THE "CULTURAL EVOLUTION" OF MAN AND THE CHRONOSTRATIGRAPHICAL BACKGROUND OF CHANGING ENVIRONMENTS IN THE LOESS PALAEOSOIL SEQUENCES OF OBI-MAZAR AND KHONAKO (TADJIKISTAN)

ABSTRACT: South Tadjikistan is an exceptional area for studies of Palaeolithic artifact assemblages against the chronostratigraphical and palaeoclimatic background visible in the Middle and Upper Pleistocene loess sections. The Tadzik loess stratigraphy can be correlated with the oxygen-isotope record, not only on the basis of glacial and interglacial cycles but also on the basis of the climatic differentiation of single interglacials.

About 17 archaeological find horizons, situated in interglacial buried soils, in interstadial sediments and in loess were stratified at the outcrops of Obi-Mazar/Lakhkhi and Khonako. They span a time range from about 700,000 to 70,000 years. A "development" in artifact manufacture and in the complexity of site activities is visible. Up to the 5th palaeosol complex (PC) (ca 500 ky) there were Lower Palaeolithic pebble assemblages. A late Lower or early Middle Palaeolithic industry has been identified in the 4th PC (ca 400 ky). The development of a Middle Palaeolithic blade industry can be seen in the 2nd PC (from about 240 up to 200 ky). This blade industry is overlaid by a Mousterian assemblage of heavy Levallois flakes in the 1st PC (about 100 ky).

KEY WORDS: Lower Palaeolithic – Middle Palaeolithic – Blade technology – Loess stratigraphy – Chronostratigraphy – Palaeoclimate – Palaeoenvironment – Central Asia

INTRODUCTION

The Afghan-Tadjikian Depression, located in the middle of Central Asia, is surrounded by high mountain ranges: the Hissar-Karategin in the north and north-west, branches of the Pamirs in the north-east and branches of the Hindukush in the south and south-east. In the west this depression is open to the Karakum desert (Figure 1). Since 2 My, as a result of deflation processes, aolian dust has been transported to the east and became sedimented as loess in the piedmountains. The sediments built up huge mantle layers, especially in the Middle and Upper Pleistocene. Following erosional processes at springs and river valleys, outcrops several kilometres in length and more than 100 m high were formed. These sections consist of sequences of palaeosol complexes (PCs), divided by loess and interstadial sediments and numerous archaeological find horizons. They provide an insight into the palaeoclimate and palaeoenvironment as well as settlement history and the techno-typological development in the artifact manufacture of Palaeolithic man.
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sequences and the body of single palaeosol complexes also enable a high correlation with climatic oscillations documented in the oxygen-isotope record.

The 9th and 7th PC's of the Tadjik sequence can be correlated with stages 17 and 19 of the deep-sea record, while the 8th PC can be linked to an oscillation within stage 18.

The 7th and 6th PCs in Tadjikistan, as well as the 5th and 4th PCs, were generally divided by thick loessic sediments, but the 5th and 6th PCs were not (Figure 2). In the deep-sea oxygen-isotope record stages 16 and 12 were interpreted as extreme glaciations, and stage 14 as a milder ones (Kukla 1987, Shackleton 1978). It seems reasonable to correlate stage 16 with the thick loessic layer between PC 7 and PC 6 and stage 12 with the thick loessic sediments between PC 5 and PC 4. The milder glaciation stage 14 must be correlated with slightly-weathered sediments between PC 6 and PC 5 (Dodonov et al. 1996). The sequence from stage 15 up to stage 13 shows three main warmer oscillations. In Tadjikistan these warm periods could correspond to a double PC 6 and PC 5 (Figure 2).

From the 4th PC up to PC 1, the Tadjik loess stratigraphy can be correlated from stage 11 up to stage 5. The 1st PC (stage 5) is linked to the last interglacial. PCs 1, 2 and 3 consist of two or three climatic optima (Bt or Bm horizons), which were divided by loess, interstadial sediments or carbonated horizons, showing colder and arider climatic events. In contrast, the 4th PC is a more homogenous soil complex, showing only one climatic optimum. The oxygen- isotope record reflects these characteristics. Stages 5, 7 and 9 show differentiated curves, whereas stage 11 shows a more simple oscillation (Schäfer et al. 1996a).

Well-situated and well-preserved Tadjik sections the 1st, 2nd and 3rd PCs have a characteristic body. The 3rd PC consists of two climatic optima, which may be compared to two oscillations in the isotope record. The 2nd PC consists of three well-developed soils (climatic optima). The lower soil is divided from the middle one by a carbonated crust, loess and interstadial sediments, showing a longer cooling/adiaridity; the middle soil is separated from the uppermost one by a slightly-developed carbonated horizon. The body of the 1st PC also consists of three well-evolved soils but, contrary to the 2nd PC, the lower two climatic optima were divided by only a shorter climatic cooling/adiaridity. An analogy seems to be visible in the isotope record (Figure 2). The body of the 1st PC also consists of three well-evolved soils but, contrary to the 2nd PC, the lower two climatic optima were divided by only a shorter climatic cooling/adiaridity. An analogy seems to be visible in the isotope record (Figure 2).

A comparison with the Chinese loess stratigraphy and the oxygen deep-sea record has been established (Figure 2).

There is not only a general conformity of the Tadjik loess stratigraphy, the Chinese loess stratigraphy and the oxygen deep-sea record concerning the number of palaeosol complexes. Details of the Tadjik loess palaeosol

ENVIRONMENT

With reference to the body of interglacial, interstadial and glacial sediments, a clear differentiation of palaeoclimate is visible in the loess soil sections. The differentiation of single palaeosol complexes also enables the reconstruction of warm humid periods against colder/drier events. The 2nd PC of Khonako III in particular, shows a highly differentiated stratigraphic sequence of the environment of the penultimate interglacial (see above). But there is no agreement about the interpretation of the soil genesis among scientists. The main conflict is the question of whether the soils were built up epigeneically or synsedimentarily. Following the epigenetic theory, the strongly-weathered soils (Bm, Bn horizons) develop from a stable surface during a warm and humid climatic optimum. In contrast, the synsedimentary theory means that these soils must have developed parallel to an ongrowing surface as a result of continuous sediment accumulation (Sosin 1988). These two assumptions have far-reaching consequences for the interpretation of the settlement of Palaeolithic man. If the soils were epigenetic, the settlement of Palaeolithic man took place before the climatic optimum, i.e. a colder/drier interstadial phase. If the soils were built up synsedimentarily, the settlement took place during the climatic optimum (Lomonov, Ranov 1985). This relationship has been discussed in detail by Dodonov, Ranov and Schäfer (1995). In comparing the Tadjikian soils with other areas, Bronger et al. (1995) come to the conclusion that the strongly-weathered soils were epigenetic and that some overlying slightly-weathered sediments might be synsedimentary. At their present stage of work the authors favour the synsedimentary theory. Our main argument rests on today's visible sediment accumulation in our interglacial.

Today the recent soils of the area are heavily degraded as a result of human activity. The landscape is characterised by deforestation and surface erosion. But in some refugia areas there are still remains of coniferous forests (in higher areas) and deciduous forests. The interpretation of palaeosols in comparison to the Holocene one has been discussed (Lomonov 1980, Sosin 1989, Dodonov et al. 1995, Bronger et al. 1995). Most authors favour a deciduous forest as being a reconstruction of the palaeolandsacpe during climatic optima. During interstadials a forest steppe (savanah) might be reconstructed, and during maximal cooling/ardisation a stepppe environment.

Environmental reconstructions on the basis of faunal remains are still in progress. Our recent excavations have enabled the study of some herbivores and of many rodents and molluscs. The rodents have also been of importance in establishing a local biocronology.

ARCHAEOLOGY

The Tadjik chrononstratigraphic has consequences for the data of well-known loess Palaeolithic archaeological sites, which have been studied by V.A. Ranov for many years (Ranov, Davis 1979, Ranov 1982, 1995). As a result
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of recent geostratigraphical research and archaeological excavations, the stratigraphical and chronological position of several sites such as Karmandan, Lakhuti, Obi-Mazar and Khonako has been verified or corrected (Schäfer et al. 1996a, b). But there are also sites such as Karatau, whose geochronological position will not be clear until new investigations have taken place.

Since 1993 the authors have been involved in new archaeological and geostratigraphical expeditions in South-Tadzikistan, especially in the region of Khovaling at the outcrops of Obi-Mazar/Lakhuti and Khonako (Figure 1).

**Obi-Mazar/Lakhuti**

The outcrop of Obi-Mazar/Lakhuti is located on the right bank of the river Obi-Mazar, opposite the village of Lakhuti. The outcrop extends about 1.5 km north-east along the river, reaching a height of about 130 m (Figure 3). The aeolian sediments above river gravels show a thickness of about 90 m from the 7th PC up to the recent surface. The middle part of the outcrop is named Obi-Mazar, the north-eastern part Lakhuti and the slope between is known as Obi-Mazar-Opselen. The oldest archaeological finds at this place are from the lower 6th PC (PC 6b) of Obi-Mazar and Lakhuti. The youngest artifact is a flake from the 3rd PC of Obi-Mazar. Some more widely-spread finds were common in the PC 6a of Lakhuti and Obi-Mazar-Opselen, as well as in loessic sediments between PC 6a and PC 5 of Obi-Mazar-Opselen. Denser artifact concentrations were found in the 5th PC of Lakhuti, Obi-Mazar and Obi-Mazar-Opselen. From the 4th PC of Obi-Mazar dense artifact...
concentrations were found alongside the whole extension of the outcrop. These finds provide an insight into the settlement of Palaeolithic man from about 620,000 (PC 6b) up to 400,000 (PC 4) years.

The raw material source for the artifact production were the neogene conglomerates of the underlying bedrocks. They could have been collected as pebbles in the gravels of the Obi Mazur. The raw material was mainly quartzite and quartzitic sandstone; metamorphic rock such as porphyry and porphyrit, as well as quartz, cornelian and chert has been collected in lesser quantities. The archaeological sites cannot be interpreted as base camps. Fireplaces and dense knapping concentrations were absent (Lomov, Ranov 1985, Ranov, Amosova, 1993). The finds indicate shorter events or, more probably, they were vestiges of a preferred, recurrent exploitation of the landscape, perhaps during migration.

In times of the formation of the 6th PC up to the 3rd PC, i.e. from the lowermost to the uppermost find, a considerable change in the landscape took place. The distance and morphology between the find horizons and the water source changed as a result of tectonics, the incising of the Obi-Mazur and the aeolian sedimentation. The exact appearance of the palaeolandscapes is unknown, but it is obvious that during the older settlement phases the distance to the river was shorter and the relief of the landscape much flatter than in younger epochs (Figure 4) (Dodonov et al. 1995).

FIGURE 4. Ideal reconstructed palaeorelief at the Obi-Mazur (modified according to Dodonov et al. 1995).

FIGURE 5. Lakhuti PC 5 and Obi-Mazur PC 4: profiles and vertical artifact distribution.

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FIGURE 6. Artifacts from Lakhuti/Obi-Mazur:
1 - Levallois core from Obi-Mazur PC 4; 2 - discoid core from Lakhuti PC 5.
A clear distinction in artifact distribution and assemblage character is visible between the 5th and 4th PC, the main find horizons of Obi-Mazar/Lakhuti. In the 5th PC the artifacts were spread from the carbonated crust (ScA) alongside the whole soil sequence (Bm – Bh – Bhm) through the transitional sediments to the overlying loess over a distance of about 2.5 m. They were not concentrated in horizontally-elaborated layers (Figure 5) (Ranov 1986). The assemblage is a Lower Palaeolithic industry in the tradition of the Karatau pebble culture (Figure 6). Their age is about 500,000 years (Figure 2). The pebble-nodules were cracked in amboss technique. The further reduction was centripetal (discoid) or in citron technique. A core preparation is rare and not standardized. Most striking platforms were cortical. Blades were almost absent. The scrapers could actually be called retouched flakes rather than real scraper types (Dodonov et al. 1995).

In the 4th PC the artifacts were also spread from the carbonatic crust through the well-weathered soil up through the transitional sediments to the loess. But in contrast to the 5th PC they built a dense layer in the upper part of the well-weathered soil (Bh) (Figure 5) (Ranov, Amosova 1993). The assemblage is final Lower Palaeolithic or transitional to the Middle Palaeolithic (Figure 6). It is about 400,000 years old (Figure 2). The artifacts are smaller than those of the 5th PC. The reduction was mainly discoid, the cores were sometimes exploited to a larger extent. A preparing of a striking platform is known. Tools are nearly absent. No scrapers and only a few negatives on angular debris or irregular flakes were visible. Citron flakes were more rare than in the 5th PC. The prominent feature of the assemblage is a large amount of angular debris (Figure 11) (Schäfer et al. 1996b).

Khotanak

The outcrop Khotanak is located 10 km north-east of Khovaling. It extends about 5 km from the mountain summit between the river Lakhsu in the east and Obi-Mazar in the west, to the Holocene terrace of the Obi-Mazar. Our recent archaeological and geological investigation has mainly taken place at Khotanak III, a small depression close to the peak of the watershed. The slope of Khotanak III has an elevation of 90 m and extends about 300 m close to the outcrops of Khotanak I to the east and Khotanak II to the west (Figure 7). The section extends from the 5th PC up to the recent surface. Archaeological finds have been excavated in the 4th, 3rd, 2nd and 1st PCs as well as in loess and interstitial sediments between the 2nd and 1st PCs. These finds cover a time range from 400,000 up to 70,000 years (Figure 2).

The raw material is the same as in Obi-Mazar/Lakhuti. The source might have been gravels from the Obi-Mazar or the Lakhsu, but a nearer source was the neogene gravels of the bedrocks, which were probably accessible at water sources such as springs and brooks.

The palaeoenvironment from Khotanak III differs from that of Obi-Mazar/Lakhuti, and so probably does the exploitation of the landscape by Palaeolithic man. In Obi-Mazar/Lakhuti the finds were located at a river bank or at slighter slopes and plains close to a river bank. In Khotanak III the people left their remains in a smaller depression or flatter area in the vicinity of the mountain top.

As in Obi-Mazar/Lakhuti, the palaeostratigraphy between the older and younger soils is different in Khotanak III. From older to younger soils, the relief becomes more exposed. But in contrast to Obi-Mazar/Lakhuti the differences in relief might not include a higher variation of the whole biotope.

Some artifacts were found in the 4th PC (400 kpy) in a smaller sediment. In contrast to the finds from the 4th PC of Obi-Mazar/Lakhuti, they were less concentrated and spread over a broader distance. The assemblage is nearly identical with that of Obi-Mazar/Lakhuti PC 4 (Figure 11). This conformity might be more chance because of the small number of finds, but it may also indicate a general characteristic of the industry of the 4th PC. If the latter is the case, the varied environment between Obi-Mazar/Lakhuti and Khotanak III, visible in the differing geomorphological position, is without influence on the artifact assemblage.

Only a few artifacts have been found in the 3rd PC of Khotanak III. They are not yet sufficient to gain a clear conception of their distribution and assemblage characteristics. Unfortunately up to now, only one find has been made from the outcrop Obi-Mazar/Lakhuti, so we have a time gap in the "cultural evolution" between the archaeological assemblages from the 4th and the 2nd PCs.

From the 2nd PC up to the uppermost soil of the 1st PC of Khotanak III a highly-differentiated geotrustigraphy reflects the climatic events of this period. In addition, several archaeological finds and find horizons could be linked with environmental changes over a limited timeframe (Figure 8).

Artifacts were found in all sediments: in interglacial soils, in interstitial sediments and even in loess. Their
distribution is split into three patterns: first, a distribution of single artifacts alongside the whole horizontal and vertical excavation area; secondly, a denser concentration of artifacts in areas or layers; and thirdly, a dense concentration of artifacts in a special area inside a pedological unit (Figure 8).

Artifacts of the first type of distribution show the highest variability in raw material. Most tools could belong to this group. The location of artifacts might reflect some sort of background activity of Palaeolithic man (Roebroeks et al. 1992). The artifacts were deposited or lost independently over a long period of time, without having any relation to each other and to the artifacts which were found in concentrated areas.

Artifacts lying more or less horizontally in dense concentrations inside pedological units were of one single type or of only two types of raw material. They were relicts of specialized short activities at the site. These locations have been found in slightly weathered sediments (LB3) between the lower and middle climatic optimum of the 2nd PC (ca 230 ky), at the end of interstadial 2b (two metres above the upper climatic optimum of the 2nd PC – ca 180 ky) and in interstadial 2a (one metre below the beginning of the 1st PC – ca 150 ky).

In the western excavation area many artifacts have been found inside and between the upper and middle climatic optimum (PC 2a – PC 2b; ca 220–200 ky). They were lying more or less concentrated and sometimes formed horizontal layers. Their relation to the pedological units is not yet clear. Some refittings show that there has been some post-sedimentary vertical movement of artifacts. Future analysis will show their exact relation to the surrounding sediments.
At present a serious interpretation of the settlement activities cannot be given.

The assemblages from the 2nd PC (PC 2b–2a) are characterised by a reasonable number of blades and broken blades (19%) as compared with flakes and a few Levallois flakes (41%) and angular debris (35%). Cores were rare (1%) and heavily reduced. The tools were mainly laterally-retouched blades (Figure 9), only one Mousterian point (convergent scraper) was found (Schäfer et al. 1996b).

The assemblage of LI 2b (Figure 8) contains 33% blades, 40% flakes and 15% angular debris. An interesting aspect is the occurrence of three pyramidal (conical) cores. They are highly standardized in technology and morphology and therefore not accidentally made (Figure 10).

In LI 2a it was only possible to dig a small sondage in an exposed situation of the slope and only a few artifacts were found in concentration (Figure 7). The artifacts were very small (mainly <3 cm). Blades and bladelets formed 44%, flakes 36% and angular debris 20%.

From the lower climatic optimum of the 2nd PC (ca 240 ky) up to the LI 2a (ca 150 ky) a continuous "development" is visible. The number of (Levallois) flakes decreases and the number of blades increases. We have to consider whether the two blade concentrations of the interstadials (LI 2b and LI 2a) reflect a general trend in artifact manufacture or if they only mirror specialised activities.

In the 1st PC of Khonako III a few artifacts have been found in the upper climatic optimum (PC 1a – ca 70 ky). A more characteristic assemblage attached to the 1st PC was found at the outcrop of Khonako IV. Due to geomorphological observations and the occurrence of a horizon of lenses of charcoal and reddish sediments (natural surface fires) which are also visible in Khonako III, an identification as the 1st PC seems reasonable! The site is located at a small brook, a few kilometres west of Khonako III, at a slight slope to the Holocene terrace of the Obi-Mazar. At this place some artifacts have been found in aeolian sediments of the upper climatic optimum of a palaeosol complex (the lower climatic optimum continuously passes from alluvial to aeolian sedimentation). Some slope finds (due to the hafting red sediment) probably originate from the same horizon. The assemblage can be characterised as a Mousterian one with heavy Levallois artifacts (Schäfer et al. 1996b).

CONCLUSIONS

The Tadjik loess stratigraphy is comparable to the oxygen-isotope record. This is documented by a general similarity in the number of palaeosol complexes and warmer isotope stages from the M/B palaeomagnetic boundary to the Holocene. What is more, the Tadjik loess stratigraphy confirms the idea that the oxygen-ill-breve record reflects global climatic events: for example, the assumed extreme cold stages 12 and 16 have their analogy in the higher loess accumulation rate between PC 4 and 5 and between PCs 6 and 7. The differentiation of interglacial soil complexes in several climatic optima have their analogy in the corresponding oscillations of the interglacial isotope stages (Figure 3).

From the oldest archaeological site (Obi-Mazar PC 6b – ca 620 ky) up to the youngest excavation place (Khonako III LI 2a – ca 150 ky) a clear "development" in artifact manufacture is visible (Figure 11). The proportion of manuports, pebbles, citrus flakes and cores decreases continuously, while blades increase. Although the number of excavated sites and pieces collected is small, it seems that each find horizon reflects a typical artifact assemblage which differs from other find horizons.

In Khonako an "evolved" prismatic blade industry with laterally-retouched blades is overlain by an "archaic" Mousterian industry. In Central Asia a comparable situation is Obi-Rakhat (Uzbekistan) (Suleimanov 1972). The Prae-Aurignacian of Yabrud (Syria) is well-known. In North-western Europe there are several Palaeolithic sites characterised by variations in blade technology (and laterally-retouched blades) from the last interglacial and the beginning of the last glaciation (Rieuillon, Tuffreau 1994, Carré et al. 1995). Khonako III is a very early blade industry and one more example of a non-continuous evolution within the Middle Palaeolithic (between 240,000 and 40,000 years).

There are not yet enough data available to establish the influence, or non-influence of the environment, on the assemblage character. Previous observations of the Lower Palaeolithic sites (up to 400 ky) do not confirm a decisive dependence of climate, biotope or topography. A few finds from Obi-Mazar-Opolsen which have been found in loessic sediments between the 6th and 5th PCs (indicating a first settlement of hominids during a glacial period – ca 540 ky) do not show significant differences to the 5th PC. Artifacts from Obi-Mazar PC 4 and Khonako PC 4 are quite similar, although the geomorphological situation (and probably the biotope, including the resources for food and raw material) between a plain or slight slope in the direct vicinity of a river differs from those of a mountain ridge.

Future research on the loessic outcrops in the vicinity of Khovaling will enable a comparison of Palaeolithic sites: (1) of identical time, the same topography (biotope) and identical climate; (2) of identical time, different topography (biotope) and comparable climate; (3) of different time, comparable topography (biotope) and comparable climate; (4) of different time, comparable topography and different climate; (5) of different time, different topography (biotope) and comparable climate.

These analyses will be very helpful for the interpretation of artifact assemblages regarding the old question of the
relation between culture, function, environment and evolutionary development.

NOTES

1. We would like to thank the Deutsche Forschungsgemeinschaft for their financial support of our field work (Socha 335). We are also grateful to the Governor of Khovsgol for his help.


3. In the geological and palaeoecological literature, finds from the alluvial gravels in the south-western part of the slope were named Lakhuti 1, finds from alluvial gravels in the north-eastern part were named Lakhuti 2. In the older archaeological literature, finds in the aeolian sediments of the middle part of the outcrop were named Ohi-Mazar or Lakhtu 3, archaeological finds in the aeolian sediments in the north-eastern part were named Lakhuti.

4. In an earlier publication (Schäfer et al. 1996b) the occurrence of a reddish loess (burnt sediment) with lots of charcoal was interpreted as a fire-pit. Due to the occurrence of many such lenses alongside the whole palaeoecological, the authors assume that their origin is natural.

REFERENCES


