Relations between climatic changes and prehistoric human migrations during Holocene between Gissar Range, Pamir, Hindu Kush and Kashmir: The archaeological and ecological data

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ARTICLE INFO

Article history:
Available online xxx

ABSTRACT

In the beginning of the Holocene, hunter–gatherer populations settled in the Pamir plateau, especially in the tectonic depression of Markansu near the Kara Kul Lake (Osh Kona site, 4100 m, 9580 BP and 7145 BP). These populations were well adapted to high altitude life conditions in summer. They were using stone tools related to a cobble tool tradition that Ranov considered as the local continuation of an Asian Middle Palaeolithic (Ferghana, Darwaz or Punjab). However, they disappeared during the second half of the Holocene. As well, hunters–gatherers characterised by a tradition close to Markansu Culture, namely Hissar Culture, appeared during the Holocene in the northern mountains of the Tajik–Afghan depression (Amu Darya upper basin) occupying the middle altitude valleys (Gissar Range) when Neolithic populations began to develop at lower altitudes. For Ranov, origin and destiny of both Markansu and Hissar cultures were the most important questions to solve in this region. The Department of Prehistory, National Museum of Natural History (Paris) conducted field work in collaboration with the University of Peshawar between 1996 and 1998 in the northernmost valley of the Indus basin giving access to the Wakhan corridor. The upper Yarkhun valley (Chitral district, Pakistan), accessible only by foot, was surveyed from 2500 to 4000 m altitude. This allowed the discovery of 6 sites yielding lithic artefacts, among which half are cobble tools. They attest to human activity later than 5500 BP, suggesting population movements between the Amu Darya and Indus basins. The consequences of the Quaternary climate oscillations between South Asian monsoon and Northern hemisphere influences on the one hand, and the impact on biotopes of the increasing pastoral activity on the other hand, are discussed as probable causes for the disappearance of the mountainous nomadic hunters of Central Asia.

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1. Introduction

The sharp contrast between the highest mountains in the world with peaks exceeding 7000 m altitude in Pamir, and the two Amu Darya and Indus upper basins, confers specificity to the human settlements in this region since the Late Pleistocene and particularly during the Holocene. Due to the strong gradients the climate changes made the biotopes shift more vertically than horizontally. As far as early human populations are concerned, this leads to different adaptations (behaviour and biology), since it is not necessary to move on long distances for escaping drastic environmental changes (Fig. 1).

The Himalayas, Hindu Kush, Pamir, and Tibetan Plateau are young mountainous formations emerging from the collision between the Indian and the Eurasian tectonic plates. Recent isotopic analysis from the enamel of herbivores suggests that the Tibetan plateau was 2700 m below its present elevation 2–3 million years ago (Wang et al., 2008). The elevation has increased faster since the Pliocene, and transformed the landscapes and the climate during the Pleistocene. Surveys in the sub-Himalayan and Tajik–Afghan foothills as well as in higher regions such as eastern Pamir, have shown evidence of prehistoric occupations, but a distinction is made between low-middle altitude and high altitude zones (above 2000 m). The first human occupations are known since the Lower Pleistocene: 2 Ma in the Potwar plateau in the western Siwaliks (Rendell and Dennell, 1985; Rendell et al., 1989) and Tajik loess (Ranov, 1995, 2005; Ranov and Dodonov, 2003, Dennel 2004, 2008), whereas in the Pamir, settlements seem to be rare before the Holocene (Fig. 2).

One specific feature of the Holocene populations in the foothills and high plateaus is the persistence of a stone knapping technology contemporary to the Neolithic culture, that recalls the Soanian...
technical tradition frequently found on the surface of the sub-Himalayan terrain, and is marked by the large utilisation of quartzite cobbles for making cobble tools and flakes. The question was raised of a common background or technical template between the mountainous regions of Pamir and the Indus upper basin including the Himalayan foothills and Sub-Himalayan ranges (Siwaliks). Three expeditions in 1996, 1997 and 1998 in the high valleys of Hindu Kush, close to the Pamir plateau, investigated the possibility of finding traces of such a local tradition (Dambricourt Malassé, 2008; Gaillard and Dambricourt Malassé, 2008). Lithic assemblages have been discovered in the upper Yarkhun valley (southern slopes of the Hindu Kush Range, Pakistan), in six localities between 2500 and 4000 m altitude (Gaillard et al., 2002), the last one close to the Boroghol Pass (3800 m of altitude) which allows communication between the Hindu Kush high valleys and the Pamir. This paper will discuss the hypothesis of the development and the disappearance of a vast hunting territory during the Holocene between Amu Darya and Indus upper basins in the light of the Pleistocene human settlements and Quaternary climate changes.

2. Southern Tajikistan

The southern part of Tajikistan comprises two contrasted regions: the Pamir with high valleys and plateau on the one hand, and the hills of the the Gissar Range covered with loess on the other hand (Fig. 2). Exploration in this sector began in 1956 with the archaeologist V. A. Ranov and later developed in collaboration with J. Schäfer in Gissar Range (Schäfer et al., 1998) and V.A. Zhukov in Pamir (especially the Mesolithic Istyk cave).

2.1. Afghan—Tajik depression and Gissar Range

The sites located in southern Dushanbe are in a clear stratigraphical context, in well-studied long sequences of loess including many pedocomplexes, which reflect warmer climatic phases during the Pleistocene (Ranov, 1982, 1984, 1995, 2001; Ranov and Schäfer, 2000; Ranov et al., 1999). The earliest occupation appears at Kul-dara, in the pedocomplexes 12 and 11, dated to about 900–950 ka (Ranov and Dodonov, 2003; Ranov, 2005). At the end of the Palaeolithic and preceding the Neolithic, two technical traditions co-existed in Central Asia, the Mesolithic with geometric microliths and an Epipalaeolithic resulting from a local evolution of the Palaeolithic cobble tool tradition (Ranov, 1993, 2003, 2005).

Then, contemporary to the Neolithic, a series of sites discovered in the 1960s by Okladnikov revealed the presence of a hunting territory associated with a specific environment. These sites usually occur on the lower river terraces (20–30 m), at altitudes ranging from 700 to 1500 m, always in the context of loess deposits, surrounded by mountains. They are mostly open air sites where fireplaces are not common (Ranov, 1982; Amosova et al. 1993). The lithic assemblages, attributed to the Hissar Culture, include numerous tools on cobbles from a large variety of rocks. However, flint was also used, and in this case the knapping technology is well mastered and oriented towards the production of flakes and small blades. There is no pottery, but some polished axes and a few ornaments in bone are found. Among the bone remains, domesticated as well as wild animals are represented. In the later stages, grinders and pestles increase in number, suggesting increasing consumption of grains. The economy of these populations observed during the VIII–VII millennia was based on hunting and gathering. While the neolithisation clearly occurred in some localities during the VI–IV millennia in vast areas (1–1.5 ha) (Ranov 1984; Amosova et al., 1993), the destiny of those hunter–gatherer tribes remains unclear. Two possible evolutions have been proposed: shift towards either farming—breeding economy or pastoralism (Ranov, 1984, 2005). Nevertheless nothing allows systematic conclusion of a transformation driven by an inner trend. Hunter—gatherers were living in the same environment as farmers; some of the tribes could collect cultivated grains and kill some animals from the livestock, all the more easily as they were domesticated. A third hypothesis which had not been taken into account is the extinction of some tribes by endemism and disorganisation of their ecosystem, because of interferences between climate changes and anthropic activities such as deforestation and overgrazing.

2.2. Pamir

Above 2000 m altitude, prehistoric evidence is scarce before the early Holocene. In the northeastern region, a Late Pleistocene...
occupation is known from the Djamanta cave on the Karasu river, the archaeological layer yielded broken bones and fire-places but no tools (Ranov and Sidorovo, 1979). Similar occupations are also known in south Pamir from many open-air sites dated to between 20 and 12 ka BP in the Alichur Valley (Ranov, 1984).

Ranov did not rule out the possibility of earlier human occupations, even as early as the Middle Pleistocene when the Pamir was below its present altitude. Although rare, some isolated Mousterian or Upper Palaeolithic artefacts, dating from 40 to 20 ka were actually collected (Ranov, 1984). Plio—Pleistocene river terraces are still preserved and they have not recorded any trace of ice sheets (Bondarev et al., 1997). A partial isolated temporal bone, dated to 30 ka and excavated from the Darra-i-Kur rock-shelter in Badakhshan (Afghanistan) at 1300 m altitude clearly shows biological adaptation (see below). Therefore, altitude is not a sufficient argument to explain the scarcity of archaeological evidence before the early Holocene. The severely low temperatures during the Last Glacial Maximum seem to be a satisfying hypothesis.

In contrast, numerous localities with pebble tools were recorded on Holocene terraces in the entire Eastern Pamir. Most remarkable are two open-air sites. The first one, in the north, is the Epipalaeolithic site of Osh-Khona in the Markansu tectonic depression, near the Kara Kul Lake, at the altitude of 4100 m (Ranov, 1984, 1988, 1993). The second one, in the southeastern Pamir, is Karatumshuk (Tokhtamych) near the Sarykol Range and the Chinese border. In the southeastern Pamir, the sites are located along the Alichur and Murgab Rivers (Figs. 2 and 3).

Today, the Markansu depression (Margansu valley or Death Valley) offers a desolated mineral landscape drastically contrasting with the early Holocene conditions (Fig. 4). Half a dozen open air sites (on moraines and river terraces) provide lithic assemblages characterized by two stone knapping processes, one producing pebble tools and the other one producing microliths and microblades. This particular tradition, the “Markansu Culture”, mixes Epipalaeolithic and Mesolithic. While hunting activity is attested from the Epipalaeolithic sites of Markansu, a proto-pastoralist economy cannot be excluded in the other sites.

![Fig. 4. Ujusu River, Osh-Khona archaeological site (arrow) and Kara Kul Lake (satellite view adapted from Google Earth).](image)

Such a co-existence is observed during the same period in the northern Tibetan plateau, around Quingkai Lake (Western China), Jiangxigou 2, dating to ca. 9000–5000 BP with microlithic tools and a small number of ceramic shards, “appears to be connected to early Neolithic agricultural settlements along the upper Yellow River (Huang He) drainage during the middle Holocene, and may provide insights into forager—agriculturalist interactions that lead to the development of pastoralist systems in the region”, whereas Heimache 3 is, “a brief hunter’s camp dating ca. 8450 cal BP, with evident affinities to late Upper Paleolithic camps in the same region that date several thousand years older” (Rhode et al., 2007).

Osh-Khona archaeological site is located on the right bank of the Ujus River, at its confluence with the Oshkhona Zhilga River, 15 km from the modern Ujus glacier terminus (Ranov and Sidorovo, 1979). The excavations have exposed a cultural layer typical of hunters’ summer campsites, with three 14C dates: 9530, 7380 and 7095 BP (Velitchko and Lebedeva, 1974; Ranov and Davis, 1979). All the bone remains belong to wild fauna: large mammals (Ovis, Capra), rodents (chiefly marmots and hares) and birds. Charcoal remains from fire-places represent three taxa: Betula (birch), Juniperus (juniper) and Eurotia ceratoide (winterfat) (Ranov and Sidorovo, 1979). The assemblage includes a large number of cobble tools, small blades in selected flint, end and side scrapers, etc.

The most difficult question to solve is the origin of these hunters. Ranov thought they could not originate from Xinjiang, where a quite distinct Sibero—Mongolian tradition occurs. He suggested they arrived from the neighbouring terrain of Fergana, easier to access but with important cultural adaptations. In the southeast, the hypothesis of a North-West Indian or Far West Tibetan origin for the hunters’ open-air site of Karatumshuk cannot be dismissed, even though few archaeological data are available.

Osh-Kona is the only human settlement for which climate changes are well documented, through multidisciplinary investigations leading to reconstruct oscillations during the final Pleistocene and Holocene (Serebranny and Solomina, 1996; Bondarev et al., 1997). The age of the Last Glacial Maximum (LGM) is disputed, as it occurs either at ca. 44 ka or at 14–10 ka. Nevertheless, in either case the Kara Kul basin was free of ice during the interval 15,660 BP to 3240 BP, and the major deglaciation occurred ca. 10,000 years ago, at the end of Batura glacial stage (10.8—9.0 ka BP) (Lewis et al., 2002). Three lake terraces have been identified: T1: 8–7 m above river level of Markansu valley dated between 12,200–11,800 BP; T2: 6–5 m, 9000–8500 BP and T3: 1.5–1 m (Bondarev et al., 1997). The summer campsite is associated with the second terrace, but the settlement could have been
interrupted between 9500 and 7400 BP by moister climatic condition ca. 8700 BP, when the glaciers re-advanced and the lake level increased. A new phase of occupation occurred until 7000 BP then the hunters abandoned the site.

Zech et al. (2005) concluded that, “Increasing aridity in the Pamir is most likely responsible for the progressively limited extent of the glaciers during the Late Pleistocene”. The causes of this increasing aridity cannot be imputed to a rapid uplift of the Pamir, as the tectonic rise in the last ten thousand years did not exceed 2 or 3 cm/y (Agakhanyantz, 1996).

The culture directly overlaying the hunters’ settlements is the Bronze Age and especially the pastoral Kajrat-Kum Culture: no transitional Eneolithic has ever been observed. The hunters abandoned the Pamir plateau during the second period of the Holocene, probably because of increasing aridity generating an impoverishment of the biodiversity until the present. The Kara Kul Lake is the largest of the High Pamir (tectonic origin, area: 38,000 ha, maximum depth: 242 m), but today it is remarkably poor in fish, and just one endemic species (Noemachielus lacusnigri) reproduces. For comparison, Yashikul Lake (moraine and landslide origin, area: 4800 ha, maximum depth: 50 m) shelters 3 species (Sarvatova and Pietr, 1999). Prehistoric populations hunted large numbers of birds: 126 species, 10 of which on the average represented 4% of all hunted species (Sidorovo, 2000). This supports the hypothesis of the role of hunting in the subsistence economy of the Middle Paleolithic inhabitants of Central Asia.

Increasing aridity provoked greater salinity of the Kara Kul Lake but also changes in air circulation. The French surgeon Marie Jeanne Koffman, a member of the 1958 Pamirian Expedition headed by B.A. Lidvintchskij, describes the Markansu depression not only as a desolated landscape but as a huge rocky desert with dust devils able to project stone blocks (personal communication). The dust devil is an ascent of warm and dry air created by a very powerful thermal phenomenon (zone of warm air surrounding by cold air). The Kyrgyz people precisely name this depression “creek of tornadoes” or “creek of death”, “Markansu”.

Ranov considered the Hissar culture as an enigma, nevertheless observing similarities with the Markansu Culture (Ranov, 1984). In comparing the high valleys around the Kara Kull depression, it clearly appears that communications were easy with the Gissar Range (Fig. 1). Moreover, archaeologists recorded the same micro-lithic points in Istyk cave (Istykskaja, South-Eastern Pamir, 37°44’N, 74°23’E) and in the Afghan–Tajik depression as in Tutkau (Gissar Range) and on the other side of the Amu Darya, in the dunes of Northern Afghanistan (Ranov, 2003). So, Ranov considered the Hissar Culture as a component of the Eastern Pamirian Epipalaeolithic–Neolithic related to hunting economy, and based on seasonal activities between the middle-low valleys and the Pamir plateaus. Unfortunately, all the Pamirian valleys have not been explored, especially the Gorny Badakhshan and the Darvaz Range respectively in Central and South Western Pamir (Fig. 1) where archaeological records could provide more precise observations.

Moreover, movements between South Eastern Pamir and India cannot be excluded as Ranov and Sidororo concluded, “On the south and south-west of the Pamir we find the well-known rich Palaeolithic sites of Punjab (…) H. de Terra’s previous works have led to the discovery of much later Mesolithic cultures. These industries, in our opinion, show a definite similarity with the Gissar culture” (works of de Terra et al. 1934, 1936; Teihrad de Chardin and de Terra 1936; Ranov and Sidororo, 1979, p. 176).

During the Holocene, the Southern Hindu Kush highest ranges were exposed to continental monsoons generating asynchronies well described for the Nanga Parbat (North Pakistan, Karakoram range, 440 km south of Kara Kul Lake; Fig. 2). When the sub-continental temperatures were increasing along with humidity, the high massifs of the South Karakoram and South Hindu Kush were exposed to strong monsoons and the glaciers advanced (William et al., 2000) whereas in the opposite, the Tibet plateau was influenced by, “Northern Hemisphere climate oscillations (rapid climate changes), with minor influences from the South Asian monsoon” (Seong et al., 2009). So, the coldest phases of the Indian Sub-continent were not necessarily restricting conditions for the North-Western Indian hunters to migrate to the Indus high valleys and reach the Wakhan Corridor.

2.3. Anthropological features

Only two Pleistocene human fossils are known in this huge palaeozoone from sub-Himalayan borderlands to Gissar Range. The first one is the famous Neandertal child excavated from the Teshik Tash rock-shelter (180 m) in Uzbekistan, and associated with a Mousterian lithic industry (Movius, 1953a,b). However, this Middle East or European technical tradition has never been recorded in the High Pamir. The second human fossil is the petrous bone from Darra-i-Kur rock-shelter (1300 m; Afghanistan). This fragmented bone is quite similar to the Middle East Protocromagnoids (Angel, 1972). Nevertheless the skull base developed particular features, for instance the important size of the foramen that corresponds to the vascularisation of the middle ear. The internal acoustic meatus (a neuro-vascular orifice) is thrice the normal size of that of Homo sapiens in cross section. This implies more oxygenised blood.

Besides, the imprint of an important muscle of the vocal tract, the fossa digastrica, is especially deep and indicates a powerful muscular system sustaining the larynx. The styloid bones are also robust as a part of this system sustaining the throat; some tendons and muscles fixed on the styloid bones help in opening the Eustachian tube to equalize middle-ear pressure with the outside atmospheric pressures in altitude. Therefore the biology was clearly adapted to the high altitude conditions and to important changes of the atmospheric pressure. The corpse was not discovered in its natural environment (1300 m) and the most frequent life conditions for this person were higher biotopes in Pamir or Hindu Kush (Dambricourt Malassé, 2008; Gaillard and Dambricourt Malassé, 2008). Only four Mesolithic skeletons are known from the excavated site of Tutkau: two women and two children. The skulls alone have been described. The adults had developed robust features and they cannot be related to any geographical type (Kiyatkina and Ranov, 1971; Dambricourt Malassé, 2008).
3. Hindu Kush: the Yarkhun Valley

The Gissar ‘enigma’ (Ranov, 1984) actually raises the question of the extent of hunting territories in the high massifs from the Final Pleistocene (major deglaciation) to the Middle Holocene, when fauna exposed to deterioration of the climatic conditions, was forced to withdraw in the lower valleys. The southward expansion of this territory was unknown, and that is why in 1996, 1997 and 1998 the authors explored one of the highest valleys of the Hindu Kush Range, between 2500 and 4000 m high (French—Pakistani missions funded by the French Ministry of Foreign Affairs).

The Yarkhun valley was selected for its upper reaches are directly connected with the Pjandzh River (Wakhan Corridor) through one of the lowest passes of the sector, the Boroghol Pass (3800 m; Fig. 1). The geology consists of metamorphic series including mainly marble, quartzite, micaschist, schist, gneiss, and amphibolites. After several days of walking, the first sites were discovered on the Yarkhun river terraces, 10–25 m above water level and about 400–1000 m away from the main river bed. All are open-air sites and yield only lithic industry. There are neither any organic remains, fire-places or settlement structures (Fig. 5).

Fig. 6. Stone tools of the Yarkhun valley (drawings by C. Gaillard).
From downstream to upstream along the upper Yarkhun River, six spots and sites were identified: Nakht Sir Dem (NAK): 3 artefacts, Shusht (SHT): 3 artefacts, Lasht-Savalior (SAV): 24 artefacts, Zeshtsh-o-Gutsh (ZTG), altitude 3350 m: 42 artefacts, Boroghhol-Chilmârâbâd (BOR), altitude 3650 m: 7 artefacts, Thinioupk (THI), altitude 3900 m: 18 artefacts.

Most of the tools are made in amphibolite (80%). Only in the upper reaches of the Yarkhun the quartzite is preferred. There are also a few tools in marble, but crystalline rocks such as gneiss and schist, the most common in the local landscape, were apparently not used. The large majority of the tools are core tools of rather large size; the smaller items, particularly cutting tools, are rare in these series and one can wonder whether there was no small cutting tool at all or whether they were made in other raw materials, such as schist for instance, of which all the natural fragments are cutting, or even wood. Many of the tools (56% at ZTG) are on cobbles, usually flat, others being on different types of blanks, especially flakes and small slabs. The flakes are always slightly abraded and it is possible that they were selected among the components of the gravel. The shaping of the tools is very light and does not modify much the original morphology of the blanks. Typologically, they are not well defined and only a few of them display standard morphologies occurring in different sites. These more standardised tools may deserve the names of axes or adzes, with triangular or rectangular outline (Fig. 6). In some cases the lateral sides are concave, either naturally or resulting from a large flake scar; these recall one type of the Aceramic Neolithic of Kashmir (“waisted tool”). Besides, there are a few choppers and chopping tools characterised by large and deep flake scars.

As far as chronology is concerned, it is difficult to assign an age to these sites, since the tools are usually lying on the surface or hardly buried in the deposit of the lowest terrace. They are slightly rolled and none of them is in mint condition, therefore they cannot be very recent (Fig. 7).

The only chronological reference is the Quaternary geomorphology. During the Last Glacial Maximum, the snowline in Hindu Kush was located at 900–1100 m high (Porter, 1985) and the bottom of the Yarkhun valley was covered by a glacier. The profile of the Boroghol Pass shows a typical glacial valley profile. Communication between both sides of the Hindu Kush Range (Wakhan and Chitral) was possible only by walking on the glaciers. Necessarily the artefacts are much more recent than Late Pleistocene.

When the valley is broad enough, a few terraces can be observed along the river (2–4). All along the Yarkhun, in the sector of Shusht and Lasht, the alluvium includes a conspicuous level of boulders (30–50 cm) bearing a dark brown patina. These brown boulders usually lie close to the Yarkhun water level. At the site of Zeshtsh-o-Gutsh, this level is well exposed on the bank and appears as a boulder conglomerate hardened by cementation of the sandy matrix (Fig. 8). Tentatively, this dark patination may be related to the “desert varnish” of the Batura glacial stage observed in the nearby Hunza valley (Derbyshire et al. 1984) dating to 10.8–9.0 ka BP (Owen et al., 2002; Lewis et al., 2002; Waragai, 2004). At Zeshtsh-o-Gutsh, lithic artefacts are resting on a loose grey gravel of unpatinated cobbles and devoid of any large boulders; this gravel covers the brown boulders.

The major deglaciation with the retreat of the Chitral–Yarkhun glacier generated huge terraces only visible in cross section in the lower course of the Yarkhun River. The faults between Pamir and Hindu Kush, two tectonic complexes characterized by intra-continental subductions between Hindu Kush and Pamirian plates (Negredo et al., 2007), could have been active and the tectonics...
could have contributed to change the regime of the Yarkhun, especially when the water level increased in the Himalayan fringes, as shown by a recent Franco–Nepal research program (Bettinelli et al., 2008). Nevertheless, considering the climate factors only, this occupation probably occurred after the major deglaciation ending the Batura glacial phase attested by the brown varnish on the boulders. The second terrace was formed during a climatic phase not easy to date. For instance advances of Nanga Parbat glacier appear to have resulted from an increase in precipitations during winter ca. 7000–5500 BP. In Bhutan the same phenomenon is observed ca. 6710–4680 BP (Meyer et al., 2009). This period corresponds to the North-Western Hindu Kush, this implies a new little glacial advance in the high valleys, which ended 5500 years ago when a cooling phase started again implying drier conditions, drop of snowfall and therefore reducing ice masses. In the Tibetan plateau “an abrupt shift to dry climatic conditions between 5000 and 4500 BP coincided with glacial decay” (Meyer et al., 2009). So it seems reasonable to date the grey cobble gravel terrace of the Yarkhun River to the Atlantic phase or to a later humid or warmer phase after 5500 years BP. The communication between the Amu Darya and Indus upper basins, separated by the Hindu Kush Range, again became theoretically possible since the second half of the Holocene and is attested for the first time by the discovery of archaeological stations in the Yarkhun Valley dating no more than the 6th millennium (Gaillard et al., 2002; Fig. 9). The same pattern has been recently observed in Bhutan “the sudden disappearance of juniper and rhododendron pollen, the immediate onset of pollen input from cereals and a clear pattern of over-grazing, trampling and peat deterioration can be linked to human arrival in the valleys at ca. 4280 ± 130 cal BP” (Meyer et al., 2009).

To conclude, nomadic hunters occupied not only the Eastern Pamir as in Alichur or Murgab Valleys, but also the Hindu Kush as in the Yarkhun valley, with possible access between the two through passes such as Boroghol Pass. From where did these populations come and where did they live during winter, is the actual question. There were no reasons for them to limit their territories to the Pamir: Epipalaeolithic and Mesolithic activities are equally attested in the lower valleys of the southern Hindu Kush.

4. The Siwaliks and Kashmir

The same pattern as the Hissar cultural transition or acculturation is observed in the nearby Swat Valley in the rock shelter site of Ghaligai (Fig. 1). This site offers a sequence of seven major periods of which the earliest provides an industry mostly comprising pebbles and flakes (Stacul, 1984). The overlying level yields fine wheel-thrown pottery attesting a complete cultural change. Three 

\[ ^14 \text{C} \] dates give an age of 4970–4930 BP. “The stone artefacts are all made from pebbles (...) there are also tools made from animal bones. Animal remains include antler and boar tusks, and lead us to think that in this period those who frequented the shelter practised hunting” (Sharif and Thapar, 1999). The authors conclude that the Ghaliagai Neolithic belongs to a single complex, also including Sarai Kala near Taxila and Burzahom in Kashmir, both located on the eastern side of the Indus.

A few stratified Neolithic settlements are known in the Srinagar Valley of Kashmir, especially at Burzahom (Indian Archaeology, a Review (I.A.R.), 1961–1962, 1964–1965) and Gufkral (Sharma, 1982a,b; Fig. 1). These sites are imbedded in the top of a loess sequence, developed in the valley since 300 ka (Singhvi et al., 1987), but believed to be devoid of any Palaeolithic remains. Worth noting in the Srinagar Valley is the occurrence of an Aceramic Neolithic phase before the Neolithic proper. This cultural phase without pottery is identified in stratigraphy at Gufkral (Sharma, 1982a,b), Kanshiro and in several small localities. The lithic industry of this phase includes different types of stone tools and at some places large split cobbles that were first attributed to the Palaeolithic but actually are Neolithic (Pant et al., 1982).

5. Discussion and conclusion

Human occupation on the Western Himalayan fringes is attested at least 2 Ma ago, as shown by the flakes from Riwat in the Potwar plateau (Siwaliks, Pakistan). Human occupation is known in Eastern China around 2 Ma in the Renzi cave—Renzidong (Huang, 1999; Dong, 2006) and future investigations will probably discover equally old human settlements in early Indian Pleistocene formations (Dambricourt Malassé, 2009). The Himalayas and Tibet Plateau were 2700 m below the present altitude when the first human populations began to move between India and Western China. Later, migrations depended on the climate because of the elevation and formation of new natural barriers such as the glaciers during the maximum of glacial periods. In the loess deposits of Southern Tajikistan (pedocomplex 12–11, 900–950 ka), human settlements were favoured by a warmer/wetter climatic stage and the associated lithic technology was mainly based on the production of small flakes. In the Siwaliks, lithic assemblages composed of flakes and cores on cobbles indicate human activity much before 1 Ma (Pabbi Hills). Then, around 1 Ma the rich fauna started disappearing (Nanda, 2002, 2008) while the first conglomeratic fans accumulated down slope as a consequence of an important uplift of the mountain range. Soon after, the severe global cooling down and change in the glacial—interglacial periodicity disturbed the ecosystems.

The Acheulian technical tradition occurring in peninsular India since 1.2 Ma (Paddayya et al., 2002) probably arrived in the sub-Himalayan lands during this Pleistocene ecosystemic crisis (Rendell and Dennell, 1985), but sites are few and no archaeological record indicates a long and local evolution. The Acheulian is totally missing in the loess sequences of Tajikistan where native populations continued to mainly produce flakes and cobble tools. The Acheulian technology did not cross the mountainous massif. Therefore the Hindu Kush seems to have been a natural barrier during Lower and Middle Pleistocene, even in the interglacial periods. However, as in southern Tajikistan, the cobble tool component never disappeared from the Northwestern Indian lithic industries before the Middle Holocene: it occurs in the Acheulian assemblages (Gaillard et al., 2008) as well as in the probably much later Soanian assemblages (Gaillard et al., this issue). Obviously the increasing abundance of...
quartzite cobbles resulting from the dismantlement of the Himalayas and spreading in vast alluvial fans, were encouraging the production of cobbles tools and flakes.

The major deglaciation occurred during Early Holocene, as attested in the high massifs, Himalayas, Hindu Kush, Pamir and Tibetan Plateau. “Deglaciation in the mountain ranges of the Himalayas and the consequent meltwater discharge into the adjacent seas was negligible immediately after the global LGM and it was therefore of minor importance as a forcing factor for global climate change during the end of the last glacial cycle. However, our studies show that glaciation and particularly deglaciation is important in controlling the deposition of thick valley fills and the landscape evolution of the high mountain environments” (Owen et al., 2002). During the glacial phases the Hindu Kush Range was probably an “ice barrier” between the Anu Darya and Indus upper basins. Nevertheless, whereas exogenous traditions reached the foothills on both sides at different periods, Acheulian in the South, MoUSTERIAN (naming of Ranov) in the North, none of them developed. Only the cobbles tool tradition (at least the cobble tool element) persisted beyond the neolithisation, eventually crossing the barrier of the Hindu Kush as Gupta (1979) suggested previously, when passes were ice-free.

The data suggest that the hunting territory in high plateaus was a biotope exploited during summer, since the Late Pleistocene, by Central Asian hunters and that a huge territory opened from the second half of the Holocene, including lower valleys not only such as Gissar and Afghan Badakhshan, but also Chitrál, Swat, Indus and maybe other regions awaiting further investigations in Himalayas and Western China. Without those movements which allowed interbreeding between the tribes, the genetic variability would have declined.

But the most important event is that, after having for at least 2 million years, exposed to predators, climate changes, faunal extinction, earthquakes, high altitude conditions, living in the lower valleys of the highest massifs of the earth, crossing the highest plateaus, hunting in the forest, knitting cobbles to make their tools, this way of life disappeared suddenly about 5000 years ago. The high valleys were their summer hunting territories but in winter they probably returned in the lower valleys. The new event which occurred around 5000 years ago was pastoralism and the extensive exploitation of wood. Observing the ecosystem in the south of the Yarkhun valley (Chitral), Miehe et al. (2009) raise the question of the deforestation and ask which Neolithic factors have generated a deregulation of the mountainous climate. Besides the possibilities of shifting to agricultural or pastoral economies, a third hypothesis regarding the disappearance of the last central Asian hunters-gatherers is their extinction caused by endemism in relation with the forest retreat in the low altitude zones.

References


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9

Please cite this article in press as: Dambricourt Malassé, A., Gaillard, C., Relations between climatic changes and prehistoric human migrations during Holocene..., Quaternary International (2010), doi:10.1016/j.quaint.2010.04.001