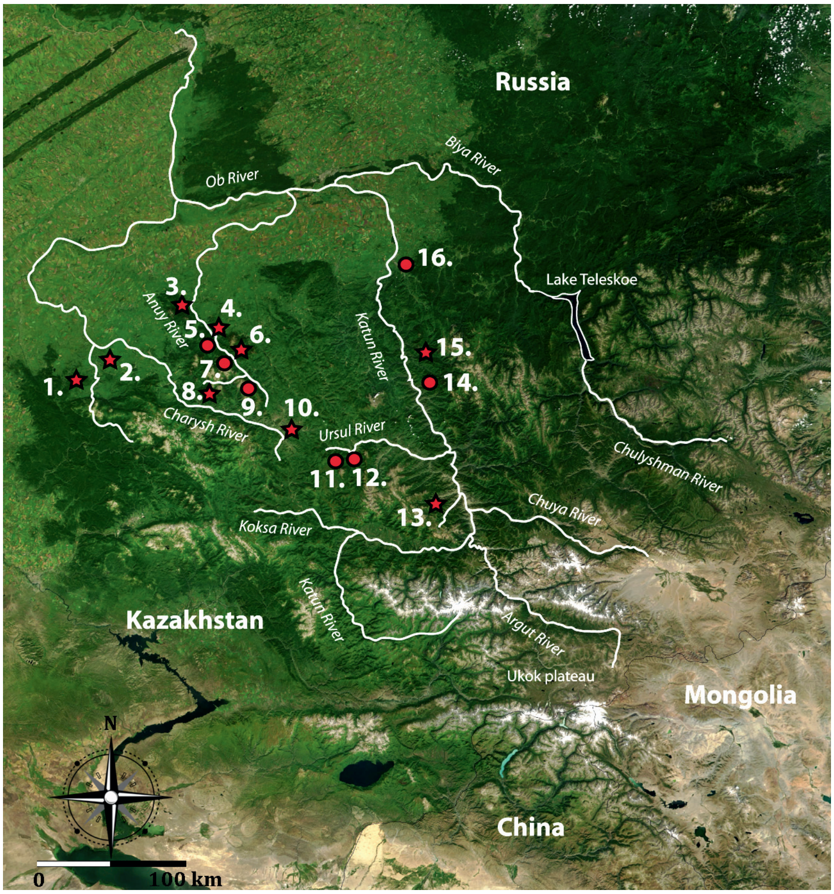

Figure 4: Distribution of the Paleolithic sites in Gorny-Altai. Stars are Cave sites, dots are open-air sites. 1. Strashnaya Cave, 2. Chagyrskaya Cave, 3. Okladnikov Cave, 4. Iskra Cave, 5. Karama, 6. Anuy I-III, 7. Denisova Cave, 8. Kamminaya Cave, 9. Ust-Karakol 1, 10. Ust-Kanskaya, 11. Kara-Bom, 12. Tiumechin 1-4, 13. Maloyalomanskya Cave, 14. Kara-Tenesh, 15. Biyka Caves, 16. Ulalinka. (modified after NASA Visible Earth)

1.3 PALEO-CLIMATE AND ENVIRONMENT

As stressed by several authors, the Altai represents a mosaic of different environments. In the following section, only the main lines of the Siberian paleoclimatic records are summarized. The main stages of Siberian chrono-climatic sequence as defined by Kind (1974) are still widely used (Arkhipov, 1999; Arkhipov *et al.*, 2005) (Figure 6). According to this system, the Late Pleistocene is divided into four stages: Kazantsevo, Ermakovo, Karga and Sartan (see below):

- The *Kazantsevo* stage is the last interglacial, correlating with the OIS5e in the marine records. The maximum transgression was dated by ESR in the Pur River and in the Puyasina River Basin to around 134.8 ka (Arkhipov *et al.*, 2005). In the Yenissei, deposits of the Karginsky cape were used by Kind (1974) to define the Karginian interstadial on the basis of radiocarbon dates. ESR results of 121.9 ka suggest, (Arkhipov *et al.*, 2005), however, that these deposits should be assigned to the Kazantsevo. In southwestern Siberia, the Bersky complex has been dated by TL from 130 ± 31 to 110 ± 27 ka. The Blake magnetic excursion is attributed to this period (Arkhipov *et al.*, 2005). Based on paleo-pedological, palynological and paleontological evidence, the climate of the interglacial is evaluated as humid and warmer than to-day (Agadjanian and Serdyuk, 2005; Arkhipov *et al.*, 2005). In southwestern Siberia and in the Altai, a vegetation of meadow steppe coexists with a forest environment. Coniferous trees occur but are associated with an expansion of broadleaf species. According to Chlachula (2001), the last interglacial deposits are not well documented in the Altai and occur mainly in the northern plain.

- The *Ermakovo* stage is documented in the tills of the lower Ob basin, at Kashgorskaya and Kormuziganskaya, and dated by TL to between 110 ± 15 and 80 ± 11 ka (Arkhipov, 1989; Arkhipov *et al.*, 2005). It is also represented by the Tulinsky loess and by the formation of glacial-fluvial deposits along the Chuya River. Pollen data from the Katun River points to an expansion of dwarf-birch and indicate cold climatic conditions. Cold snaps occur during periods corresponding to OIS5d-c and to OIS4 and corresponding to an increase of coniferous and dry steppe and a decrease of broadleaf species, whereas OIS5a-b is considered as a warmer period. A large glacier that dammed the Chuya River and the formation of a glacial lake are associated with OIS4 (Devyatkin, 1965 quoted after Chlachula, 2001). Based on the chemical composition of sediments, Fedeneva and Dergacheva (2003) identify two possible warming events within the Zyriansk (Ermakovo) stage.

- The *Karginian interstadial* is represented by alluvial and lacustrine deposits and dated by radiocarbon to between 50 and 23 ka which corresponds to OIS3. It consists of three warm and two cold events. The first warm event is dated circa 55-50 to 44-43 ka and corresponds to the maximum transgression, when the sea entered the lower course of the Ob. The Malaya Kheta and Lipovka-Novoselovo warm stages are comparable to the modern climate and generally speaking, the Karginian interstadial is seen as a temperate period. At Denisova Cave, paleontological analyses have detected fluctuations within Karginian layers, however, in an unclear sedimentary context (Agadjanian and Serdyuk, 2005). This period is marked by changes between broadleaf and coniferous species, with cool to warm indicators and humid to moderately humid indicators (Wrinn, 2010).

- The *Sartan* glaciation is considered as the beginning of the climatic degradation that leads to the Late Glacial Maximum and the maximum advance of the ice-sheet. The climatic conditions are cold and dry and marked by the retreat of forests. Geomorphological evidence suggests a multiplication of lake formations during the last glacial period (Chlachula, 2001). At the beginning of the Sartan, two large interconnected glacial lakes start to expand due to the blockage of rivers by the extending glaciers, covering the Chuya and the Kuray depression. The beginning of the process is dated by radiocarbon to 25,300 ± 600 ^{14}C BP (MGU-IO-65) in the Chuya section, and the middle part of the lake formation is dated from the Inya section to 23,250 ± 400 ^{14}C BP (SOAN 2239) and 22,275 ± 370 ^{14}C BP (SOAN 2240). At the end of the Pleistocene, the retreat of the glacier blocking the Chuya River presumably caused catastrophic floods through the drainage network of the Katun and the Biya rivers (Grosswald, 1980; Rudoy, 1984, 2002; Baker *et al.*, 1993; Rudoy and Baker, 1993; Grosswald and Rudoy, 1996). Although the last flood is dated by radiocarbon to 13 ka, it is assumed that several filling/drainage cycles occurred during the Late Pleistocene (Zolnikov, 2008), but geomorphological evidence of this is poorly preserved (Chlachula, 2001). Currently, the existence of such phenomena is widely accepted (Shahgedanova, 2003), even though some scholars tend to minimize its intensity (Velichko, 1984).

Criticisms of Kind's chrono-climatic division have been recently raised. Some of the stages and substages eponymous sections, such as Karginsk Cape or Malaya Kheta, have been erroneously dated by radiocarbon to OIS3 (Astakhov, 2006). In fact, OSL, TL and ESR dates indicate that radiocarbon dates provided only minimum ages for these deposits, and that they should be assigned to the Kazantsevo interglacial (Arkhipov *et al.*, 2005; Astakhov, 2006). New reference sequences for the Upper Pleistocene have been described from Marresale polar station (Astakhov, 2006) and from the Laptev and east Sibe-

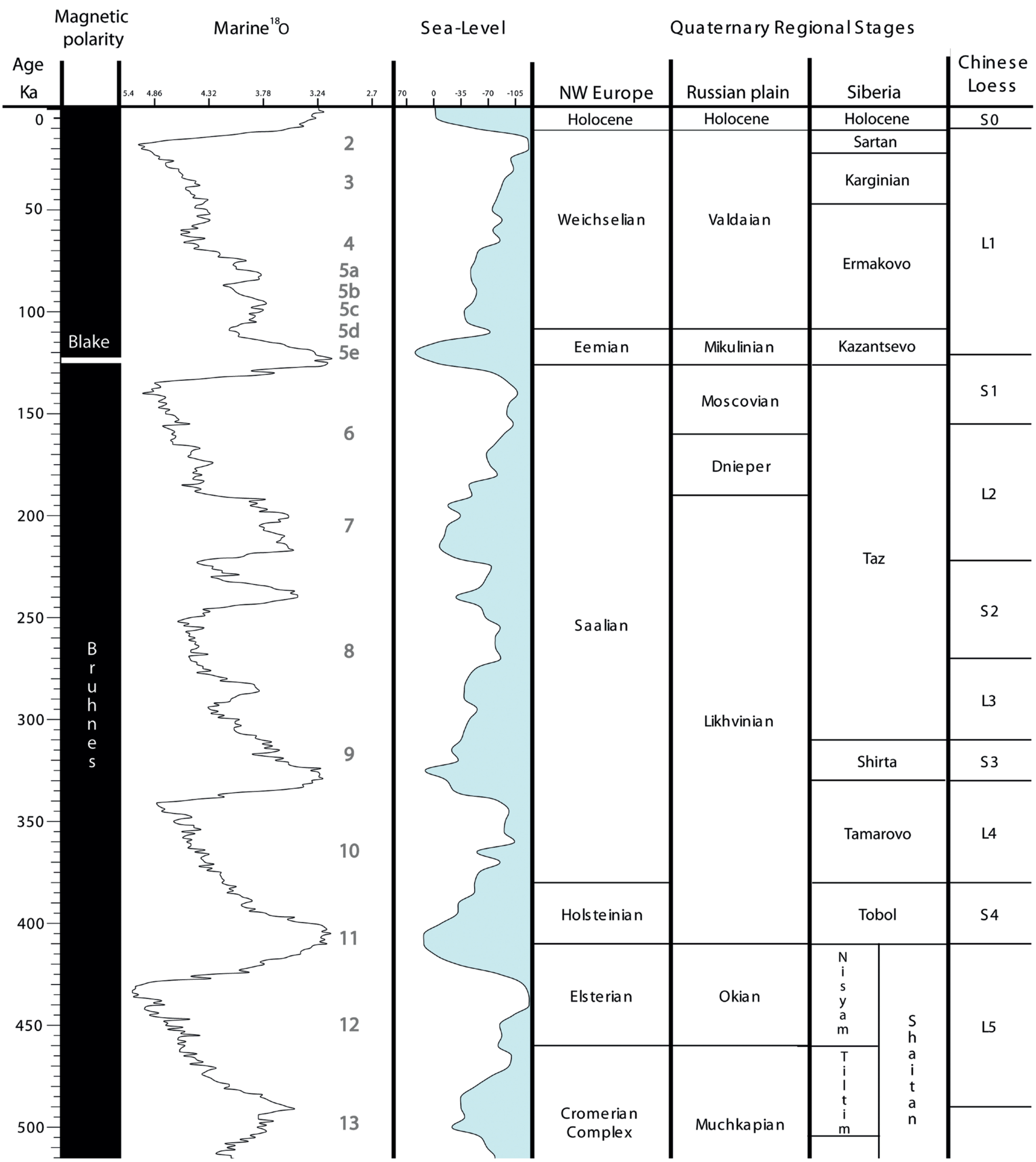

Figure 5: Correlation of the main chrono-stratigraphic stages from Siberia, with the Oxygene Isotopic Stages, the sea-level fluctuations (in meters relative to present), and other quaternary regional stages (adapted from Time-Scale Creator 5.4, Lugowski and Ogg, 2005–2009)

rian seas (Sher *et al.*, 2005). The alternative chrono-climatic scale, however, does not differ much from the traditional one. The division in four main stages is preserved but with new names. The Kazantsevo (OIS5e) is named Malokhetsky or Karginsky, and the former Karginsky (OIS3) is renamed Varyakha interstadial. The latter takes place between 50 and 30 ka BP (Astakhov, 2006; Astakhov and Nazarov, 2010). OIS5e is seen as a genuine interglacial climate, but the climatic improvement of OIS3 is regarded as less significant than previously thought. Climatic differences between OIS3 and OIS2 tend to be minimized, and the whole period is believed to be rather cold and dry with a persisting steppe tundra environment and permafrost (Scher *et al.*, 2005). The Sartan, renamed Syoyakha stage, would start circa 30 ka BP (Astakhov, 2006).

In spite the confusing denomination of climatic events, recent dating seemingly confirmed a relatively good agreement between Kind's regional chronostratigraphy and the global record based on Oxygene Isotopic Stages. Beyond the general stages, however, the definition and the correlation of sub-stages is a more delicate matter.

The Kurtak loess paleosol succession is recognized as the best-studied reference sequence for OIS3 in Siberia (Astakhov, 2006) (Figure 7). The Kurtak complex and Chani-Bay complex are located along the western slope of the Yenissei valley, in southcentral Siberia. The high-resolution sequence does not contradict Kind's division but provides a more precise picture of the Late Pleistocene climatic succession with OIS3 being particularly well documented. Fragmentary data obtained from the Berezhekovo P29 sections (Chlachula, 1997; Haesaerts *et al.*, 2005) provide an overview of OIS5 and OIS4 records dated by luminescence (Zander *et al.*, 2003). Pedological observations show several episodes of pedogenesis, with the Kamenny Log soil attributed to OIS5e, and with the Sukhoy-Log Pedocomplex attributed the OIS5a-d. The Chaninsky loess represents the full development of the Ermakovo (or Murukta) cold stage

Climatic stage	OIS	Stade-Interstade	
Sartan	2	Norilsk Stade	11-10.3 ka
		Taymirian-Kokorovian	ca. 13 ka
		Nyapan	ca. 15.5 ka
		Early Interstade	ca. 16 ka
		Gydanian	ca. 24 ka
Karginian Interstadial	3	Lipovka-Novoselovo	30-25 ka
		Konoschelye	
		Malaya Kheta	42-35 ka
		Lokhpodgortian	
		Igarka-Zolotomysskian	ca.55-43 ka
Ermakovo	5a-d/4	Murukta	110 - ca.55 ka
		Interstade	
		Lower Tungunska	
Kazantsevo Interglacial	5e		130-110 ka

Warm oscillation

Figure 6: Siberian late Pleistocene chrono-climatic divisions (modified after Kind, 1974 and Vasiliev, 2001)

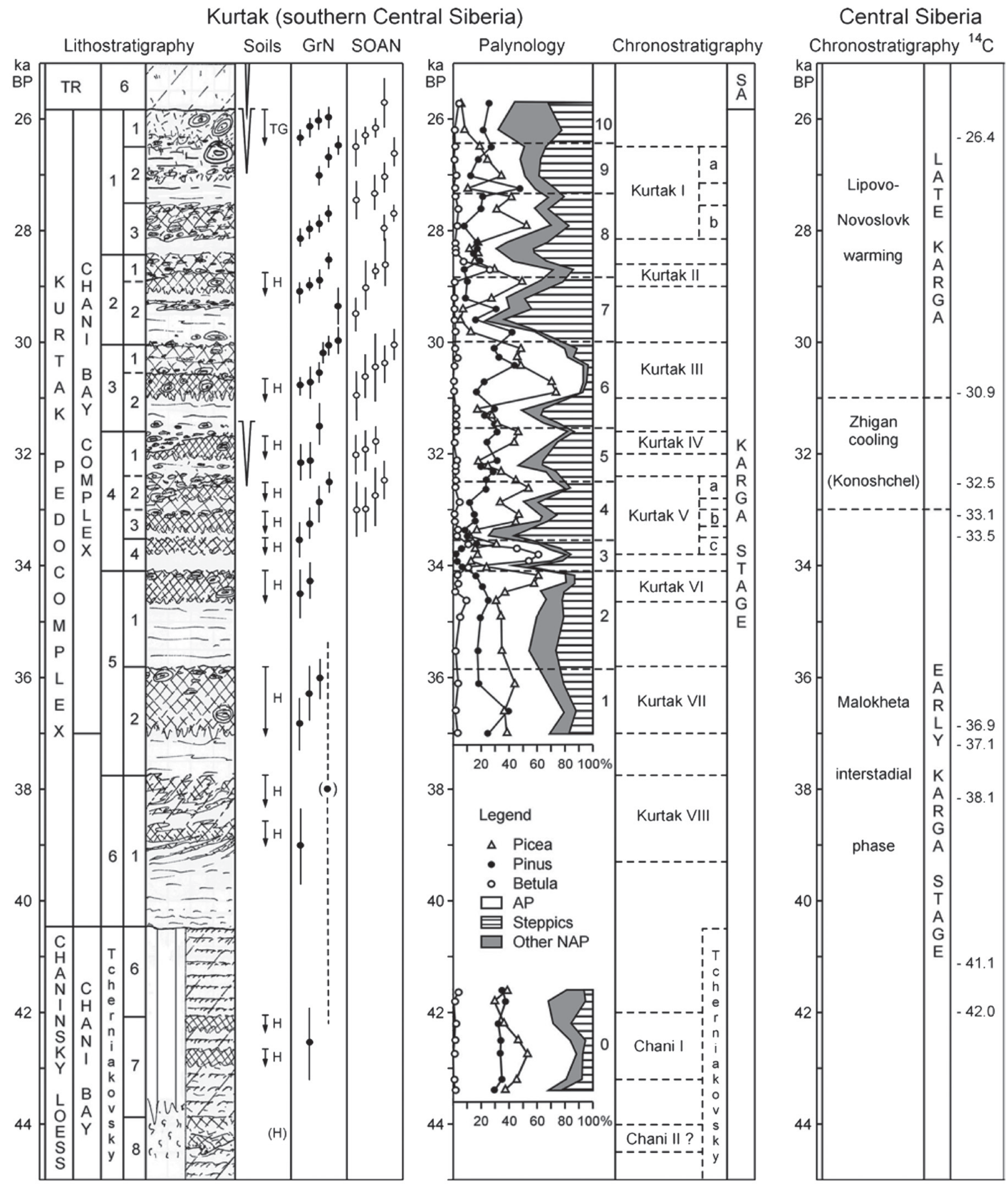

Figure 7: Kurtak sequence correlated with the Siberian chrono-climatic sequence (after Haesaerts *et al.*, 2005)

during OIS4. Magnetic susceptibility studies yielded an inverted signal attributed to a re-deposition of eolian and alluvial sandy particles (Chlachula, 1997; Evans *et al.*, 2003).

Kurtak and Chani-Bay sequences provided a detailed record of climatic fluctuations during OIS3. Pedological and palynological data document a succession of 14 short interstadial periods dated by more than 100 radiocarbon dates on charcoal and wood remains to between 42,520 and 25,710 ^{14}C BP (Haesaerts *et al.*, 2005). The Malaya-Kheta sub-stage (or Malokheta) is dated from at least 44 ka ^{14}C BP to circa 33 ka ^{14}C BP. It includes six pedogenesis episodes marked by a stabilization of the surface and a diversification of the vegetation cover leading to development of a soil. Chani I to Chani III paleo-soils represent the Tchernakovsky soil which is associated with damp conditions. The upper part is dated circa 44 and 42 ka ^{14}C BP (Drozdov *et al.*, 1990; Haesaerts *et al.*, 2005). Kurtak VIII to V are short interstadial periods interrupted by loess deposition. Ice wedges are observed at the base of unit KP3 and are dated to 31.5 ka ^{14}C BP. A second series of wedges are visible in the P31 Chani Bay section in sub-unit 1-1, dated to around 26 ka ^{14}C BP. The first cold snap is interrupted by the Kurtak IV soil. It is followed by a warming that includes Kurtak III to I interstadials periods, ranging from 31 to 26 ka ^{14}C BP.

To summarize, the Kurtak sequence illustrates four main phases within the Karginian stage that can be correlated with the regional sub-stages (Figure 7). The first one, between 45 and 40 ka ^{14}C BP, corresponds to the Tchernakovsky soil, with a vegetation cover of spruce and pine and relatively humid conditions and could be correlated with the Igarka-Zolotomyskian sub-stage. The second phase, from 40 to 33.7 ka ^{14}C BP, is characterized by a rather unstable climate, less humid, associated with spruce vegetation, and represented by the warmer episodes of Kurtak VIII to VI. It can be correlated with the Malaya Kheta sub-stage. The third phase, between 33.7 and 31.7 ka ^{14}C BP, shows a succession of brief events such as Kurtak V and IV, with a global interstadial climate that can be correlated with Lipovo-Novoselovo sub-stage. The fourth phase shows a progressive climatic degradation between 31.5 to 26 ka ^{14}C BP, marked by two ice-wedge horizons. The first one can be correlated with the Konoschelye cooling and the second one marks the beginning of the Sartan stage.

The Kurtak OIS3 record is part of a general chronostratigraphic system that allows correlations with the Eastern European record. Combining east Carpathian sequences from Molodova V, Mitoc-Malu Galben and Cosautsi, Haesaerts *et al.* (2010) proposed a correlation with the Central Siberian record based on the Kurtak and Afontova Gora sequences. The reconstructed sequence is then correlated with the Greenland climatic record (GISP2) (Haesaerts *et al.*, 2009) and with the pollen sequence from the Dinkel valley, in the Netherlands (Figure 8). The inter-regional sequence covers entirely the period between 42.5 ka ^{14}C BP and 10 ka ^{14}C BP. One of the matches is illustrated by the tundra-gley indicating intense permafrost across regions around 26 ka ^{14}C BP. This episode corresponds to the Heinrich 3 event. Kurtak III/ Molodova 1-II/Malu-Galben 11 are associated with the Greenland Interstadial (GI) 7 and Kurtak II, Ib and Ia with the GI6, 5 and 5b. Another clear landmark is the Tchernakovsky soil, dated to circa 42.5 ka ^{14}C BP, which is represented in the east Carpathian sequence by the Molodova lower complex (sub-unit 8-1) and by the Bohunice soil and the Willendorf interstadial in Central Europe (Haesaerts *et al.*, 1996, 2010).

Heinrich events are a series of brief cold oscillations originally identified in the sea cores from the North Atlantic (Heinrich, 1988) which have also been recorded in Asia. The Late Pleistocene climatic records of the stalagmites from Hulu Cave, in China, display a clear correspondence with the GISP2 marine record. Heinrich events 6 to 1 are recorded and warmer events are linked with an increase of the east Asian monsoon intensity (Wang *et al.*, 2001, 2008). In northern Mongolia, the Dorolj 1 and the Moltynam sequences have yielded crytoturbated gleys that are associated by Bertran and colleagues (2003) with the Heinrich 2 episode, circa 21 ka ^{14}C BP. In the lake Baikal, the sedimentary core BDP-93-2 records seem to illustrate a response to Heinrich events, with a decrease in diatoms production in the delta of the Selenga River. During the Holocene, strong erosion

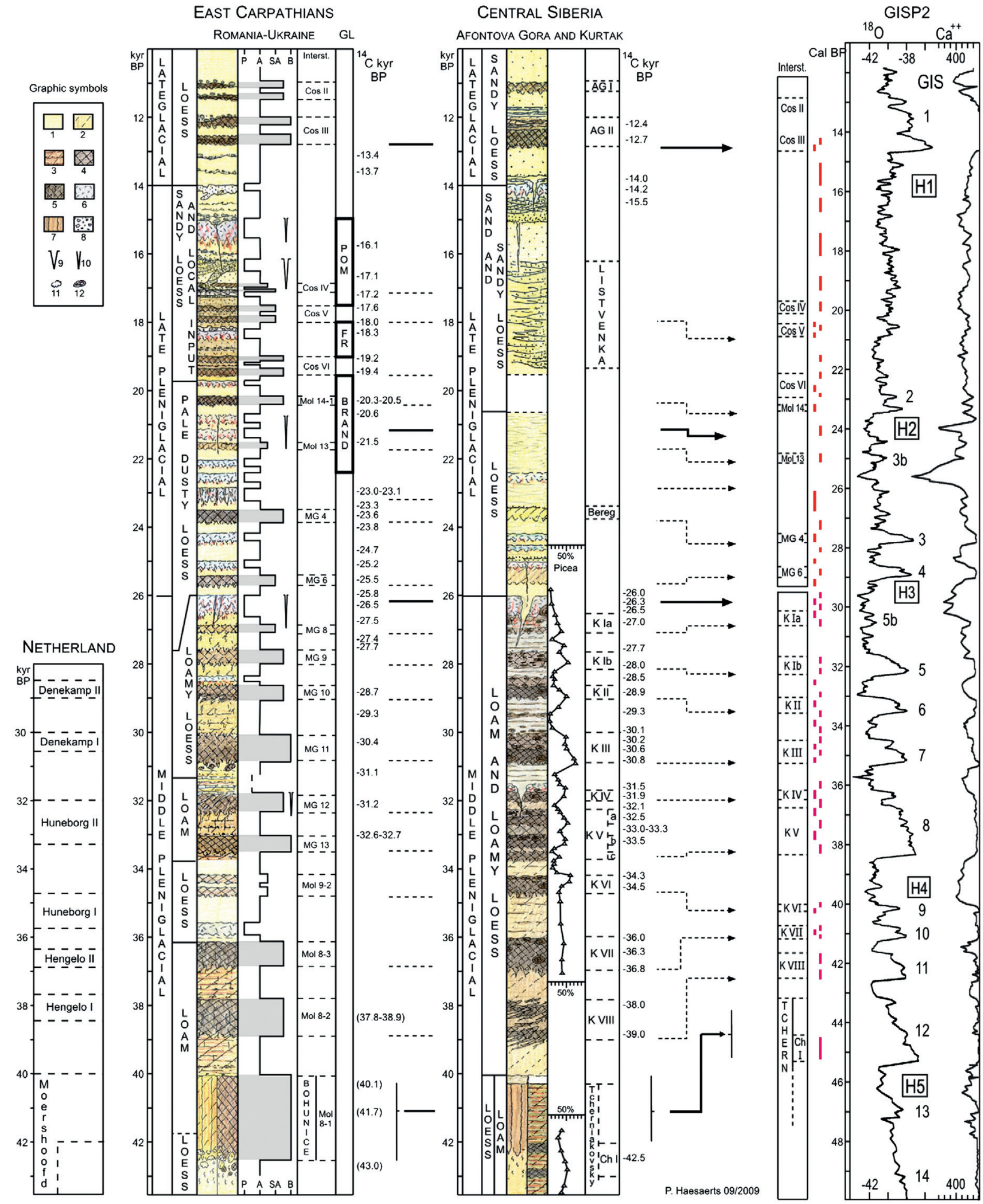

Figure 8: Correlation between the east Carpathian and the Central Siberian sequences, the Dinkel valley pollen record and the Greenland core GISP2 (after Haesaerts *et al.*, 2010)

is associated with the Bond cycles and with the so-called 'Kuzmin effect' (Prokopenko *et al.*, 2001). In central Siberia, the Henrich 4 event is recorded at Kurtak as a loess-like silt horizon (Haesaerts *et al.*, 2009) and marks the end of the Malaya Kheta sub-stage. Heinrich 3 corresponds to the beginning of the Sartan stage and is particularly well marked by a loess-like silt with ice-wedges developing at the base (Haesaerts *et al.*, 2005, 2010). In the Altai, Heinrich events are recorded by magnetic susceptibility in the loess sequences from the Katun and the Biya Rivers (Evans *et al.*, 2003). These events have an climatic impact recognized throughout Eurasia although the nature of the responses is still unclear and may depend on local environmental settings.

All in all, the Late Pleistocene Siberian chronostratigraphy matches with the Northern Hemisphere global climatic record. Sequences from the Altai, Yenisei basin, Baikal Lake and Selenga River delta appear to be in phase with the Oxygen Isotopic Stages. Sub-stage definitions are more problematic; however, Kurtak high-resolution sequence demonstrates that climatic oscillations that correlate with Greenland Interstadials or Heinrich events take place during the OIS3 in Central Siberia. The broad geographic representation of Heinrich events is reinforced by evidence from diatom analysis, magnetic susceptibility and speleothem records. Although environmental responses are expected to show regional or micro-regional variations, synchronous climatic changes are detected from Europe to Central China.

1.4 HUMAN REMAINS

Central and Northeast Asia is vast territory for which a relatively poor fossil record is available for the Pleistocene. This section is a summary and more precise descriptions can be found in the forthcoming chapters. The review of the relevant fossils is presented from west to east, surveying the record from Uzbekistan, Kirghistan and from the Altai.

In Uzbekistan, the site of Anghilak has yielded a human fifth metatarsal (AH-1). The fossil was found in the screens and is derived from a horizon dated to 43,900 ± 2000 ^{14}C BP and 38,100 ± 200 ^{14}C BP (Glantz *et al.*, 2008). It is not diagnostic of a particular taxon but described as relatively gracile. The associated lithic material has Mousterian affinities. At Teshik-Tash, in southern Uzbekistan, human remains (a cranium, a mandible, an atlas, a fragmented axis, clavicles, rib fragments, a left humerus shaft, a partial left femur and fragmented fibula) (Sinelinikov and Gremiatskyi, 1949) have been discovered in a Mousterian context (Okladnikov, 1949). The original hypothesis of a burial could not be confirmed. The sequencing of mitochondrial DNA (mtDNA) extracted from Teshik-Tash remains has confirmed the presence of Neandertals in Central Asia. Further evidence was discovered in 2003 at Obi-Rakhmat, in northwestern Tian-Shan. Six isolated, permanent, maxillary teeth and 121 cranial fragments were uncovered in stratum 16 (Glantz *et al.*, 2008; Glantz, 2010). They are assigned to a single juvenile individual between 9-12 years of age. Although some descriptions of OR-1 underline a mosaic of morphological features, the comparison of discrete attributes from the set of teeth (28 non-metric dental traits scored from Neandertals, UP, and MP modern humans) together with a morphometric analysis of the first-upper molar result in OR-1 being assigned to Neandertals (Bailey *et al.*, 2008). This attribution is reinforced by the study of the bony labyrinth and of the semi-circular canal (Glantz *et al.*, 2008). At the Kulbulak open-air site, an isolated tooth was found in 2009 (Flas *et al.*, 2010). It is associated with an undated UP assemblage from layer 2.1. Mentioned as a worn lower left pre-molar in the first descriptions, it is still under study.

The cave of Sel-Ungur is located in the Fergana valley, in Kirghizstan. Human remains from this site are six teeth and a fragment of humerus. The teeth were tentatively attributed to *Homo erectus* (Islamov *et al.*, 1988). So far, no detailed analysis has been published and the interpretation of some of these remains as human is still to be confirmed. The associated fauna and the 230Th/U date of 126 ± 5 ka (LU-936), obtained on the overlying deposits, assign these finds to the Middle Pleistocene. Although reported as Acheulean, the lithic assemblage is better associated with the pebble assemblages from Tajikistan (Vishnyatsky, 1999). In Tajikistan, recent excavations at Kuhdji have yielded an isolated deciduous tooth from the bottom of a Mousterian level (horizon 8) dated to 42,100+2,440/–1,870 ^{14}C BP (GrN-23686) by radiocarbon on a charcoal sample. The tooth is worn and not diagnostic of any taxa (Trinkaus *et al.*, 2000). It has been attributed to a juvenile individual of 3 to 5 years old.

At Okladnikov Cave, in the Altai, dental remains occur in stratum 2 with a left lower molar, and in stratum 3 with left lower premolar, a left lower molar and a right lower molar. Post-cranial remains are found in stratum 2, with an adult humerus, and in stratum 3 with a sub-adult humerus and a hand phalanx (Viola *et al.*, 2011). The good preservation of the collagen extracted from the phalanx, from the sub-adult humerus, the femur, and from the adult humerus has led to the reconstruction of the mtDNA sequence which has been identified as Neandertal (Krause *et al.*, 2007). The archeological assemblage is Mousterian but the dating of the human occupation is far from clear (see also Chapter 7). Direct dates would indicate a Neandertal presence in the area lasted until at least 37 ka ^{14}C BP (Krause *et al.*, 2007).

At Strashnaya Cave, eight deciduous teeth were found that presumably belong to a single individual (Viola *et al.*, 2011) from an unclear stratigraphic context that can be attributed to the UP. The specimens could not be assigned to a clear taxon. At Maloyalomanskaya Cave, the discovery of a single human tooth has been reported (Alekseeva and Maloletko, 1984), but no descriptions have been published (Goebel, 2004).

At Denisova Cave, two teeth have been found in the 1984 collection from the central chamber. Denisova 1 is an upper central incisor found in layer 12. Although it has been repeatedly published as a human tooth (Turner, 1990; Shpakova and Derevianko, 2000), Viola *et al.* (2011) assign it to a worn incisor from a large bovid. Denisova 2 is a deciduous molar (right first lower) found in layer 22.1 that would

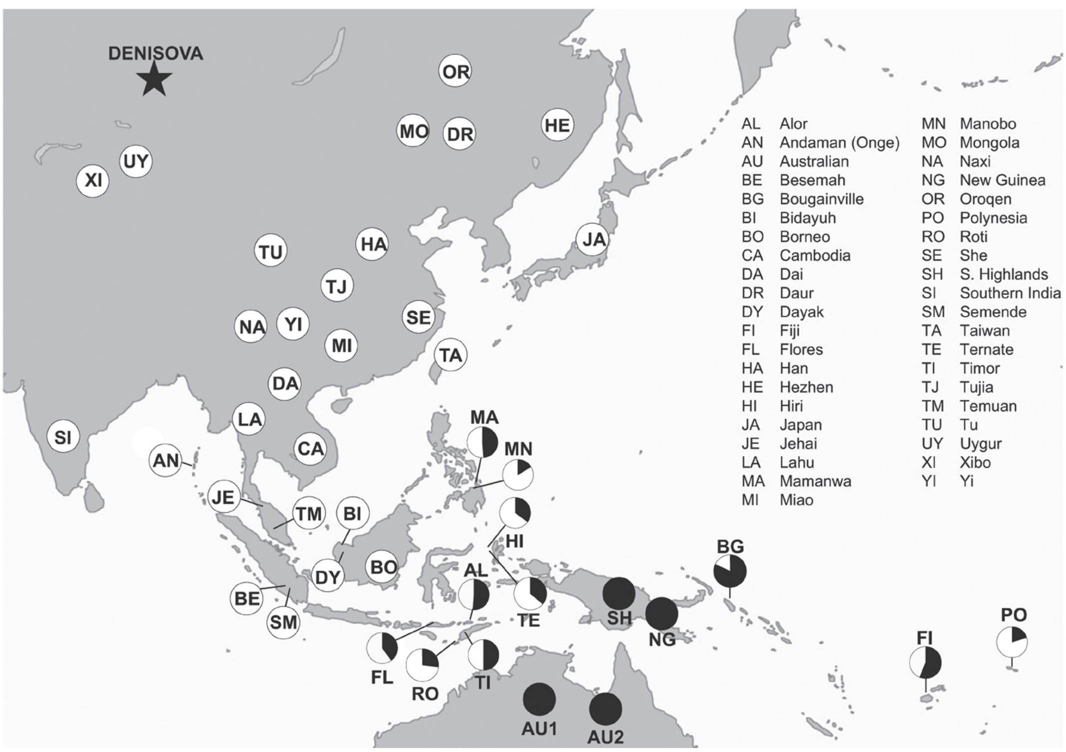

Figure 9: Denisovan genetic material as a fraction of that in New Guineans. The pie-charts show the relative proportions of admixture (after Reich *et al.*, 2011)

date to at least OIS 5e. In 2000, layer 11.1 of the south gallery yielded a tooth in square G2 belonging to a young adult and identified as a third or second upper molar (Reich *et al.*, 2010; Viola *et al.*, 2011). Denisova 3 is the proximal epiphysis of a juvenile manual phalanx uncovered in layer 11.2 of square D2 of the east gallery (Krause, Fu, *et al.*, 2010; Reich *et al.*, 2010; Viola *et al.*, 2011). The phalanx belongs to a distinct individual with an age evaluated at around 6-7 years old. Both mtDNA and nuclear DNA were extracted from these remains resulting in the identification of a hitherto unknown archaic hominin (Krause, Fu, *et al.*, 2010; Reich *et al.*, 2010). The nuclear DNA indicates that these hominins, referred to as 'Denisovans', belong to a lineage sharing a common origin with Neandertals that post-dates the split with MH ancestors. First morphological descriptions of the tooth noted a set of archaic features not seen in Neandertals or in early modern humans, further suggesting a distinct evolutionary history. It was suggested that Denisovans did not contribute significantly to the genome of Eurasian populations except among some present day populations from Melanesia and Australia (Reich *et al.*, 2010, 2011). The geographical pattern observed among populations that presumably took part in the first MH dispersals suggests an encounter between the first MH and the Denisovans on the continent. The latter may have occured prior to the colonization of Melanesia and was likely followed by a population replacement. Genetic evidence appears clustered (Figure 9) but this view has been recently challenged suggesting a more widespread genomic contribution (Skoglund and Jakobsson, 2011).

The fossils from Denisova have not been directly dated but new radiocarbon dates produced on cut-marked bones and bone tools from level 11 show post-depositional mixing from the subsequent level 9 and from underlying levels (Reich *et al.*, 2010). The chronological and cultural attributions of the Denisova hominins remain, therefore, unclear.

At the recently discovered Chagysrkaya Cave, Viola and colleagues (2011) described human fossils associated with layers 6b and 6c. Chargyrskaya 1 is a worn upper deciduous canine and Chagyrskaya 2 is an atlas fragment. Both fossils are associated with layer 6b. Chagyrskaya 3 is an upper premolar and Chagyrskaya 4 is a lower incisor. Both are worn and small and would fall outside the range of Neandertals. However, mtDNA was extracted and, although the results are not fully published, they seem to indicate an attribution to Neandertals (Viola *et al.*, 2011). The rich lithic and fauna assemblage is assigned to the Mousterian and the excavation is still ongoing. Unpublished radiocarbon dates indicate an age circa 45 ka ^{14}C BP and older.

Only a few fossils testify to the presence of MH in Siberia and Mongolia, with the earliest being a frontal bone from Pokrovka/Maly Log dated to around 28 ka ^{14}C BP (Akimova *et al.*, 2010). In western Siberia, a talus bone from the locality of Baigara, dating to over 40,300 ^{14}C BP (Kuzmin *et al.*, 2009), is morphologically close to MH. Human remains from Malta are dated to around 19 ka ^{14}C BP (Richards *et al.*, 2001). In Mongolia, the skull from Salkhit has been described as bearing a mosaic of archaic and modern features (Coppens *et al.*, 2008).

1.5 THE MIDDLE TO UPPER PALEOLITHIC TRANSITION IN THE ALTAI AND THE DISPERSAL OF MH IN ASIA

The following section is a summary of the current models explaining the first appearance of the UP and the appearance and dispersal of MH throughout Asia. The models usually follow a paradigm of local transition sometimes combined with elements of dispersal scenarios.

A local transition model has been repeatedly proposed to explain the emergence of the UP in the Altai. Derevianko (2011) suggested that the Altai was first colonized by small populations of *Homo erectus/ergaster* starting from circa 800 ka, which subsequently disappeared from the region circa 500 ka. The site that represents this first wave is Karama, along the Anuy River (Derevianko and Shunkov, 2009). The lower portion of the sequence has yielded cultural layers (layers 8-14) associated with RTL dates of 643 ± 130 ka and 542 ± 110 ka. The diversity of the exotic flora is said to fit with a Middle Pleistocene attribution (Bolikhovskaya *et al.*, 2006). Although the identifiable artifacts do not include handaxes, Derevianko and Shunkov (2009) underlined elements that would fit with an Acheulean attribution.

Based on the assemblages from the lowermost layers of Denisova Cave, Derevianko (2011) suggests that a new population then settled in the Altai during the Middle Pleistocene at around 300 ka. These newcomers bring the first evidence of Levallois and blade technology. Although first mentioned as Mousterian (Derevianko and Shunkov, 1992; Escutenaire, 1994), they are seen as derived either from a Late Acheuleo-Yabrudian (Derevianko and Postnov, 2004; Derevianko, 2011a) or from a Kazakh/Mongolian MP background (Shunkov, 2005). The Altai MP includes mainly two variants. Based on low Levallois indexes and on high frequencies of Mousterian elements, Shunkov (Shunkov, 1990, 2005) recognizes a Mousterian variant opposed to a Levallois-Mousterian variant. These two variants were interpreted as possibly reflecting different settlement patterns of a single MP tradition (Derevianko and Shunkov, 2002; Shunkov, 2005). Mousterian assemblages which are only represented in cave sites would represent long-term occupations as opposed to the Levallois-Mousterian seasonal occupations from open-air contexts. A behavioral ecology approach was further developed by Wrinn (2010). Based on the occurrence/absence of formal tools or chips testifying to tool rejuvenation or raw material management (Kuhn, 1995; Adler and Tushabramishvili, 2004), he classifies these MP occupations into three main categories: ephemeral/task specific, ephemeral generalized and intermittent generalized occupations. His analysis of the fauna and of the lithic frequencies suggests a low intensity of occupation of the region which could have served as a refugium for hominins during cold phases (Wrinn, 2010).

Recently, Derevianko and Markin (2011) suggested that Okladnikov Cave and the newly discovered Chagyrskaya Cave illustrate the existence of a distinct MP facies which they call the Sibiryachinsky variant. The described characters correspond to the above mentioned Mousterian variant, and this facies is seen as relatively late and intrusive. The Sibiryachinsky assemblages are said to represent Neandertal populations moving into Central Asia (*e.g.* Teshik-Tash) and subsequently to the Altai under the pressure of the spreading MH populations (Derevianko, 2011a).

The local Levallois-Mousterian is said to have gradually evolves into two main UP variants, the Ust-Karakol and the Kara-Bom variants (Derevianko and Volkov, 2004). Both UP trends are seen as the result of an incipient evolution from a local Middle Paleolithic background and are contemporaneous with the Sibiryachikha Mousterian tradition (Derevianko, 2011a). These variants can be described as follows:

- The *Ust-Karakol* variant emerged at the beginning of OIS3 from a Levallois background assigned to OIS5e at Ust-Karakol 1, sector 2, (layers 19-18), with preferential and orthogonal unidirectional flaking and a unidirectional and volumetric blade production. The late phase of the process sees the parallel invention of microblades detached by pressure flaking, circa 60-50 ka (Derevianko and Volkov, 2004; Derevianko, 2011). Other assemblages from Anuy I-III, Strashnaya upper levels, Tyumechin-4 and Ushlep 6 are associated with the Ust-Karakol trend. Due to the presence of Dufour retouched bladelets and of carinated endscrapers, scholars have suggested that the Ust-Karakol assemblages represent the early developments of the Aurignacian techno-complex (Otte and Derevianko, 2001; Otte and Kozlowski, 2003; Otte, 2004) while other authors found some analogies with the UP of western Siberia (Zenin, 2002) or Mongolia (Jaubert *et al.*, 2004; Derevianko and Kandyba, 2009a; Gladyshev, Olsen, *et al.*, 2010). Although the use of pressure flaking is reported by Derevianko and Volkov (2004), other authors do not formally recognized this technology in any of the Ust-Karakol assemblages. Kuzmin (2007) and Keates (2007) suggested that the Ust-Karakol trend could be seen as the origin of microblade technology.

- The *Kara-Bom* variant from the eponymous site is said to follow a different evolutionary path. In the MPH1 and MPH2 layers of this site, convergent and unidirectional Levallois following the recurrent method was used to produce elongated

> pointed blanks (Derevianko, Petrin, *et al.*, 1998; Derevianko, Petrin, and Rybin, 2000; Derevianko and Markin, 1999; Rybin, 2004). Rybin (2004) considers that this technology lacks antecedents in the region and could correspond to a migration of populations from the Levant. It is represented in Central Asia by laminar MP assemblages such as Kuhdji in Tajikistan or Obi-Rakhmat in Uzbekistan. In Kara-Bom levels OH5 and OH6, blade cores were reduced by bidirectional flaking from a broad surface with a use of a narrow face tentatively associated to the end of the reduction process (Derevianko and Volkov, 2004). The upper layers testify to a UP reduction in which cores are reduced from the narrow face. This variant illustrates a distinct technological transition process, from a surface to a volumetric conception of the core.

The central chamber of Denisova Cave was repeatedly described as non-Levallois (*e.g.* Derevianko, Markin, *et al.*, 2001; Derevianko *et al.*, 2003; Derevianko and Shunkov, 2005) but later was said to illustrate the gradual developement of the 'Ust-Karakol trend' (layers 20-12), between 100 ka and 30 ka, toward genuine UP (layers 11 and 9) (Derevianko, 2011a). The late phase includes the early appearance of bone tools, and fully developed forms of ornaments made of bone and stone (Derevianko and Rybin, 2003; Derevianko *et al.*, 2003; Derevianko, Shunkov, *et al.*, 2008). The Kara-Bom variant is also described in Kara-Tenesh, Maloyalomanskaya Cave or in the Byike complex. Numerous authors have suggested analogies with sites from Central Asia (Obi-Rakhmat, Kuhdji), the Cis-Baikal (*e.g.* Makarovo-4, Kistenevo 9), Trans-Baikal (*e.g.* Khenger Tyn 2, Barun-Alan, Khotyk, Kamenka A and C, Varvarina Gora, Podzvonkaya) or Mongolia. Although he underlined that UP 'culture' spread all over Siberia around 40 ka, Derevianko (2011) also states that the Altai MP cannot be excluded as its possible source.

Regarding the origin of MH, Derevianko (2011) recently stated that if the Late Pleistocene humans were members of the *Homo sapiens species sensu lato,* they consists of sub-species such as *H. sapiens africanensis* (Africa), *H. sapiens neandertalensis* (Europe), *H. sapiens altaiensis* (Siberia, Mongolia, Central Asia) and *H. sapiens orientalensis* (Southeast Asia) (see also Derevianko and Shunkov, 2011). The developing *H. sapiens altaiensis* represented by the Denisovans (Krause, Fu, *et al.*, 2010; Reich *et al.*, 2010) descend from unknown migrating populations coming from the Near-East at around 300 ka. They would eventually evolve independently into MH, represented by the remains from Pokrovka/Maly Log (Akimova *et al.*, 2010). *H. sapiens altaiensis* is also assigned to southern Siberia as a whole, to Central Asia, and to Mongolia but is seen as independent from Southeast Asian evolution. By arguing for a local biological and cultural evolution toward modernity, Derevianko's view can be seen as part of the multi-regionalist model (Thorne and Wolpoff, 1981; Wolpoff *et al.*, 1984):

> '…archeological data demonstrate that the appearance of *Homo sapiens sapiens* in Eurasia in general was not caused by a long-range migration from Africa, although some amount of gene flow from Africa to the Near-East and to Europe during various periods cannot be denied.' (Derevianko, 2011a, p.479)

Regarding the origin of *H. sapiens altaiensis*, Derevianko tends to emphazise gene flows between the Denisovans and the ancestor of modern Melanasian populations. He argues that there is no evidence consistent with a MH migration from Africa. Instead, he suggests an uninterrupted regional development of MH with a rather limited migration-range (Derevianko, 2011b). The multi-regional hypothesis as defined by Wolpoff *et al.* (1984), however, combines local drifts and multidirectional gene flows. As opposed to Coon's interpretation (1962) which implies a polyphyletic model of independent evolutionary trends, the candelabra hypothesis (Weidenreich, 1947) originally suggested a monophyletic, multiregional model that includes contacts and interbreeding between populations. The apparent continuity of the local archeological sequence plays an important role in Derevianko's model which considers no signs of long-range migrations (Derevianko, 2011b). Multi-regionalist views have been frequently expressed to explain the emergence of MH in southeast Asia (Wolpoff *et al.*, 1984; Wang and Tobias, 2001; Etler,

2004) and its possible subsequent dispersal from east to west (Otte, 2007).

The Out-of-Africa model posits that MH originated in Africa and subsequently dispersed around the globe. This model is supported by a significant body of chronological (Clark *et al.*, 2004; Grün *et al.*, 2005), morphological (*e.g.* Brauer, 1984; Stringer *et al.*, 1984; Schwarz and Tattersall, 1996; Tattersall, 2006) and genetic data (see review in Krause *et al.*, 2007; Green *et al.*, 2010; Krause, Briggs, *et al.*, 2010; Rasmussen *et al.*, 2011) and is one of the most popular models to explain the appearance of MH in Europe and in the Near-East. According to this model, two routes have been proposed to explain the peopling of Asia by MH.

The 'northern route' crosses through Central Asia reaching the Altai by following the northwestern Tian-Shan. Based on the archeological material, Goebel (Goebel, 1999, 2006) argues for a quick dispersal of MH during the initial phase of the UP. He also suggests analogies with assemblages from the Near-East. A similar scenario was proposed by Rybin (2004) to explain the sudden emergence of the Levallois blade-based assemblages in the Altai (see also Krivoshapkin *et al.*, 2006). Hoffecker (2005) proposed that the northern route was also followed earlier by Neandertal populations when migrating into Asia. In China, numerous fossils dating to the late Middle Pleistocene have been described as "Archaic *H. sapiens*" (*e.g.* Bae, 2010). However, some authors have underlined the ambiguities of such a taxon arguing that it is used as a kind of "wastebasket" (Tattersall and Schwartz, 2008). The recent publication of the Zhirendong, mandible which shows a mosaic of modern and archaic morphologies, is dated to more than 100 kyr, and was discovered outside of a UP context, illustrates this equivocal situation (Dennell, 2010; Liu *et al.*, 2010). Early blade industries are rare in China, with some of the earliest examples of Shuidonguou dated to 29 ka ^{14}C BP (Madsen *et al.*, 2001; Brantingham *et al.*, 2004)

Another route of MH dispersal possibly pre-dates the northern route. The so-called 'southern route' (Stringer et al, 2000; Oppenheimer, 2004, 2009; Field and Lahr, 2005; James and Petraglia, 2005; Oppenheimer *et al.*, 2006; Field *et al.*, 2007). MH would have left Africa through the Bab-el-Mandeb strait to Arabia and Iran and then followed the Indian coasts down to Southeast Asia. The recently published material from Jebel-Faya has been used to suggest that southern Arabia was colonized during OIS6-5e but also during OIS5a. A land bridge was open between Arabia and Iran via the Hormuz strait for a period ranging from 75 to 14 ka (Armitage *et al.*, 2011; Rosenberg *et al.* 2011). So far, the described Arabian lithic assemblages (*e.g.* Amirkhanov, 2006; Rose and Usik, 20010; Petraglia *et al.*, 2010; Petraglia *et al.*, 2011) seem to differ from the Zagros UP (Olszewski and Dibble, 1994; Olszewki and Dibble, 2006; Otte and Kozlowski, 2007; Otte *et al.*, 2007, 2011) or MP (Dibble, 1984; Dibble and Holdaway, 1990, 1993; Olszewski *et al.*, 1993). Petraglia *et al.* (2007) have tried to show that MP human occupation persists at Jwalapuram through the Youngest Toba Tuff eruption that occurred at circa 74 ka (see also Haslam *et al.*, 2011; Petraglia, Ditchfield, *et al.*, 2011). This view, however, has been recently challenged (see Balter, 2010). The latter assemblages are not associated with human remains, but based on analogies with MSA lithics it has been suggested that they might represent the first evidence for MH dispersal (Clarkson *et al.*, 2011). Based on the sequence from the Jwalapuram locality 9 rockshelter (India) (Haslam *et al.*, 2010), Clarkson *et al.* (2011) documented the occurence of microliths at around 35-30 ka. The appearance of this technology has been interpreted as a response to the increasing aridity leading up to the LGM (Petraglia *et al.*, 2009) and seen as continuity with the local MP. However, Mellars (2006) underlined the similarities with the backed microliths of Howiesons Poort assemblages from South Africa and suggested that the first appearance of microliths represents evidence for the migration of MH out of Africa. Earliest evidence of archeological occupations found in Fa Hien Cave, Sri-Lanka, is dated to 38-36 ka and is associated with microblades and MH remains (Petraglia *et al.*, 2009). MH remains are directly dated to circa 42 ka at Niah Cave, in Borneo (Barker *et al.*, 2007). Australia is reached by at least 45 ka, as shown by luminescence dates and human remains from Lake Mungo (*e.g.* Bowler *et al.*, 2003; O'Connell and Allen, 2004). Hoffecker (2005) suggested that MH diffusion through Asia along the southern route might

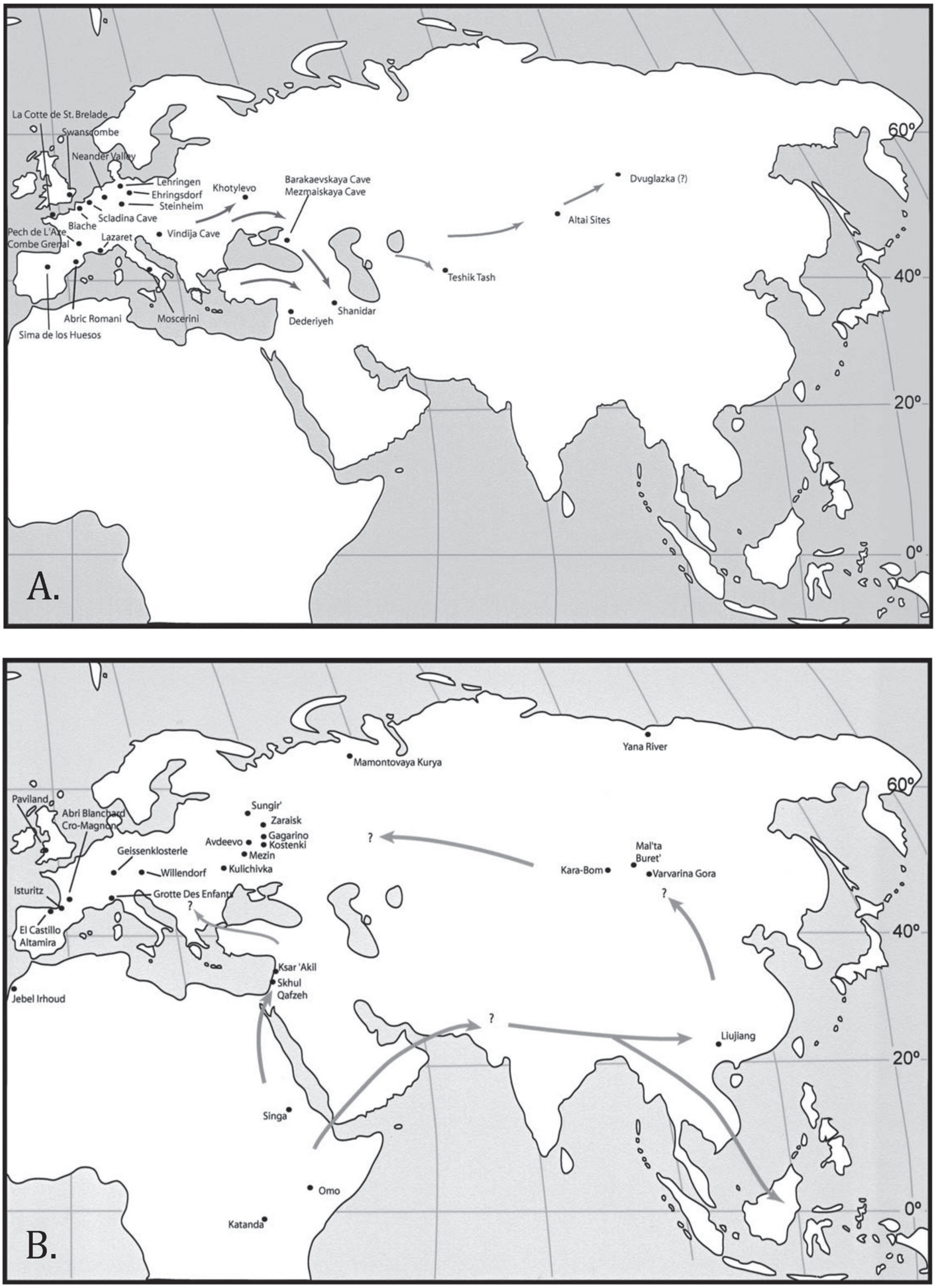

Figure 10: Schema of Neandertal (A) and MH (B) dispersals through Asia (after Hoffecker, 2005)

be followed by a colonization of Northeast Asia through northern China, Mongolia and then Siberia (Figure 10).

1.6 SUMMARY

The Altai region has yielded a cluster of MP and UP stratified sites that have been recently excavated using a multidisciplinary approach. These sequences provide key-evidence illustrating changes in material culture corresponding to the shift from the MP to UP. In Europe, this phenomenon is associated with the replacement of Neandertals by MH. Based on the Altai data set, scholars have put forward different scenarios regarding the transition processes, ranging from hypotheses of local evolution to migrations. The most developed model proposes a parallel development of two distinct UP traditions that both emerged from a local MP background (Derevianko, 2010). In this model, the MP strata from Denisova Cave show a locally-developed Levallois blade-based UP tradition which also occurrs at the open-air site of Kara-Bom. Simultaneously, the Ust-Karakol tradition testifies to a different path leading to the Upper Paleolithic, with some techno-typological similarities with the European Early Upper Paleolithic. In addition, the Chargirskaya tradition represents an intrusive late Mousterian facies, overlapping chronologically with the first occurrence of the Upper Paleolithic in the area. This model of local continuity is, however, contradicted by paleontological and genetic evidence.

Questions remain regarding who was responsible for making these tool technologies. Recent developments in ancient DNA studies have shown that Neandertals were present in the Altai around 40 ka (Krause *et al.*, 2007), associated with Mousterian assemblages. However, a previously unknown genome was sequenced, demonstrating the presence of another type of hominin in the region, the so-called ‘Denisovans’ (Krause, Fu, *et al.*, 2010; Reich *et al.*, 2010). The presence of MH is confirmed by at least 28 ka in Siberia (Akimova *et al.*, 2010).

1.7 TRANSITIONAL, INITIAL OR EARLY UPPER PALEOLITHIC: WHY IT MATTERS

Assemblages displaying a combination of MP and UP technological and typological features represent a taxonomical challenge. In the Near-East, they were recognized in the first half of the 20th century in the Northern Levant from sites such as, Ksar-Akil, Antalia shelter, Abu-Halka or Emireh Cave (Neuville, 1934; Haller, 1946; Garrod, 1951, 1955). Early excavated sites did not provide sufficient stratigraphic resolution for detailed interpretation (Kuhn, 2003), however, similar assemblages have been recently documented at Üçagizli, Umm el-Tlel (*Paleolithique intermédiaire*)(Boëda and Muhesen, 1993; Bourguignon, 1998), and as Jerf-al-Ajla and also in the Southern Levant at Boker Tachtit, Tor Sadaf (Fox, 2003) and Tor Fawaz (see also Belfer-Cohen and Goring-Morris, 2003). Some authors (*e.g.* Azoury, 1986; Marks and Ferring, 1988; Gilead, 1991) considered these assemblages as ‘transitional’, not only in the sense that they occur in an intermediate chrono-stratigraphic and taxonomic position between the MP and UP technocomplexes, but furthermore that they clearly indicate a local development toward UP from a MP substrate. Yet, the presence of transitional assemblages implies *de facto* that the transition happened in the region. Some other authors have underlined this latter assumption as problematic and have suggested that it should not be stipulated in a given typological name (Kuhn, 2003).

Although stressing that transitional assemblages should not be merely studied for themselves, Marks (1990, p.71) suggests the term of Initial Upper Paleolithic (IUP) to describe an arbitrary stage within the transition continuum:

> ‘…Therefore, the Ksar-Akil sequence, with all its problems, provides the best view we have of what I would consider as Initial Upper Paleolithic. After all, in any continuum the breaks are arbitrary and imposed by those studying it. Where better to begin the Upper Palaeolithic than with a technology where virtually all core reduction is pointed toward blade production? The Levallois-like points

> of Boker Tachtit, Level 4, and Ksar-Akil, 25-21, are really no more than pointed, symmetrically converging blades…'

It is clear that a transition defined as a continuum implies a continuity in the human occupation and the documentation of a gradual technological shift. On the one hand, the difficulty in demonstrating continuity may reflect the discontinuous nature of the archeological record (Marks, 1990) and the chronological assignment of assemblages most often relies on radiometric data with large uncertainties (Kuhn, 2003). In the Levant, in spite of a rich record, UP continuity with the MP *sensu stricto* remains difficult to demonstrate (Kuhn, 2003). On the other hand, the Boker Tachtit sequence underlines the possibility of a gradual technological transition (Marks, 1983; Marks and Volkman, 1983) in this region. Apparent discontinuity is also the result of significant and observable behavioral changes. Compared to older blade assemblages (*i.e.* Tabun D type), IUP technology is chiefly blade based at the expense of other reduction methods (Meignen, 2007). Convergent blanks tend to be laminar and the toolkit presents a majority of UP types. Although less frequent than in the subsequent EUP, ornaments and bone tools appear for the first time in the archeological record during the IUP (Kuhn *et al.*, 2001). The combination of these changes justifies the use of an arbitrary label such as IUP. It is more descriptive than interpretative and does not imply (or exclude) a local emergence of the described behaviors.

The IUP differs from the EUP as the latter exhibits consistent technological characteristics of UP behaviors such as volumetric blade and bladelet production but also a more abundant production of formal bone tools and ornaments. Bladelets may represent a behavioral shift toward the adoption of composite projectiles (Bon, 2005; Teyssandier *et al.*, 2010). In Europe and in the Near-East, this stage is represented by the Proto-Aurignacian/Early Ahmarian and by the Aurignacian (Le Brun-Ricalens *et al.*, 2009; Tsanova *et al.*, 2012). In these regions, EUP assemblages show only rare evidence of MP traits, if present at all.

It is understood that the IUP show regional variations and the use of this terminology in the present study does not necessarily imply a cultural connection between assemblages. How the different forms of IUP are related is still unclear and this specific issue should be the subject of additional research. The need to identify the initial occurrence of UP in a given regional sequence is reinforced by the idea that MH first dispersed through Europe (*e.g.* Tostevin, 2000, 2003; Bar-Yosef, 2003, 2007; Hoffecker, 2009; Müller *et al.*, 2011) or Asia (Rybin, 2004; Armitage *et al.*, 2011; Clarkson *et al.*, 2011; Haslam *et al.*, 2011; Rose *et al.*, 2011) before developing the whole set of UP behaviors. The use of the IUP terminology becomes even more relevant outside of the Near-East where evidence of MP to UP continuity is more disputable (Tostevin, 2000, 2003; Nigst, in press). The variability observed among assemblages can no longer be seen exclusively as evidence for various regional transitional processes as it could also reflect distinct dispersal events taking place during a narrow time span. In this context, it is crucial to rely on a more precise, clearly defined and neutral terminology.

These assignment of assemblages to a particular type will be further discussed in Chapter 9 as 'Transitional', IUP and EUP labels have been used to describe some of the assemblages in question (*e.g.* Derevianko, Petrin, and Rybin, 2000; Brantingham *et al.*, 2001; Rybin, 2004; Zwyns *et al.*, 2011).

1.8 FORMULATING RESEARCH QUESTIONS

The model of local transition proposed by Derevianko is a scenario in which two populations confined in a closed environment following parallel biological and cultural evolutionary paths toward modernity is unique. Archeological data play a major role in the construction of the model which is articulated around three main ideas. First, two blade-based UP variants have been defined in the region based on their laminar technology. Second, two different and contemporaneous gradual transition processes were described in the eponymous sequenses of Kara-Bom and Ust-Karakol 1. The third key idea is that inter-regional comparisons based on lithic assemblages and chronological data support a local-evolution scenario but may also indicate a spread of the UP variants across Northeast Asia. Having formulated these three statements, it appears that the proposed model can be tested through the study of laminar technology of relevant assemblages.

The present analysis is based on a sample of lithic material from the two main eponymous sequences where the variants have been defined, the open-air sites of Kara-Bom and Ust-Karakol 1. Additional assemblages of Anuy II and Anuy III have been studied in order to enlarge the sample. Only open-air sites have been selected in order to facilitate the taphonomic analysis and to obtain comparable results. The study follows a three-tiered approach designed to test three hypothesis but also to propose an alternative model. First, the integrity of the sample is assessed based on a taphonomic analysis. Second, the lithic material is described using a combination of quantitative and qualitative methods. Third, the data set is used to support a reconstruction of the laminar reduction sequences with a special emphazises on features that may illustrate technical traditions rather than strict economic factors.

This study addresses three main research questions derived from the current model:

- *Question 1 – are there two distinct UP variants in the region:* a taphonomic assessement and a detailed technological analysis on selected assemblages would provide a better understanding of their similarities and differences. A technological analysis of blade reduction systems is applied but with a focus on small laminar elements. This allows a refined definition of the variants and a test of the validity of a division in two variants as defined in the published material.

- *Question 2 – is there a chronological overlap between of these UP variants:* While transitional assemblages have often been described in different parts of the world, convincing examples of sequences illustrating long term gradual transition are rare. Therefore, the claim of parallel developments of two distinct UP traditions in the same region needs to be tested as it does not appear parsimonious. Transitional assemblages are often defined as presenting features from both the MP and UP, underlining the need for a taphonomic assessment of their integrity in stratified sequences. Chronological and chrono-cultural issues can then be addressed.

- *Question 3 – what is the geographical distribution of the variants?* Although the UP traditions are said to be the result of a local development, long distance comparisons are proposed with the neighboring regions to the west (Central Asia) and further east (Baikal area, Mongolia). These analogies are said to support the absence of long-range migrations. In light of the refined definitions of the UP variants, the geographic limits of the techno-complexes are discussed. The idea is to test whether inter-regional comparisons are consistent with a model of UP local development or if they could support other models of diffusion.

1.9 PROPOSING AN ALTERNATIVE MODEL

Archeological data have been used to support a local development of UP behavior but also an independent biological development of MH which is at odd with the genetic and paleontological data. Based on the results obtained from addressing the three above-listed questions, an alternative model is proposed. The present study confirms the existence of two significantly different UP techno-complexes but it does not support the idea of a synchronous and parallel development. Instead, the data are consistent with a chrono-cultural model of diachronic succession. It is argued that the current data support the existence of an Initial Upper Paleolithic (IUP), or Kara-Bom variant that may overlap with the end of the Altai Mousterian and with both techno-complexes disappearing from the region prior or during the Heinrich 4 climatic event. The Early Upper Paleolithic (EUP), or Ust-Karakol variant, occurs for the first time in the region, during or soon after Heinrich 4. This regional model can be tested easily with the acquisition of new chronometric data. Regional and inter-regional comparisons do not support the idea of a local transition *sensu stricto*. It is instead consistent with several intrusions from the Central Asian lowlands, even if some of them may have developed regional differences. The striking analogies between the Altai IUP and assemblages from the Baikal shores and from northern Mongolia suggest a model in which long distance population movements/contacts were established by the beginning of OIS3. Although the chronology is still coarse-grained, the timing of the first appearance of the IUP in Northeast Asia is contemporaneous with the apparent dispersal of the Bohunician throughout Europe and also with the first appearance of MH in Southeast Asia.

1.10 STRUCTURE OF THE STUDY

Following this introductory chapter, the study is organized around three main chapters:

In Chapter 2, a detailed presentation of the methodology used in the analysis is presented. It provides definitions and references that will help the reader to understand the terminology used in the analysis, in the presentation of the results and in the subsequent discussion.

Chapters 3 and 4 present the data analysis. The data set is analyzed quantitatively and qualitatively and the raw results are presented with the help of a minimum of references. In other words, the results discussed are specific to the present analysis. Chapter 3 deals with the material assigned to the Kara-Bom Upper Paleolithic variant and Chapter 4, with the Ust-Karakol Upper Paleolithic variant.

Chapter 5 compares the obtained results with the previously published analyses. The Kara-Bom variants and the Ust-Karakol variants are then respectively assigned to Initial Upper Paleolithic and Early Upper Paleolithic. Arguments to support this analytical classification are presented in Chapter 6 and are discussed in Chapter 9.

Chapters 6, 7 and 8 address questions formulated above. In Chapter 6, a research question is addressed by comparing the main characters of the two technical traditions. The latter support the assignement of the Upper Paleolithic variants to IUP and EUP. Chapter 7 addresses the second research question. An alternative model is formulated and tested with a critical review of the regional record based on publications and personal observations. Finally, a third research question in Chapter 8 by a more general review of the inter-regional context that also includes personal observations.

The last part, Chapter 9 consists of a general discussion summarizing and interpreting the results in the frame of broader debates. It is followed by a brief conclusion and by some suggestions regarding future directions of research.