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Who Were the Chagyrskaya Neanderthals? The Possibility of Their Dispersal Across Central Asia and Southern Siberia

My article in the previous issue, based on findings of archaeological excavations of Paleolithic sites in the Altai, primarily in Denisova Cave, as well as facts concerning the time of origin of Neanderthal anatomy and genetics in Europe, challenged the view, based on the genetic analysis of the Altaian Neanderthals, that they had migrated to the Altai before 175 ka BP and occupied Denisova Cave by turns with Denisovans. In fact, the Neanderthal occupation of the Altai began apparently no earlier than 60 ka BP. Thus far, Neanderthal fossils with a Micoquian Mousteroid industry have been found in three caves: Chagyrskaya, Okladnikov, and Strashnaya. This group of Neanderthals, evidencing the easternmost dispersal wave of those humans in Asia, was termed the Chagyrskaya group.

Keywords: *Chagyrskaya Neanderthals, Obi-Rakhmat, Teshik-Tash, Micoquian, Mousterian, H. s. denisovan, Middle and Upper Paleolithic.*

Introduction

In the late 20th to early 21st centuries, researchers of the Paleolithic of the Altai and adjacent regions in Southern Siberia associated all the Middle Paleolithic industries recovered from Paleolithic sites, including Denisova Cave, with Neanderthals. It was reasonable, because only one taxon—*H. neanderthalensis*—has been known in the European Paleolithic in the Late Middle to the first half of the Upper Pleistocene. The Early Paleolithic industry was attributed to *H. erectus* and *H. heidelbergensis*, and the Middle Paleolithic industry to Neanderthals. The discovery in 1983 of Okladnikov Cave with a Mousterian industry dating back to 45–40 (37) ka BP (Derevianko, Markin, 1992) has enabled the identification of two lithic industries that existed in the Late Pleistocene in the Altai—the Middle Paleolithic industry in Denisova Cave and the industry typologically close to the Mousterian of European Neanderthals in Okladnikov Cave. The genetic analysis of DNA extracted from anthropological remains from Okladnikov Cave has shown that it was inhabited by Neanderthals (Krause et al., 2007). The DNA sequencing of the fossil (Denisova 3) from Denisova Cave led to the discovery of a previously unknown taxon, Denisovan, which was genetically distinct from both anatomically modern humans and Neanderthals (Krause et al., 2010; Reich et al., 2010). In 2007, S.V. Markin discovered Chagyrskaya Cave, containing Neanderthal remains dating to 60 (55)–45 ka BP and associated with the Mousterian industry (Derevianko, Markin, Zykin, 2008, 2009; Derevianko, Markin, Zykin et al., 2013;

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Derevianko, Markin, Kolobova et al., 2018). The lithic industries of Denisovans and Chagyrskaya Neanderthals differed from one another by the main technical and typological indicators of primary reduction, toolkit composition, and tool production techniques (Derevianko, 2001, 2009; Derevianko, Shunkov, Agadjanian et al., 2003).

Chagyrskaya Neanderthals started to disperse in the Altai ca 60 ka ago; their lithic industry was termed Sibiryachikha. The homogeneity of the industry of Chagyrskaya Neanderthals who settled in Okladnikov and Chagyrskaya caves is manifested mainly in the primary reduction (selection of raw materials, preparation of cores for knapping, and production of blanks—mainly flakes of various sizes).

The typological basis of Sibiryachikha toolkits is formed by side-scrapers and *déjeté* tools. The bilaterally worked tools (bifaces) serve as diagnostic elements of the Sibiryachikha lithic industry. The largest number of bifacial tools was found in Chagyrskaya Cave (Derevianko, Markin, Kolobova et al., 2018). According to the researchers, morphological structure of the bifacial tools was dominated by foliate bifaces; there are also segment-shaped, trapezoid, and triangular bifaces. In terms of general morphometric characteristics, bilaterally worked tools are subdivided into bifacial side-scrapers and points. The collection also includes a group of backed knives-scrapers that can be attributed to the Keilmesser backed knives—the marker of the Eastern European Micoquian (Shalagina et al., 2019). In general, the Sibiryachikha industry should be considered as a variant of the Micoquian Mousteroid industry.

The Chagyrskaya and Okladnikov cave sites were seasonal camps of hunter-gatherers, who hunted wild animals in the Charysh and Sibiryachikha valleys and butchered their prey at the sites. Judging by the composition of the large mammal fauna in the Altai, the main object of hunting for the Chagyrskaya inhabitants was bison (54 %), mainly half-adult individuals and females. Some bones bear cut marks produced by the stone tools of Chagyrskaya people. Bison hunting was most likely seasonal, and could have been timed to coincide with the annual migrations of *Bison priscus* herds in the Charysh valley (Derevianko, Markin, Kolobova et al., 2018).

The economic activity of the Chagyrskaya Neanderthals populating Okladnikov Cave was associated with hunting large animals, mainly horses, argali, rhinoceros, bison, and red deer. A significant part of the tools from this site show signs associated with butchering hunting prey.

Who were the Chagyrskaya Neanderthals, what were their origins and dispersal area in Central Asia and Southern Siberia?

Morphology of postcranial remains of the Chagyrskaya Neanderthals

In the Okladnikov Cave bone collection, A.P. Buzhilova (2013) identified the remains of at least two children, one adolescent, and one adult. The researcher believes that the latter two individuals may be of different sexes. The fragments of child bones (Okladnikov 7, 8, and 10) probably belonged to a single juvenile individual (9–12 years old). The two lower dental germs of the third molar M_3 (Okladnikov 4 and 5) correspond to one stage of development, with enamel hypoplasia reaching 1.7–2.0 mm above the tooth neck. Similar age characteristics and identical stress indicators suggest that the teeth belonged to the single individual (Ibid.).

Chagyrskaya Cave yielded remains of five adult individuals. Four isolated deciduous teeth (Chagyrskaya 1, 18, 19, and 20) were lost naturally, so theoretically these could have belonged either to a single adolescent or four different children of various ages (Derevianko, Markin, Kolobova et al., 2018).

Various laboratory studies of the comparatively small number of anthropological finds from the Altai Paleolithic sites have provided a significant amount of analytical data on the morphology of both Denisovans and Chagyrskaya Neanderthals (Viola, 2009; Viola et al., 2011, 2012; Dobrovolskaya, Tiunov, 2011; Mednikova, 2011a, b; 2013a, b; Buzhilova, 2013; Dobrovolskaya, Tiunov, 2013; Mednikova et al., 2013; Dobrovolskaya, Mednikova, 2015).

Remains of the dental system are among the most informative anthropological finds. In Okladnikov and Chagyrskaya caves, teeth of Chagyrskaya Neanderthals of various ages were found; and in Chagyrskaya Cave, also a mandible fragment. Five teeth of adolescents 12–14 years old and children 5–7 years old were recovered from the culture-bearing layers of Okladnikov Cave: the second lower right primary molar m_2 (layer 7), the first lower left premolar P_1, the first (second?) lower left permanent molar $M_{1(2?)}$, the third lower right permanent molar M_3 (layer 3), and the third lower left permanent molar M_3 (layer 2). These finds has revealed the important information relevant to the succession of habitation of the Altai region by representatives of the genus *Homo*. The recovered dental remains were examined by several experts in

physical anthropology, who produced three different interpretations of the taxonomic affiliation of the finds.

According to C. Turner's interpretation, the teeth from Okladnikov Cave bear several markedly Neanderthal features and are more similar to those of European rather than Asian *Homo sapiens neanderthalensis* (Turner, 1988, 1990a, b). V.P. Alekseev studied these fossils later and concluded that their small number and state of preservation do not allow the unambiguous taxonomic diagnosis. In his view, their morphological features are compatible with the hypothesis that they represent anatomically modern humans (Alekseev, 1998).

The dental remains from Okladnikov Cave were later also studied by other anthropologists. All experts noted the difficulty of interpreting the finds. B. Viola noted archaic and Neanderthal features, which were emphasized by a complex occlusal surface, specifically by a complicated pattern of grooves, a marked anterior fossa and the sixth cusp. On the other hand, the first molar from Okladnikov Cave has no epicristid (Zubov, 1992), which is a characteristic feature of Neanderthals (96 % according to S. Bailey (2002)). Viola argued that the third molars of another individual from the same cave demonstrated incomplete formation of the crests, which indirectly indicates the presence of an epicristid. The results of microtomography and virtual 3D reconstruction of the lower permanent molars from Okladnikov Cave allowed the researcher to identify the epicristid on the enamel-dentine junction. Citing a summary by Bailey (2002), Viola emphasizes that this feature brings the finds closer to Neanderthal teeth (2009: 133).

Viola examined two teeth from Chagyrskaya Cave and, despite the incomplete preservation and the obvious crown wear, came to the conclusion that the inhabitants of the cave belonged to the Neanderthal physical type (Viola et al., 2011). The team of authors published the results of a preliminary analysis of the mandible fragment with the teeth found *in situ*: a canine, two premolars, and two molars. The moderate crown wear made it possible to identify the presence of anterior fossa and epicristid on the molars, and the development of metaconid and crest (typical of the Neanderthal dental complex) on the premolars. The researchers believed that this finding linked the Altai hominins with the Neanderthals of Western Europe (Viola et al., 2012).

A.P. Buzhilova (2011, 2013) has carried out the most comprehensive study of the dental remains from Okladnikov and Chagyrskaya caves (excavations of 2008–2012). The analytical data on teeth from these sites were compared with those from Strashnaya and Denisova caves.

A.P. Buzhilova analyzed the available comparatively small collection of fragmented fossils and came to a number of very important conclusions. I will dwell on some of them. The comparative analysis has allowed the scholar to state that Neanderthals from Chagyrskaya Cave occupied an intermediate position between other Eurasian Neanderthals and anatomically modern humans in terms of the diameters of crowns of deciduous teeth. The analysis of the front deciduous teeth revealed a tendency of possible continuity between the Chagyrskaya Neanderthals and certain groups of the Upper Paleolithic population of Siberia (Listvenka, Strashnaya); the findings on the category of molars suggested their proximity to the robust Upper Paleolithic forms of Europe and partly Siberia (Malta). However, further studies are required to clarify these conclusions.

In general, according to Buzhilova, the teeth from Okladnikov and Chagyrskaya caves reveal similarities to those of Paleolithic *H. sapiens* both in terms of crown sizes and phenotypic traits, although some of them can undoubtedly be attributed to Neanderthals. This combination of ancient and more advanced dental characteristics can be considered a distinctive feature of Neanderthals from the Altai caves. "Thus, the dental data confirm the intermediate position of the Chagyrskaya Neanderthals between other Neanderthals of Eurasia and anatomically modern humans, which was earlier identified based on the morphological features of the skeleton" (Buzhilova, 2013: 64).

The morphology of postcranial remains from Okladnikov Cave was best described by M.B. Mednikova (2011b). She examined twelve postcranial bones, including juvenile specimens (humerus, right and left femurs, tarsal navicular bone) and remains of adult individuals (humerus, patella, foot and hand bones). The researcher argued that juvenile bones from Okladnikov Cave in diaphyseal parameters and morphological features are similar to those of the Neanderthal child from Teshik-Tash Grotto. According to the conclusion by D.G. Rokhlin (1949), the age of the Teshik-Tash individual determined by the postcranial skeleton is 7–9 years, and by the degree of teeth eruption 9–10 years. On the basis of these data, Mednikova (2011b: 20) concluded that even taking into account the inter-individual variability in the rate of somatic development, 8–10 years was the most likely age of the Altai child. Judging by the femur size, the body length of the Teshik-Tash child was only

123 cm, and that of the Neanderthal from Okladnikov Cave 129 cm. According to the estimate by Mednikova after the method by (Palkama et al., 1965), the height of both individuals was 138 cm. All the juvenile bones from Okladnikov Cave were of the same age, so she did not exclude the possibility that these belonged to a single individual.

Mednikova carried out a detailed and meticulous analysis of the postcranial remains of adults from Okladnikov Cave and made a generalized description of the Neanderthal skeleton from this cave. It was taken into account that most of the bone fragments probably belonged to women/woman. The level of sexual dimorphism among the Shanidar skeletons (the best studied collection for this trait) was quite high. On this basis, this feature could possibly be extended to the men from Okladnikov Cave. Among late European Neanderthals, the degree of variation in body size between men and women was lower, and Mednikova believed that this fact should also be taken into account (2011b: 72). Judging by the dimensions of medial phalanx of the hand, the body length of men from Okladnikov Cave could have varied in the range of 160–163 cm. The body length of women did not exceed the dimensions known for female Neanderthals in Western Asia—ca 158 cm.

Describing the upper limbs, Mednikova notes that the humeral shaft is smooth, straight and has no torsion. Its section is subtriangular. The medullary cavity is relatively small, its section is oval and anteriorly extended. The cortical layer is robust. The size of the lower epiphysis matches that of the most gracile forms of Middle and Upper Paleolithic humans.

As to the lower limbs, the middle and subtrochanteric part of the femur shaft section is stretched in the medio-lateral direction. The pilaster is presumably absent in adults. A wide gluteal tuberosity and a small femoral neck angle are comparable to those of the early *Homo*. The neck is extremely robust and short. The internal robusticity of the shaft is marked, the lateral walls being especially thick.

Despite the belonging to people of different sexes and ages, including children, the fragments of postcranial bones from Okladnikov Cave show a certain common feature, namely a specific combination of archaic and unique (individual) traits. The morphology of postcranial skeleton of the Sibiryachikha people is very similar to that of Neanderthals, but some archaic features bring them closer to *H. erectus*. The Chagyrskaya paleoanthropes show the least similarity to early anatomically modern humans of the Near East (except for the indices of the shape of the talus).

Mednikova has identified several peculiar features apparently inherent to the Chagyrskaya group. The main factor in the development of these features was the founder effect, which manifests itself as a genetic-automatic process in the conditions of isolation. Another factor could be biological adaptation to the environmental settings in the Altai low and middle mountains. Postcranial bones of these hominins are generally gracile and demonstrate a systemic morphological tendency—widening of articular surfaces, lateral hypertrophy of patella, etc. (Ibid.: 72–73).

Mednikova carried out a comparative analysis and identified nine morphological features of similarity between the Altai group of paleoanthropes and the Neanderthals from Tabun and Shanidar.

1. The humerus of a child from Okladnikov Cave is similar to that of Tabun C1 in terms of the midshaft cross-section index.

2. In the pilastry index (87.18), the right femur of the child from Okladnikov Cave approaches that of Tabun C1, which is flattened in the antero-posterior direction (calculated after (Pearson, 1997: 673)). Such a shape is considered a typical feature of *H. erectus* morphology.

3. The left femur of the Chagyrskaya child reveals a likewise weak extension of the shaft in the lateral view.

4. The humerus of an adult individual from Okladnikov Cave shows similarities with the most gracile forms, among which the closest are the Middle Paleolithic Shanidar 6 and Tabun C1.

5. The patella from Okladnikov Cave is similar in length (height) to the knee-cap of Tabun C1. All other Neanderthals had larger patellas.

6. The right calcaneus from Okladnikov Cave is closest in width and height to Tabun C1.

7. The talus of the adult from Okladnikov Cave is close to Tabun C1 in total length, head and neck length, as well as in the size of the articular facet of the lateral malleolus, which is atypically small for Neanderthals.

8. In terms of articular length and midshaft width, the third or fourth middle phalanx from Okladnikov Cave falls within the variation range of Shanidar males, and in terms of robusticity index it matches the third middle phalanx of Tabun C1. Despite the debate about the location of the Tabun C1 specimen (in layer B or layer C), the age of this individual is within the range of 122 ± 16 to 139 ± 25 ka BP (Bar-Yosef, Callander, 1999; Grün, Stringer, 2000).

9. The damaged medial phalanx of the second digit from Okladnikov Cave shows similarity to Tabun C1

in height (level of flatness) and, to a lesser extent, in width of the head (Mednikova, 2011b: 80–81).

On the basis of all of the above, Mednikova concluded that the mosaic pattern of similarities between the Neanderthal populations of the Levant and Altai may indicate their close genetic relationship. Since these populations belonged to territories and periods remote from one another, one cannot rule out the possible exodus of Neanderthals of such a morphotype from some third, intermediate center (Ibid.: 80–82).

When considering the morphology of the postcranial finds, Mednikova payed special attention to the robusticity of some bones from Okladnikov and Chagyrskaya caves. A special analysis of the hand phalanges of Okladnikov 2, Okladnikov 5, and Chagyrskaya 16-3-12 (the new catalogue number, Chagyrskaya 56c) has been carried out to clarify this issue (Mednikova, Shunkov, Markin, 2017). Cross-sectional geometry of middle phalanges of hand digits 2–4 was estimated by means of microtomography, in order to non-destructively study the internal structure of the specimens. Fossils from Okladnikov and Chagyrskaya caves, as well as the remains of five Neanderthals from Europe, were analyzed.

The La Ferrassie 1, 2, and Abri Pataud specimens were studied using the equipment of the Musée de l'Homme (Paris). All other fossils were scanned using the Xradia Versa XRM-500 X-ray 3D microscope at the laboratory of LLC *Systems for Microscopy and Analysis* (Moscow). The same scanner was previously used for studying the phalanx of the girl from Denisova Cave (Mednikova et al., 2013).

The Neanderthals from Okladnikov and Chagyrskaya caves differed from representatives of Western populations in a number of traits. For instance, the index of robusticity of the walls displays a noteworthy wide range of inter-individual variability, which is typical of both Neanderthals and Cro-Magnons. The degree of corticalization of phalanges is less variable among the European and Siberian male Neanderthals as compared to the female individuals of the same species from Okladnikov and Chagyrskaya caves in the Altai. The range of variation of this trait among the Neanderthals is delimited by these two female individuals: Okladnikov is hypermassive, while Chagyrskaya is hypergracile.

The Chagyrskaya and European Neanderthals demonstrate certain morphological and genetic differences, which emerged through divergence. Neanderthals populated the vast territory of Eurasia with various ecological conditions and, apparently, were often isolated from other groups; hence, they developed significant variability in morphology and lithic industry. Mednikova, having summarized information on the available postcranial remains from the Altai, concluded that in terms of morphology, the Altai Neanderthals demonstrated high inter-individual variability, with certain patterns (Mednikova, 2014, 2015). A proximal foot phalanx and a distal hand phalanx from Denisova Cave (Mednikova, 2011a, 2013a), as well as tubular bones of various individuals from Okladnikov Cave (Mednikova, 2011b), display the thickness of walls that is exceptional even for Neanderthals. Neanderthal postcranial bones from Chagyrskaya Cave were not distinguished by extraordinary internal robusticity (Mednikova, 2013b).

The results of microtomographic analysis of the medial hand phalanges confirm the previous conclusions regarding differentiation of the Southern Siberian Neanderthals into at least two morphological variants (Mednikova, 2015). It has been hypothesized that these variants might be related to different waves of migration of *H. neanderthalensis* to the Altai. On the other hand, it might be a result of genetic contacts of the Neanderthals with hominins of different taxa, for example, Denisovans (Ibid.).

However, as Mednikova and her colleagues note, taking into account the territorial proximity of the said caves, genetic contacts between the groups of cave dwellers cannot be excluded as well. In any case, the wide range of variability is a phenotypic reflection of the complicated history of origin of the Chagyrskaya Neanderthals (Mednikova, Shunkov, Markin, 2017).

The assumption on the possible division of the Chagyrskaya Neanderthals into two groups that independently migrated to Southern Siberia, in my point of view, requires additional argument. I withdrew my name from the authors list of the paper "Robusticity of Hand Phalanges: Relevance to the Origin of the Altai Neanderthals" (Ibid.), because the Chagyrskaya Neanderthals exhibited significant morphological variability. Mednikova (2011b) noted the pronounced gracility of female individuals; it is highly probable that various degrees of robusticity of the bones could be explained by sexual dimorphism. The available sample—fossils from Okladnikov Cave—is clearly insufficient for the fundamental conclusion that there were two or more migration waves of Neanderthals to the Altai. This idea is contradicted, for example, by the fact that the Chagyrskaya and Okladnikov lithic industries show a well-marked continuity of

development, and constitute a single Sibiryachikha industrial technical and typological complex of lithic tools.

M.V. Dobrovolskaya and A.V. Tiunov (2013), based on isotopic analysis data, studied the diet of the Chagyrskaya Neanderthals. Analyses of collagen from bone tissue of the postcranial skeleton remains did not reveal any differences in hominins from Okladnikov Cave—adults and adolescents, men and women. For comparative analysis, collagen was derived from bone tissue of herbivores (Tiunov, Dobrovolskaya, 2011; Dobrovolskaya, Tiunov, 2011). The researchers came to the unequivocal conclusion that the inhabitants of Okladnikov and Chagyrskaya caves hunted animals of certain species. Probably, the diet included fish.

The researchers provide noteworthy information about some aspects of life activity of hominins from Okladnikov and Chagyrskaya caves. The $^{87}Sr/^{86}Sr$ ratio in tooth enamel (Latkoczy et al., 2004) indicates that the Chagyrskaya Neanderthals permanently lived in this area, without leaving it. Favorable environmental conditions obviously ensured rather comfortable living for the people. Moreover, children, adolescents, adults, men, and women were equally provided with food. Indeed, the Chagyrskaya Neanderthals had shelter (cave), surrounded by steppes and forest-steppes inhabited by various animals, including large ungulates; there were constant sources of fresh water and raw materials for making tools. All this contributed to long-term residence at the same place (Dobrovolskaya, Tiunov, 2013).

Genomic sequence of the Chagyrskaya Neanderthals

DNA sequencing of the anthropological remains from Okladnikov Cave has finally determined the taxonomic affiliation of the cave dwellers (Krause et al., 2007). Neanderthal mtDNA was identified in the genome of an adolescent from Okladnikov Cave, which provided the grounds to expand the area of dispersal of this taxon in East Asia. The comparison of the mtDNA sequence of hominins from Okladnikov and Teshik-Tash caves with that of Neanderthals from Europe showed that the Teshik-Tash individual had greater similarity to individuals from Skladina Cave in Western Europe than the Okladnikov Neanderthal. The adolescents whose remains were found in the Altai and Uzbekistan belonged to European and West Asian Neanderthals (Ibid.).

DNA sequencing of the Chagyrskaya 8 phalanx provided important information (Mafessoni et al., 2020). The genetic analysis has shown that the individual lived ~80 ka BP, which contradicts the estimated time of Neanderthal habitation of the cave (60–45 ka BP). According to the available ^{14}C- and OSL-dates for the Chagyrskaya cave site, individuals Chagyrskaya 8 and Denisova 3 lived at approximately the same time.

The researchers note that Chagyrskaya 8 displays more common-derived alleles with Vindija 33.19 (Croatia) and other late Neanderthals from the Caucasus and Europe than with Denisova 5. As compared to Vindija 33.19, Chagyrskaya 8 shares fewer common derived alleles with other Neanderthals who lived in Europe ~50 ka BP, i.e. around the same time as Vindija 33.19. However, Chagyrskaya 8 shares more common derived alleles, than Vindija 33.19, with Denisova 11, a first-generation Neanderthal-Denisovan hybrid (Slon et al., 2018). Vindija 33.19 and Chagyrskaya 8 do not differ in the common derived alleles from Denisova 3; this means that among currently known Neanderthals, Chagyrskaya 8 is most closely related to Denisova 11 (Mafessoni et al., 2020: 15133). Chagyrskaya 8 is less closely related to Vindija 33.19 and other Neanderthals that contributed to the genetic heritage of modern non-African populations.

The coalescent analysis and modeling have shown that individuals Chagyrskaya 8 and Denisova 5 could be part of small subpopulations not exceeding 60 individuals, while analyses of the genome of Denisova 3 indicated that subpopulations of early modern humans and Denisovans were larger than 100 persons, provided that the migration rate between populations does not exceed 1 %.

The researchers concluded that Chagyrskaya 8 was more closely related to Vindija 33.19 and other late Neanderthals of Western Europe than to Neanderthal Denisova 5. The Neanderthals who lived in Chagyrskaya Cave were related to the populations of Neanderthals that migrated from Europe eastwards in the period from 120 to 80 ka BP. Some Neanderthals arrived to the Altai and contacted local Denisovan communities; these contacts resulted, for example, in the appearance of individual Denisova 11, whose father was a Denisovan and mother was a Neanderthal from the group to which individual Chagyrskaya 8 belonged (Ibid.).

At present, paleogenetic studies of the Chagyrskaya Neanderthals appear to be the most effective and large-scale in the genetic studies of this taxon as a whole. Genome sequencing has been carried out on

eleven Chagyrskaya samples and two Okladnikov samples. The results of the whole genome studies of the Chagyrskaya Neanderthals made it possible not only to derive the information on the genome of this population, but also to get an idea of the social organization of the isolated community of Neanderthals at the easternmost border of their distribution area (Skov et al., 2022).

The data on the social organization of the Neanderthal group that were obtained during the study of the Y-chromosome and mtDNA of the remains from Chagyrskaya and Okladnikov caves are of particular interest. As is known, the Y-chromosome is inherited through the paternal lineage, and mtDNA through the maternal lineage. To identify close genetic relationships, the researchers analyzed the cases of mtDNA heteroplasmy. Heteroplasmy can be transmitted from mother to child, and usually persists for at least three generations, so its presence in several individual remains indicates that these had a close maternal kinship (Ibid.: 521).

The derived genetic data have shown that the deciduous (Chagyrskaya 19) and two permanent teeth (Chagyrskaya 13 and 63) belonged to the same male individual, despite the different stages of their growth. Judging by the completely resorbed root of the deciduous tooth, it probably fell out for natural reasons. The researchers also determined that the two specimens—the right-side fragment of the mandible with several teeth (Chagyrskaya 6) and the left lower second incisor (Chagyrskaya 14)—belonged to the same adult individual, as evidenced by morphological similarity and identical mtDNA sequences. Chagyrskaya 12 and Chagyrskaya 8 belonged to the same female individual. It turned out that adult male Chagyrskaya 7 was related by first-degree kinship to female adolescent Chagyrskaya 17. Since these two individuals had different mitochondrial genomes, the researchers concluded that they were father (Chagyrskaya 7) and daughter (Chagyrskaya 17). In addition, the mtDNA of individual Chagyrskaya 7 was identical to that of two other individuals—Chagyrskaya 9 and Chagyrskaya 14. These individuals, as was shown by the analysis of general mtDNA heteroplasia, may have been close matrilineal relatives (fourth degree): they could have had a common grandmother. Close relationships indicate that all three individuals were contemporaries. It was also established that male individual Chagyrskaya 1 and female individual Chagyrskaya 60 were related in the second degree and lived in the cave during the chronologically similar periods. Genetic differences between all the cave inhabitants examined were insignificant. These and other data allowed the conclusion to be made that all the Neanderthals from Chagyrskaya Cave belonged to the same community (Ibid.: 522).

The two individuals from Okladnikov Cave were not related and had no family ties with any of the individuals from Chagyrskaya Cave. Therefore, the Neanderthals from Okladnikov Cave did not belong to the Chagyrskaya community. However, the mtDNA of Okladnikov 15 is identical to those of Chagyrskaya 13, 19, and 63, which were determined to be a single individual. Since mutations accumulate over time, the same mtDNA of different individuals means that the lifetimes of these two individuals were separated by several millennia (Ibid.).

Comparative analysis of nucleotide versions with the previously published Neanderthal genomes has provided important information. Genome of the Neanderthals from Chagyrskaya Cave, with high coverage degree, showed the greatest similarity to Vindija 33.19 (Croatia) among all 13 available Neanderthal genomes. The researchers concluded that although the communities from Chagyrskaya and Okladnikov caves differed genetically, both appeared to be similarly related to European Neanderthals, and were part of the same population. Not a single individual showed traces of recent genetic drift from other Neanderthal populations (Ibid.).

Studies of the genome of the Chagyrskaya Neanderthals helped to clarify the possible number of individuals living at this site. Formerly, it was assumed that Okladnikov and Chagyrskaya caves were inhabited by several dozen Neanderthals each; according to the new data, the total of 15–20 individuals habituated each cave. This number is more consistent with the "living area" of the caves. Furthermore, it turned out that in Chagyrskaya Cave, 60–100 % of women of the total of 20 inhabitants originated from other communities. However, heteroplasmy traits in individuals Chagyrskaya 14 and Chagyrskaya 7 indicates that at least some women remained in their native community.

Thus, anthropological and genetic studies of the Neanderthal remains from Chagyrskaya and Okladnikov caves showed that these hominins belonged to the eastern branch of European Neanderthals, which originated in Western Europe 200–150 ka BP. Western and Eastern Neanderthals, as well as modern humans and Denisovans, interbred and gave birth to fertile offspring (Green et al., 2010; Reich et al., 2011; Fu et al., 2015; and others). It seems reasonable to consider these three taxa not as different species, but

as subspecies of the same species, *H. sapiens sapiens*. It was as a result of their assimilation, with the stem role of African early modern humans, that the modern population originated (Derevianko, 2019, 2022; Derevianko, Shunkov, Kozlikin, 2020).

Possible migration routes of European Neanderthals to the Altai and the issues of the Chagyrskaya Neanderthals dispersal in Central Asia

The anthropological and genetic studies have shown a significant variability in the morphology and genetic sequence of Chagyrskaya Neanderthals, who demonstrate similarity to representatives of this taxon from the Near East and Europe. Hence, the possible route of their migration to East Asia and the dispersal in Central Asia are of considerable interest.

E. Ghasidian and his co-authors (2023) examined the possible route of migration of Neanderthals from the Caucasus to East Asia. Taking into account the physical and geographical data characterizing these regions in the Late Pleistocene, these created a model of the most optimal route of dispersal of the Neanderthals whose remains were found in Okladnikov and Chagyrskaya caves. The researchers proceeded from the assumption that the Caucasian Neanderthals produced two different lithic industries: the Micoquian in the Greater Caucasus and the Mousterian in the Lesser Caucasus. Notably, the Neanderthal Mousterian industry shows great variability: about ten versions have been identified in Europe; the Micoquian industry can be considered one of these. Significant industry variability was recorded among Neanderthal communities in the Caucasus (Lyubin, 1977; Doronichev, 1993; Golovanova et al., 2006, 2022; Doronicheva et al., 2020; and others). Researchers also focused on the natural and climatic situation in the chronological range of 71–57 ka BP (MIS 4). It was the period of a cold and dry climate.

Ghasidian and his colleagues considered two possible routes of migration of Neanderthals from the Caucasus: either along the South Caspian or the North Caspian corridors. During MIS 4, there was a a strong regression of the Caspian Sea due to cooling and aridization of the climate; the water level could drop by about 120–140 m, and large areas were dried up. In the previous period (MIS 5), associated with the Late Khazarian transgression, the level of the Caspian Sea was significantly higher; the researchers argued that the Caspian was connected with the Black Sea (Ghasidian et al., 2023).

The southern route, from Azykh Cave to the eastern Altai, as per the researchers, probably passed along a narrow strip of land between the Caspian Sea and the Alborz Mountains, through the Hyrcanian biogeographical refugium, then along the northern foothills of the Hindu Kush and Pamirs to the Hissar mountain range towards the Tien Shan (Ibid.: 14).

The computer program generated two main parts of this route: the first part began from Azykh Cave in Azerbaijan and ended at Teshik-Tash Cave in Uzbekistan, and the second stretched from Teshik-Tash to the Altai. For the second part of the route, two possible ways were proposed. One involved passing through the northern piedmonts of the Kopetdag, and the other led through the mountain valleys and plains south of the Kopetdag. At the northern foothills of the Hindu Kush, these two routes merged and led to the Altai.

The northern route of the Neanderthal migration began in Mezmayskaya Cave in the Greater Caucasus and ended in Chagyrskaya Cave in the Altai. Judging by the genetic and archaeological evidence, researchers suggested that this was a direct route from Eastern Europe to Siberia. During the period of 70–55 ka BP, Neanderthals could cross the Pontic-Caspian region and penetrate into the southern part of the Greater Caucasus. According to the researchers, no traces of habitation of the Lesser Caucasus by this group of Neanderthals with the Mousterian industry during this period have been found (Ibid.: 13).

Considering two computer models of Neanderthal migration routes to East Asia, the scientists suggested that during the cool period (MIS 4), the south Caspian corridor was more preferable because of favorable living conditions, and was a kind of refugium.

The Okladnikov and Chagyrskaya lithic industries, in some technical and typological criteria (primarily, the presence of bifacially worked tools of the Klausennische and Bockstein types), show the closest similarity to the Eastern European Micoquian (Derevianko, Markin, Kolobova et al., 2018).

The research conducted by Ghasidian and colleagues was certainly based on fundamental studies and interdisciplinary approach. However, when considering the territory of Central Asia as a transit area in the west-to-east migration of Neanderthals with the Micoquian industry, it should be borne in mind that a relatively small amount of anthropological remains has been found in this vast region so far.

The earliest anthropological remains in Central Asia were reported from Selungur Cave, located in the western outskirts of the village of Khaidarakan, in the Osh Region, in the south of Kyrgyzstan (Islamov, Krakhmal, 1995). The cave revealed 13 lithological layers, including 5 culture-bearing horizons yielding 1412 lithic artifacts and a great amount of faunal remains. Cultural layers 2 and 3 contained anthropological remains: layer 2 fragments of the skull cap and isolated human teeth, layer 3 solitary teeth (n=10) and fragments of humerus (Islamov, 1990; Islamov, Krakhmal, 1995). The teeth and fragments of the humerus were analyzed by various researchers (Islamov, Zubov, Kharitonov, 1988; Islamov, Starchmal, 1995; Zubov, Khodjayov, 1997).

On the basis of the derived analytical data on a relatively small number of rather uninformative classes of teeth with severe wear—incisors and premolars—anthropologists tried to determine the taxonomic position of the anthropological finds from Selungur. It was assumed that the individual to which the premolars belonged could be placed between paleoanthropes and archanthropes, with a significant shift from the general evolutionary line due to the exceptionally large values of buccolingual diameter of the crown (Islamov, Zubov, Kharitonov, 1988; Zubov, Khodjayov, 1997). Given the large size of the crown, I believe that this individual can be attributed to the late *H. heidelbergensis* (Denisovan) who migrated around 400–350 ka BP from the Levant to the east and inhabited Central Asia for a long time (Derevianko, 2022).

More information has been derived from the anthropological remains from Obi-Rakhmat layer 16; this layer contained a small number of artifacts of the Obi-Rakhmat industry. Anthropological finds included 6 solitary permanent maxillary teeth and ca 150 small fragments of OR-1 skull (Glantz, Viola, Chikisheva, 2004; Viola, Seidler, Nadden, 2004; Glantz et al., 2008; Bailey et al., 2008). The majority of the fossils were recorded *in situ*, in a small area adjacent to the southern wall of the main excavation trench. Some fossils were identified in the course of washing and sieving of the culture-bearing sediments from the above-mentioned area. The finds were concentrated in an area of 0.5 m^2; however, their fragmentary nature precludes their classification as a burial. No dates have been derived for layer 16, but for the overlying layer 14, subdivided into three horizons, several ^{14}C- and ESR-dates were generated. Horizon 14.1, containing the Upper Paleolithic industry, yielded an uncalibrated date of 48,800 ± 2400 BP (AA-36746), horizon 14.3 two ESR dates (FT 26): 40,600 ± 1600 BP (EU) and 72,800 ± 3700 BP (LU). In my opinion, layer 16 can be dated to ca 60 ka BP or even a younger period.

The teeth and skull fragments have been studied by many anthropologists (Glantz, Viola, Chikisheva, 2004; Viola, Seidler, Nadden, 2004; Glantz et al., 2008; Bailey et al., 2008). Given the morphology of teeth and fragments of skull OR-1, the researchers concluded that the fossil could be definitely attributed neither to modern humans, nor to Neanderthals, nor to archaic *H. sapiens*. "A clear determination of the morphological identity of skull OR-1 is hampered by its heavy fragmentation and the young age of the individual, but the observed morphology suggests a close proximity of OR-1 to humans of the modern anthropological type. The reconstructed left parietal bone is relatively large and thin, and the temporal bone has a relatively modern appearance. This feature of the skull, combined with its gracefulness and large size, the archaic appearance of the teeth, and the unclear morphology of the ear labyrinth, demonstrates a mosaic morphology similar to that of the recently discovered hominin remains from Oase (Romania)" (Glantz, Viola, Chikisheva, 2004: 91–92). Subsequently, based on the results of analysis of the upper dentition of OR-1, anthropologists identified these specimens as Neanderthal.

The taxonomic affiliation of the remains from Obi-Rakhmat Cave should be established with respect to the technical and typological complex of the lithic industry from layer 16, in which OR-1 was found. Continuous development of the lithic industry without any noticeable gaps was noted throughout the entire stratigraphic sequence of the site: from the lowest to the upper layers, the shares of protoprismatic, prismatic, and edge-faceted cores grew up; clear trends towards an increase in the laminar index from bottom to top through the profile (layers 21–7), an increase in the number of microblades, as well as a decrease in the overall dimensions of the blanks were noted; the proportion between types of tools changed—the number of the Upper Paleolithic tools grew up as compared to the Middle Paleolithic ones; primary reduction was characterized by an increase in the number of blade blanks and cores typical of the Upper Paleolithic strategies, with some traces of the Levallois reduction.

The Obi-Rakhmat lithic industry clearly illustrates the process of development of the Upper Paleolithic industry on the basis of the final Middle Paleolithic industry. This stage is tentatively dated to

60–50 ka BP, and the initial Upper Paleolithic is dated to 50–40 ka BP. The Obi-Rakhmat industry demonstrates no common features with the Mousterian of the Neanderthals either in primary reduction or in technical and typological characteristics. It shows the greatest similarity to the Denisova Middle Paleolithic industry (Derevianko, Shunkov, 2004; Derevianko, 2022; and others). I believe that the OR-1 fossils should be classified as *H. s. denisovan*, which retained some morphological traits from the ancestral form common with Neanderthals—*H. heidelbergensis* (Derevianko, 2020).

Both Denisova Cave and Obi-Rakhmat Grotto were inhabited by representatives of the same taxon—*H. s. denisovan*. First, the dentition of the inhabitants of these sites show considerable similarity. Second, the culture-bearing layers of these caves revealed lithic industries with close basic technical and typological features.

Indisputable Neanderthal anthropological remains were discovered in Teshik-Tash Grotto, located in the Baysun-Tau mountain range, 2.7 km from the village of Machay, in the Zautolosh-Darya sai (Uzbekistan). The grotto is situated at an altitude of 6 m above the thalweg of the sai, and 1872 m above sea level. The entrance zone is 7 m high and 20 m wide, the grotto is 21 m long. The grotto was found and explored by A.P. Okladnikov in 1938–1939 (1949).

The anthropological remains of an adolescent from Teshik-Tash have been classified as Neanderthal based on morphological and genetic evidence, but the taxonomic status of the fossils still remains controversial.

The morphological features of the Neanderthal child from Teshik-Tash Grotto have been described in many papers. Before the publication of the monographic description of the morphology of this individual, prepared by M.A. Gremyatsky (1949), and after that, almost all experts in Neanderthal issues expressed their points of view on the features of his morphology, and the significance and place of the find among other anthropological remains of this taxon. Moreover, with the emergence of new facts, some researchers changed their assessments of the significance of the Neanderthal child's skeleton from Teshik-Tash.

According to most researchers, the find shows mixed Neanderthal and East Asian traits (Debetz, 1948; Weidenreich, 1945, 1949; Howell, 1951; Trinkaus, 1983; Trinkaus, Howell, 1979; Gremyatsky, 1949; Thoma, 1973; Wolpoff, 1999; Alekseev, 2007; and others). Anthropologists have various points of view on the presence of European or East Asian features in the morphology of this skull.

I believe that the Neanderthals who settled in the western part of Central Asia migrated from the Near East: their morphological features are close to the Western Asian Neanderthals; their lithic industry is very similar to that of the final stage of the Middle Paleolithic of the Levant. This conclusion is supported by F. Weidenreich, who argued certain similarities of the Teshik-Tash fossil to some skulls from Skhul Cave (especially Skhul 5). He believed that in terms of morphology the Teshik-Tash skull could belong to an advanced hominid intermediate between classic Neanderthals and modern humans, like the Palestinian population inhabiting the Carmel mountain range; though, his frontal part and teeth show some Mongoloid features (Weidenreich, 1949: 160).

A.P. Okladnikov characterized the Teshik-Tash industry as Mousterian with Levallois elements. Y. Nishiaki and O. Aripjanov (2020) have recently examined part of the collection from this site and have come to the conclusion that in the primary reduction Levallois technique was used. Formerly, I had the opportunity to analyze the lithic artifacts from Teshik-Tash, too (Derevianko, 2011). From my point of view, the primary reduction was most often executed by radial flaking of blanks; the subprismatic flaking technique was less common, with the less careful preparation of striking platform and flaking surface. No well-prepared Levallois cores have been found in Teshik-Tash.

Teshik-Tash yielded many blades with regular shape in plan view. For example, cultural horizon 1 produced 32 blades, and cultural horizon 5, 60 blades. The subprismatic cores found in horizon 1 were not intended for the production of such blades: the length of some blades reached 10 cm, while the height of the most well prepared blade core was only 4.3 cm. This means that the cores found in the grotto were heavily exhausted or that the primary reduction was carried out outside, at the raw material outcrops.

Anyway, the Teshik-Tash lithic industry cannot be attributed to the Micoquian type. Moreover, no sites with Micoquian industry have yet been discovered in Central Asia. Judging by the homogeneous nature of the Teshik-Tash technocomplex, all five culture-bearing layers were accumulated over a short period of time; these should be dated to the period of 55–45 ka BP. Thus, the Neanderthal population from Teshik-Tash and the Chagyrskaya Neanderthals roughly belonged to the same chronological range, but produced lithic complexes with different technical and

typological features. Hence, Central Asia could not be regarded a transit area for Neanderthals with the Micoquian industry migrating from Europe to Siberia.

So far, only one site has been discovered in Central Asia (Teshik-Tash), containing the Mousterian industry and the remains of Neanderthal from the population that migrated from the Near East through the Iranian Plateau to this region. Sites with fossils of the Chagyrskaya Neanderthals and the Siberyachikha Mousterian Middle Paleolithic industry have not yet been found in Central Asia.

Noteworthy is a skull fragment discovered in 2006 in the Salkhit area, Mongolia; unfortunately, located outside of the archaeological context. The authors of the first publication devoted to this find determined clear erectoid features in the skull fragment and attributed it to *H. erectus* (Tseveendorj, Batbold, Amgalantugs, 2006).

In May 2006, in the Salkhit valley (Norovlin somon, Khentei aimak), geomorphological and stratigraphic studies were carried out (Derevianko, Tseveendorj, Gladyshev et al., 2007). At that time, the *Bayan-Erdes* company was mining gold in this area; its workers found the skull and transferred it to the Institute of Archaeology of the Mongolian Academy of Sciences. Prior to that discovery, open-pit gold mining had been carried out in the area for 5 years, which led to the complete destruction of a significant part of the loose sediments throughout the profile, up to the weathering crust of the granite base. The study area is located on the eastern spurs of the Khentei Highlands, which topographic features are hilly surfaces, small hills, low mountain massifs, separated by areas of denudation and flat depressions with lake basins.

Several excavation trenches were established in the immediate vicinity to the place of discovery of the skull fragment, in the areas not disturbed by gold miners. The section in the western side of the Salkhit valley was the most informative. The trench was 10 m long and 4.25 m deep, and reached the weathering crust overlain by a horizon of sandy-grus-gravel deposits. The loose sediments were characterized as instable due to an increase in both endogenous and exogenous morphogenesis. The cause of the changes was probably climate change towards warming (Karga period of the Late Pleistocene), which led to an increase in humidity and water supply in the area. This contributed to a more intense erosion-denudation processes leading to accumulation of absolutely unsorted clastic sediments of the deluvial-proluvial origin. A sufficient amount of free flowing water led to the formation of an alluvial-proluvial deposits at this level, which was the former bed of a small watercourse, filled with obliquely layered sandy material. The next horizon, overlying the Karga sequence, was layer 3 of slope genesis. It was likely accumulated during the Sartan period, distinguished by general cooling, lack of free flowing water (non-aquatic origin of these layers), and progressive aridity. The overlying layer 2 was deluvial-proluvial; it was attributed to the Holocene, associated with the formation of soil and plant horizons.

Summarizing the data derived from the analysis of stratigraphic section of the Salkhit valley, we can conclude that the lowermost layer of the loose sediments is not older than the Early Karga period, i.e. 55–50 ka BP. Consequently, the skull cap belongs to a person of the *H. sapiens* type or to an archanthropus whose emergence in that place is absolutely unbelievable, because the geomorphological situation in the vicinity of the Salkhit valley excludes the presence of any ancient deposits which destruction could have led to the transfer of the skull to the bottom of the valley (Ibid.: 92–93).

Subsequent research confirmed the conclusion made during field work in 2006. Initially, the age of the Salkhit skull was estimated to ~23 thousand years; however, the age was underestimated due to poor sample purification. Today, the skull is dated to 34,950–33,900 cal BP (Devièse et al., 2019).

The fragment of the Salkhit skull cap includes an almost complete frontal bone, as well as partially preserved parietal and nasal bones, which show vivid archaic features. On that ground, D. Tseveendorj and his co-authors proposed a new taxon—*Mongolanthropus* (Tseveendorj, Batbold, Amgalantugs, 2007). The comparison, through the multivariate statistical analysis, of the skull size with those of various types of hominins has revealed similarity of the Salkhit skull to the remains of Neanderthals, *H. erectus*, and Asian archaic *H. sapiens* (Kaifu, Fujita, 2012); and the Salkhit hominin was eventually classified as a Late Pleistocene modern human. Even earlier, anthropologists established the relationship of this individual with Neanderthals and *H. erectus* by some parameters, and concluded that in terms of the physical morphology this was a human of the modern type, with apparent erectoid ancestral features (Coppens et al., 2008).

Analysis of three samples of Salkhit skull biomaterial has shown that its mtDNA lineage refers to macrohaplogroup N, which, together with haplogroup M, belongs to the basic mtDNA haplogroups common to all non-African modern humans (Devièse et al.,

2019). As experts note, it is unlikely that the Salkhit mitochondrial lineage, which runs from the root of haplogroup N, directly inherits any modern human mtDNA. Among ancient modern humans, only the mtDNA of the Romanian Oase 1 skull, whose age is ~40 thousand years, falls outside the known N or M sublineages. This indicates the greater mtDNA diversity among Eurasian early modern humans than that of younger and extant populations (Ibid.: 4).

The nuclear DNA sequencing of a fragment of the Salkhit skull has revealed 18 segments of Denisovan origin longer than 0.2 nm in the genome of this hominin; 20 completely similar segments were identified in the genome of a hominin from Tianyuan Cave (Massilani et al., 2020). As per the researchers, the modern people's ancestors who lived in East Asia 40 ka BP met and interbred with Denisovans (Ibid.: 582). Based on this finding, it can be assumed that ca 40 ka BP modern humans met Denisovans (Salkhit), and as a result of introgression, genetic drift occurred from the indigenous population to the migrants. The morphology of the skull from Mongolia differs from similar finds from China.

It has been shown that the DNA of the Salkhit fossil exhibits a large discrepancy with the DNA of anthropological finds from Tianyuan Cave; therefore, the Mongolian hominin can be considered the most likely representative of the Denisovan taxon or a hybrid of a modern human and a Denisovan (Derevianko, 2022).

Thus, the currently available anthropological and archaeological materials suggest that in the Late Middle and Upper Pleistocene, populations of *H. s. denisovan*, practicing various local versions of the Denisova Middle Paleolithic industry, dispersed over the territory of Central Asia. Their lithic industry possibly formed the basis for the convergent development of the Upper Paleolithic in some regions of this part of the continent. Small groups of Neanderthals arrived to this territory from the Near East through the Iranian Plateau. The Chagyrskaya Neanderthals followed a different route from Eastern Europe to the Altai.

The most likely route of European Neanderthals with the Micoquian industry from Eastern Europe to the Altai ran through the northeastern part of the Russian Plain and the northern foothills of the Urals, where sites of the Late Pleistocene with the Mousterian were discovered (Pavlov, 2008; Serikov, Chlachula, 2014). Among these, the Garchi I site, located in the Upper Kama basin (59º04′ N; 56º07′ E), is of the greatest interest (Pavlov, 2008). The available OSL-dates suggest the age of ca 100 thousand years, which, in my opinion, is too old. The lithic industry of the site demonstrates the predominance of products with traces of continuous or partial flat-convex bifacial working: bifacial knives, angular and convergent side-scrapers, points, and foliate bifaces. The small, but distinct lithic collection of the Peshcherny Log site shows similar features (Ibid.: 35). These sites with the Micoquian industry can be considered the evidence of the west-to-east migration of European Neanderthals to the Altai.

Possibility of the Chagyrskaya Neanderthals dispersal across the South Siberian Regions contiguous to the Altai

Archaeological materials dating back to the second half of the Upper Pleistocene in Southern Siberia do not provide convincing data on the possibility of dispersal of the Chagyrskaya Neanderthals across this region. The reasons for this are the small number of sites with long stratigraphic sequences in Southern Siberia and the lack of geochronological data.

The Altai borders on Tuva in the southeast. S.N. Astakhov, one of the famous researchers of the Old Stone Age of Siberia, attributed the Tuva Early Middle Paleolithic to the Levallois-Mousterian or Mousterian, and initially dated this stage to the time not younger than the Karga period, or rather to the optimum within the Lower Zyryan (Murukta) cooling, i.e. up to 80–75 ka BP; later, he proposed an older age—the Early Kazantsevo Interglacial (MIS 5e) (Astakhov, 1986, 1993, 2008).

S.N. Astakhov identified a number of sites of the Sagly group with the final Middle Paleolithic industry; the industry reveals many Upper Paleolithic products manufactured on blades, which fact suggests a significant role of blade flaking. However, due to the lack of stratified sites, it is impossible to detect reliably the continuous development between the Middle and Upper Paleolithic, as well as to identify the chronology. All researchers of the Tuva Paleolithic attributed the Middle Paleolithic industry of the region to the Mousterian. However, in Tuva, despite the presence of some elements reminiscent of Mousterian-type products in the Middle Paleolithic industry, no sites with the Sibiryachikha industry were found.

In Middle Siberia, the Kurtak archaeological region is the best studied area (Drozdov, 1992; Drozdov et al., 2000, 2007). The Kamenny Log-1 and -2 sites have been attributed to the Middle Paleolithic in this region.

The lower culture-bearing layers at these sites, with artifacts representing discoidal reduction, dates back to the Late Early Paleolithic. On the beach surface in excavations 2–4 and in pit 12, despite of the pebble-flake industry, lithic artifacts attributable to the Middle Paleolithic were found.

The earliest artifacts were discovered on the surface and in eroded soil at Kamenny Log (analog to Kazantsevo soil; MIS 5). The primary reduction is represented by radial and Levallois cores; the tool kit includes choppers, chopping tools, various side-scrapers, and Levallois points with well-faceted platforms of the *chapeau de gendarme* type. The combination of tools of the final Early Paleolithic and Middle Paleolithic suggests that this area was simultaneously inhabited by the late *H. erectus* and Denisovans with their Middle Paleolithic industry.

The artifacts from Dvuglazka Cave in Khakassia also demonstrate the evidence of the Levallois reduction strategy—the Levallois points. Z.A. Abramova (1981, 1985) attributed the industry from Dvuglazka bottom cultural layers 5–7 to the Mousterian of the Levallois type. The available radiocarbon dates obtained for layer 6 (39,900 ± 800 BP) and layer 7 (27,200 ± ± 800 BP) are clearly too young. From my point of view, the most probable age of lower cultural layers 6 and 7 in Dvuglazka Cave is 40–45 thousand years. Notably, the Levallois reduction likely emerged in Central Siberia at the initial stage of the Kazantsevo warming (MIS 5e). The Levallois points with faceted bases date back to a younger period (MIS 5b, a); this industry survived till the arrival of early humans in Dvuglazka Cave. The emergence in Central Siberia of the Levallois reduction for the manufacture of Levallois points could have been associated only with Denisovans, because initially the Chagyrskaya Neanderthals did not use this technique. The noted traces of the use of the Levallois reduction by the inhabitants of Okladnikov Cave are associated with the contacts between the Chagyrskaya Neanderthals and Denisovans 45–40 ka BP. This situation does not exclude the possibility of settling of a small group of the late Chagyrskaya Neanderthals in Khakassia.

Conclusions

The Chagyrskaya Neanderthals with the Micoquian industry are the easternmost representatives of the European Neanderthals who migrated to the Altai. This population moved from Europe through its eastern part north of the Caspian Sea, through the Urals, and further to Western Siberia. Divergence and the need to adapt to new environmental conditions in the settlement areas led to the development of morphological and genetic variability, as demonstrated by this group of Neanderthals. Their anthropological remains have so far been found only in three caves: Okladnikov, Chagyrskaya, and Strashnaya. The Mousterian industry of the Chagyrskaya Neanderthals was found in an extremely small area. The possibility of the dispersal of the Chagyrskaya Neanderthals in adjacent regions is the issue requiring further research.

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