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NEANDERTHAL ADAPTATIONS IN CENTRAL ASIA AND THE PEOPLING OF EURASIA: INSIGHTS FROM A MULTIDISCIPLINARY INVESTIGATION OF THE OBI-RAKHMAT SITE (UZBEKISTAN)

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#S1#Abstract

This article presents the results of a zooarchaeological study of the faunal remains from a key prehistoric site in Central Asia for the understanding of the peopling of Eurasia by Neanderthals and modern humans and the origins of the Upper Palaeolithic, Obi-Rakhmat (Uzbekistan). The site is of particular interest for its peculiar lithic material associated to a long, and well dated, stratigraphy, which includes the period corresponding to the Middle to Upper Palaeolithic transition. In addition, the presence of bones, which are usually not preserved in the Palaeolithic sites of this region, due to the sedimentological and depositional context and arch climatic conditions.

This paper focuses on a taphonomical, zooarchaeological and typo-technological study, of the osseous and lithic remains from the layer 16 of the Obi-Rakhmat site. This study allows reconstructing the environment and the subsistence behaviours of the populations that left the remains found in this layer 16.

The implications of the site for the global understanding of Neanderthal in his easternmost habitats, as well as his dismiss is discussed. More generally the apparent long and persistent presence of Neanderthal in Central Asia will be considered, and other possible scenarios affecting the general current models of the peopling of Eurasia by modern humans and the origins of the Upper Palaeolithic will be proposed.

Keywords: Central Asia, Obi-Rakhmat, Middle/Upper Palaeolithic, peopling

#S2#Introduction

The transition between the Middle and Upper Palaeolithic (thereafter MP/UP) takes place during the Wechselian Interpleniglacial (or MIS 3), with a generally fairly temperate and humid climate marked by three colder events known as the Heinrich events. In the center of the Eurasian continent, this MP/UP transition is characterised by the appearance of new lithic and bone industries called transition industries (Chabai, 1998; Chabai et al., 2004; Derevianko, 2001; Derevianko et al., 2000; Marks, 1998; Zwyns and Viola, 2014) and by the presence of three human species - Neanderthals, Denisovians and the first Anatomically Modern Humans (thereafter AMH) (Krause et al., 2007; Trinkaus, 2005, 2006; Vishnyatsky, 2004). In this vast geographical area, the modalities of the arrival(s) and dispersal(s) of AMH and their associated cultural traditions are still relatively poorly known, as are their possible biological and cultural interactions with Neanderthals and/or Denisovians. Research on subsistence behaviour of the last Neanderthal societies of Eurasia has shown that some populations had a lastingly stabilised relationship with their environment (i.e. persistency of territories and behaviour) (Chabai and Patou-Mathis, 2009; Patou-Mathis and Chabai, 2005; Patou-Mathis et al., in press.) while other populations did undergone economic and socio-cultural changes (i.e. new *savoir faire* and territories) (Derevianko, 2001; Hublin et al., 2020)

Based on a diachronic and synchronic study of animal resource management modalities, both for dietary and non-dietary purposes, we attempt here to characterize the subsistence behaviours of the easternmost Neanderthal populations, in relation to those attributed to the first AMH and, as well as, between different so-called transition techno-complexes. We will draw on the study of subsistence behaviour in one site in Uzbekistan (Obi-Rakhmat). Placed in their ecological and cultural contexts, we will discuss the contributions of these data to the debate that animates the scientific

community today, the question of the MP/UP transition in these regions still not really investigated.

#S3#Study setting

The Obi-Rakhmat site (thereafter O-R) is located in central Asia, on the foothills of the Western Chatkal Mountains in North-Eastern Uzbekistan (fig. 1a). Located twelve hundred meters above sea level, the site is a collapsed cave which is now a small rock shelter (fig. 1b-c). The entrance is facing south in direction of a canyon drained by a river. The site is drained all year long by a natural spring. Archaeological investigations were performed during the 1960's by the Uzbek institute of archaeology and since the late 1990's by the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences. Andrei Krivoshapkin directed the last excavation's campaigns and researches.

In the region most Palaeolithic sites correspond to open-air sites with single archaeological layer, and long stratigraphical deposits are really rare in the area. In this context, the peculiarity of the O-R site is to have preserved an impressive 10 meters high sedimentary sequence, composed of 22 archaeological layers (Mallol et al., 2009) (fig. 1c; 2a-b).

Different radiometric dating methods have been applied to investigate the chronology of the O-R deposits, including AMS, U-series, ESR and OSL. The chronology of the sequence is now well known (fig. 2a), with the top of the sequence (i.e. the top four layers) younger than 40 000 BP, the layer 5 to 14 dated of between 40 and 50 000 BP, and the layer 15 to 22 older than 50 000 B.P down to about 80 000 BP (Blackwel et al., 2006; Krivoshapkin et al., 2010; Skinner et al.2007; Wrinn et al., 2004).

The lithic industry of the site is composed of a mix of Middle and Upper Palaeolithic tool types (fig. 2c), such as numerous points of different morphology (including

elongated Levallois points), burins, side-scrapers on blades. Core reduction demonstrates a combination of strategies characterizing the Middle and the Upper Palaeolithic, mostly aimed to blade and bladelet production (Krivoshapkin et al., 2006).

In addition, close to 150 human remains, have been discovered with the faunal remains in layer 16. The different studies performed on the specimen shows that the cranial and dental remains belong to a juvenile (Bailey et al., 2008; Glantz et al. 2004; Glantz et al., 2008; Smith et al., 2011). The cranial remains present features more characteristic of modern human, while the more archaic morphology of the teeth suggests the dentition is essentially Neanderthal. This mix of characters is usually found in Neanderthal juveniles, making the specimen one of the easternmost known Neanderthal.

#S4#Material and Method

The main part of the collected archaeological remains of the site is composed of faunal remains. A large part of the faunal collection was studied and partly published by P. Wrinn for his dissertation comprising the first part of the excavation campaign (Wrinn, 2004). We studied all the material from the excavation performed by A. Krivoshapkin between 1998 and 2012, corresponding to the first complete study of the faunal material from O-R.

Here our study focuses on the bone remains from layer 16, in which were found the human remains attributed to Neanderthal. Discovered in the summer 2003, those hominin remains correspond to the first additions to the human fossil record from Uzbekistan in over 65 years. We studied all excavated faunal remains excavated in 1999 (Derevianko's excavations) and in 2000-2006 (Krivoshapkin's excavation campaigns).

No direct datation were performed directly on the layer 16, however, datations were done on layer 14 and gave a upper limits at 48.8 ky uncal AMS, and a lower limit for the layer 19 between 50 to 80 ky by ESR (Blackwell et al., 2006; Skinner et al., 2007; Wrinn et al., 2004) (fig. 2a).

Taphonomical, paleoecological and archaeozoological approaches were applied to the study of the faunal material. Bones are described following different parameters like the total Number of Remains (NR), the total Number of Identified Specimens (NISP) and the combined Minimal Number of Individuals (cMNI) (Brugal et al.; 1984; Binford, 1981; Bunn, 1983; Lyman, 1994). Taphonomical analysis is based on the lecture of alteration marks from climate-edaphic or biological (including anthropogenic modifications). We have used several archaeological, experimental or actualistic referential to identify each kind of stigmatas (Andrews and Cook, 1985; Behrensmeyer, 1978; Gifford, 1978, Lyman, 1984; Patou-Mathis, 1997; Shipman and Rose, 1988; Villa and Mahieu, 1991). Material was also determinate thanks to the use of the comparative faunal collection from the Institute of Archaeology of Novosibirsk.

#S5#Results

Faunal Spectrum

The faunal bone collection of the site is particularly rich, with more than 100 000 remains recorded. The faunal remains are present in all layers, but 80% of the material is coming from the lower layers 12 to 21 (Patou-Mathis et al., in press).

Very few species are present, with no major change through the sequence (fig. 3). Two species are omnipresent in all layers: *Capra sibirica*, the large Siberian ibex, and *Cervus cf. elaphus*, the Red deer. Siberian ibex and deer are always the most numerous, in both, number of remains and number of individuals.

Other ungulates are: roe deer and wild boar, present mostly in the lower part of the sequence, but only represented by a few remains. Marmot and hare are also present

in the lower part of the sequence. Carnivores' remains are very rare; the most common being the golden jackal and the fox. Cave lion is present only in layer 9 and 20; hyena, only in layer 21. A possible snow leopard is present in layer 15. A few bear remains were found in layers 19 and 21 (fig.3).

Layer 16 is relatively poor in bones, a total of 2 552 remains of which 2 363 are indeterminate (92.6%), even if close to 25 m² where excavated. They belong to at least 12 individuals. Among the 189 determined bones, the ibexes predominate (34.4%) (tab. 1). The presence of red deer, roe deer, wild boar, golden jackal and hare was also identified, to which four small bird bone fragments (tab. 1) were added. There is a good representation of forest taxa (red deer, roe deer and wild boar).

Taphonomy

The material is very fragmented, more than 88% of the bones have an equal or inferior length to 2 cm. This fragmentation is mainly due of the Weathering stage which conducts to production of elongated fragment of bones. The preservation of the surface of the remains is relatively good. Although, the climatic edaphic agents are scarce (0.7% of the NR), these are essentially those due to the percolation (mainly manganese deposition). The action of plant roots is negligible, no rodents and carnivores are absent. This would indicate this level was not used as a carnivore den, and that they did not come at all.

We can therefore conclude that the climate was relatively temperate and humid. Weathering indicates moderate weathering of sub-surface of the remains with a regular relatively quick sedimentation rate.

The relatively high percentage of bones with anthropogenic markings (10.01% of the NR) is due to the high presence of burned bone (242 remains, i.e 94.5%, distributed on all excavated square). Six flakes and six bones with percussion stigma on fresh bone attest to the recovery of the long bone marrow from ibex. Only two bones bear marks

of butchery, an undetermined long bone diaphysis and one radius of ibex. Corresponding to defleshing, they both come from square II7.

Skeletal representation

Ibex

The ibex is present by 66 remains belonging to at least 5 individuals: 2 young, 1 sub-adult, 1 young adult and 1 elderly adult. The mortality observed does not correspond to a natural profile and could correspond to an anthropogenic hunting profile since the carnivores had no role in the origin and the history of the bone assembly of the layer 16. The majority of the bones belong to the cranial skeleton (34) and to the autopod (28) (fig. 4). The last four remains are attached to the upper part of the anterior limbs. The postcranial skeleton makes it possible to identify the presence of a minimum of two individuals: a young and an adult *sensu lato*. A radius (fig. 5) and a metapodial diaphysis, as well as two proximal phalanxes present stigmata of anthropic breakage. This suggests that the meat and marrow of the long bones of at least two ibexes have been consumed. Ibex remains are present on all square excavated without any clear concentration zone.

Roe deer

The roe deer is represented by 15 bones attributed to at least one adult individual *sensu lato*. The cranial remains are absent. The postcranial skeleton is represented by an element of the spine (head of the rib), a diaphysis of humerus and 13 fragments of eight bones of the autopod. The distal end of a proximal phalanx is burned. It is probable that this individual was brought whole to the cave and consumed by Man . Those bones are mainly concentrated on square H/M-6/7.

Medium size ungulates

Moreover, 92 remains belong to their dimensions probably to the ibex and/or roe deer. These are mostly bones of the axial skeleton (mainly fragments of ribs, vertebrae and

pelvis) and autopod. This relativizes the absence or the scarcity of these skeletal elements observed for these two taxa. Among this material we identified the presence of a newborn from a germ of a decidual and two fragments of long bones. This indicates a death of this individual at the beginning of the summer period.

Other mammals

As for the other remains, ten remains correspond to at least one sub-adult deer: two teeth and 8 fragments of bones (corresponding to 5 bones) of the autopod. A lower right incisor attests the presence of a wild boar, probably a female. A canid, attributed with reserve to the golden jackal, is represented by a first adult upper left premolar. Finally, a hare was identified by a cuboid fragment.

#S6#Human remains

The remains consist of six isolated (5 left and 1 right) permanent maxillary teeth (incisor, canine, two premolar and two molar) and over 121 cranial fragments (parietal, frontal, temporal, petrous, vault) recovered from stratum 16; they were all adjacent to the southern wall of the central 10 m deep pit (Bailey et al., 2008, Glantz et al., 2004, 2008; Smith et al., 2011) (fig. 1c). Their recovery, partially *in situ* and from the screening of the sediment, supports a strong spatial association of the remains in only a unique square meter (H8) (fig. 6).

Anthropologist concludes that the most parsimonious interpretation of the O-R material is that it represents a single individual of roughly 9-12 years of age (Bailey et al., 2008). The 121 cranial pieces, highly fragmentary, offer no clear indication of duplicate bones or those they are distinct in terms of their morphometric or development from the six isolated permanent maxillary teeth. Age estimates are derived, instead, from an examination of relative root development and degree of dental wear.

Mosaic morphological patterns are those which express a mix of archaic and modern features and typically, in the absence of key anatomical areas like the mental symphysis, resist taxonomic identification. In sum, at the present level of analysis, it is impossible to definitively determine whether OR-1 is a modern human, in the sense of Qafzeh and Skhul, or a Neanderthal. (Bailey *et al.* 2008; Glantz *et al.*, 2008; Smith *et al.*, 2011)

Few elements of taphonomy on human remains

The preservation of the hominin cranial fragments is quite heterogeneous. Some fragments exhibit dark grey or black stains (manganese deposits) when most of them are close to yellow or white colour (Glantz *et al.*, 2008). The surface is relatively well preserved while in others the external surface is much altered, as it was observed on faunal remains. Most of the fracture angles resulted from post-depositional processes on dry bones, although if few remains show curved bone margins. Edge rounding is also present in some fragments (fig. 6).

Globally, the different taphonomical agents observed on the human remains shows the same characteristics than faunal remains and didn't look to have any independent evolution than other bones.

Despite the relatively heterogeneous preservation, no fragments are duplicated and it is possible to refit several fragments that look very different in their preservation even if the absence of mandible (as well as the inferior teeth) has to be noticed.

We interpret this as an indication of the fragmentation of the cranium occurring shortly after its deposition thereby some fragments were exposed to different post-depositional influences on sub-surface despite their spatial proximity to each other. The absence of other human remains among the bones in layer 16 seems surprising, however, especially since a large area has been opened up in the immediate vicinity of these remains during several excavation campaigns.

The question of a possible secondary deposit of one skull cap of a young adolescent in a specific sector (square H8) and a low fragmentation and alteration rate in a third time, seems to be a parsimonious proposition, even if, without a more complete excavation of this cave, we couldn't conclude with any certitude.

In conclusion, for this layer 16, even if this assemblage is not the richest one in term of remains, it shows a classical subsistence behavior for the sequence of O-R with few activities oriented mainly on butchery during a short summer hunting camp for mid-size game (mainly ibex or red deer).

#S7#Discussion and conclusion

The Obi-Rakhmat deposit is an exceptional testimony of recurrent human occupation over several tens of thousands of years in a mid-mountain context. The quality, diversity and preservation of the remains make it an important site for trying to understand how different waves of human populations developed and adapted in Central Asia.

Excavations of O-R have uncovered 22 archaeological layers. The upper part of the filling was dated between 36 and 41, 4 ky BP (layer 7) and 48.8 ky BP (l.14) and the lower layers (l.15 to l.22) from over 50 ky BP up to about 80 ky BP (Blackwell et al., 2006; Krivoshapkin et al., 2010; Skinner et al., 2007; Wrinn et al., 2004).

The lithic assemblages of all layers of O-R show similar characters between the late Middle Palaeolithic blade industries and the early Late Middle Palaeolithic techno-complexes of Southwest Asia and the Altai Mountains in Siberia; this may reflect the gradual transition from the Middle Palaeolithic to the Late Palaeolithic in the western part of Central Asia (Derevianko, 2001; Krivoshapkin et al., 2010) or a variant of the recent Middle Palaeolithic (Vishnyatsky, 2004).

The occurrence of the more forested species at O-R seems to result from the presence of forests in the vicinity of the site in the lower part of the sequence. Their absence

seems to result from an extension of the steppic vegetation in the upper part of the sequence. These analysis shows different depositional environments between the bottom and the top of the sequence with more cold and arid conditions in the upper levels and more temperate climatic conditions in the lower layers, characterized by the development of soils reported by the sedimentological and palynological studies (Mallol *et al.*, 2009).

In the mountains of Central Asia, along the O-R sequence, we do not observe any noticeable change in subsistence behaviour. During several thousand years, an impressive resilience of subsistence behaviours where few differences appears to be likely more linked with the global climatic and environmental changes (which conducted to shorter occupations) than with some clear or abrupt cultural or traditional changes.

In all likelihood, this shelter, at an altitude of 1,250 m, whose occupations appear to be mainly of short duration, has been used on numerous occasions as a mountain hunting camp. The singularity of the layer 16 is the presence of human remains showing a mixture of Neanderthal and modern traits, characteristic of juveniles (Bailey *et al.*, 2008; Glantz *et al.*, 2008, Smith *et al.*, 2011). Moreover, a detailed understanding of the origin and history of that bone accumulation, allow proposing that the context of deposition of the human remains within the archaeological remains is not random and likely corresponds to the deposition of a human skull (without the mandible) in the living area.

In a large regional scale around the site of O-R, different sub-contemporaneous human species have been recognized: Neanderthals at Teshik-Tash (Glantz *et al.*, 2009), O-R and Aman-Kutan (presence of one human distal femur dated at about 50 ky) in Uzbekistan; Denisova, Okladnikov and Chagyrskaya in Altai (associated with Sibiryachikhian culture); and perhaps at Khudji (with a child incisor dated at 37-38 ky

uncal) in Tadjikistan (Okladnikov, 1940; Ranov and Schafer, 2000; Trinkaus et al., 2000, Vishnyatsky, 1999).

In addition, few remains of AMH were excavated at Anghilak in Uzbekistan (Glantz et al., 2003), and Denisovians at Denisova. (Altai) (Buzhilova et al., 2017; Douka et al., 2017; Derevianko, 2006; Derevianko and Shunkov, 2002; Derevianko et al., 2000).

Furthermore, the mitochondrial DNA sequences of Teshik-Tash are close to those of the Neanderthals in Europe, they seem to be more closely related to those of Scladina than to those of Okladnikov (Altai), which is geographically closer. The "eastern" Neanderthals and the European Neanderthals are thus said to have separated relatively late (Glantz et al., 2009). This would also confirm the late arrival of the Neanderthals in Central Asia and Siberia, probably during the Last Interglacial (Krause et al., 2007; Peyregne et al., 2019; Prufer et al.; 2013).

If, despite some Neanderthal characteristics, the fifth right metatarsal, discovered in 2002 in the Anghilak cave in southern Uzbekistan, does indeed belong to a modern human, the AMH were already present in this region between 43,000 and 39,000 years ago. This bone was also associated with a Mousterian lithic industry.

The mixed component of the lithic industry at O-R points to a complex genesis of the Obirakhmatian culture, perhaps reflecting cultural interactions between different human populations. The absence of clear behavioural change through the sequence, pointed by both the fauna and the lithic, makes O-R of particular interest for our understanding of the Middle to Upper Palaeolithic transition (or actually the absence of a clear transition) in Central Asia. Unless, it's a technical-economic characteristic related, among other things, to the specialized function of the site (hunting camp).

Various researchers have proposed that at least two major waves of AMH migration to Eurasia have taken place; a first wave of migration to the East about 70 or 80 000 years ago, with a probable cohabitation of different types of humans in Central Asia, and a second wave to the West 45 000 years ago, of populations possibly carrying

Neanderthal genes, and a territorial cohabitation with Neanderthals and Denisovians (Buzhilova et al., 2017; Zwyns et al., 2019).

In some areas, the cultural tradition seems to have evolved independently of the different waves of migration, which could be due to the function of the sites on this specific territory of the Tian-Chan mountain slope.

In any case, this territory of Central Asia must be understood with a specific regional model of evolution and not be directly compared with other regions of Europe or Middle East region in terms of cultural traditions or peopling by different humanities.

More work will be necessary to fully understand the human occupation at this site and its significance in this key region for the peopling of Eurasia by Modern Humans and the emergence(s) of the Upper Palaeolithic. These questions remain open and our initial research shows the need to pursue studies in these regions where several humanities have succeeded one another and have probably coexisted at certain times and in certain territories where they have been able to influence one another.

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#S9#Acknowledgments

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