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Preliminary Report on the Excavations at Khairkhan-1 Cave in Zavkhan Aimag, Western Mongolia

Abstract: In the western part of Mongolia stratified Paleolithic sites are still unknown. In the territory of Zavkhan aimag is located the Ikh-Khairkhan limestone massif. Here in 2023 the joint Russian-Mongolian archaeological expedition excavated the Khairkhan-1 cave on the area of 2 sq. ms. The depth of excavated sediments was 2 ms. Four main lithological layers were identified. Archaeological assemblages are contained in layers 1-3. The most abundant assemblage of layer 3 contains flake-based industry characterised by an overwhelming predominance of small flakes. The faunal assemblage of Layer 3 includes fragments of ostrich eggshells, bear, hare and horse bones. A rhinoceros tooth was found in Layer 3.1. In layer 4, bones of a pika, bear, and a fragment of an antelope jaw were found. Most likely, the formation of the upper part of the section up to layer 3.1. can be attributed to the early stages of the Holocene - final Pleistocene. Layers 3.1. and below, based on their faunal composition and sediment features, can be dated to the period of the last glacial maximum associated with climate aridization and increased aeolian activity. The collections obtained during the cave excavations have an archaic appearance and have no direct archaeological analogues in the Holocene complexes of Mongolia.

Keywords: *Western Mongolia, caves, typology, Holocene, Pleistocene, Paleolithic*

Introduction

The territory of Mongolia lies at the junction of the landscape zones of the mountain belt of South Siberia and the arid plateaus and ridges of eastern Central Asia. Potential transit zones for the movement of human populations run both in the latitudinal direction, between the Khangai and Khentii systems in the north and the Gobi and Mongol Altai systems in the south, and in the meridional direction, from Ordos and Dzungaria in North China through passages in the ridges of the Mongolian and Gobi Altai and the Valley of Lakes on the northern edge of the Gobi desert. The Selenga River basin, which flows in the direction of the system of intermountain depressions and tributaries of large rivers of South Siberia, was of special importance. Throughout these natural corridors the sources of high-quality stone raw materials, faunal resources and water sources were available. All this allows us to evaluate Mongolia as an extremely important region for understanding the processes of dispersal and possible interaction of different hominin populations.

There are several zones of distribution of stratified Paleolithic sites in Mongolia. In Northern Mongolia, these are the middle course of the Selenga River, and its tributaries - the Ikh-Tulburiin-Gol, Kharganyin-Gol, and Egiin-Gol rivers. This area belongs to the Khangai mountain range, which is close in its natural characteristics to the mountain belt of South Siberia.

The second area belongs to the Central Asian natural-climatic province and is located in central Mongolia, on the southern slopes of the Khangai mountain system. Here the sites are located in the valley of the Orkhon River, the upper right tributary of the Selenga River, and in the Lakes Valley Basin in the south. The third area of distribution of stratified Paleolithic sites situated in the arid Gobi Altai, in the southern part of central Mongolia. In the vast area of western Mongolia from the Russian and Dzungaria in China to central Khangai in Mongolia, despite decades of research, stratified Paleolithic sites are still unknown (Derevianko et al. 1990). Thus, this region occupied by the Mongolian Altai and Khangai systems remains a significant “white spot” in understanding of possible cultural connections of Paleolithic human populations in the eastern part of Central Asia and South Siberia.

In April 2022, the team of the joint archaeological expedition of the Institute of Archaeology and Ethnography of the Siberian Branch of the Russian Academy of Sciences and the Institute of Archaeology of the Mongolian Academy of Sciences undertook a reconnaissance trip to the Erdenekhairkhan somon of Zavkhan aimag (Figure 1). In this territory, located in the southwestern part of the aimag and belonging to the South Khangai plateau, is located a limestone massif Ikh-Khairkhan with a cave of the identical name, revered in the Buddhist tradition.



Figure 1. Geographical location of Khaikhan-1 cave.

According to local residents, there are 108 caves in this karst massif spreading in the north-northwest-south-southeast direction. The limestone ridge is dissected by deep canyons, and is surrounded by a slightly hilly plain with the beds of temporary watercourses; there are no permanent waterways in the area.

The overwhelming majority of caves exhibit either no sedimentary deposits or those that do not contain any archaeological remains. One of the caves was identified as a promising candidate for further investigation. The site was designated Khairkhan-1 and underwent preliminary testing. In a test pit measuring 1 m in length and 0.7 m in width, bones and stone artifacts were discovered at a depth of approximately 30 cm below the surface. The excavation of the cave sediments was conducted to a depth of 30 cm, after which, due to time constraints, it was decided to halt the process and resume it in the future over a larger area. Stationary excavations of the cave were carried out in June-July 2023.

Geographical settings, stratigraphy and archaeology of Khairkhan-1 cave

In geomorphological terms, the South Khangai plateau is characterized by a combination of plains, low flattened mountains, isolated massifs, ridges and depressions with a pronounced north-western direction of orographic elements with the height of the main surface 1300-2400 m above sea level, above which rise the summits reaching 2700-3100 m a.s.l. The South Khangai plateau gradually declines in the south and passes into the plains of the Valley of Lakes, which was a migration corridor of Paleolithic man [Geomorphology..., 1982; Derevianko et al. 2000].

The area where the cave is located has the local name "The Little Gobi". In terms of landscape characteristics, it is similar to the ranges of the Gobi Altai. The region is arid with scarce vegetation and a stony surface at an altitude of 1700-1800 meters above sea level. The surrounding peaks reach altitudes of 2100-2300 meters above sea level. The current fauna is characteristic of steppe and semi-desert landscapes, including mountain goats, dzeren antelope, wolves, and foxes.

The Khairkhan-1 cave is situated at an altitude of 1870 meters above sea level and has a southeastern exposure. The cave is situated at an elevation of 35 meters above the surrounding basin. The ascent is characterized by a steep incline and covered with a scattering of rocks. The cave entrance, situated in the center, reaches an approximate height of 4 meters and is approximately 5 meters wide. The cave has a view of the entrance to the neighboring canyon and the adjacent section of the intermountain basin. The cave entrance area is absent; a rock ledge leads to the

cave, but no archaeological material was found under it. The cave's interior features prehistoric drawings created with red pigment on the ceiling and walls. The cave measures approximately six meters in length from the entrance to the back wall, with the widest section occurring at the entrance. The structure of the cave indicates the potential for the presence of buried galleries. The floor of the cave is relatively flat, with a slight inclination towards the entrance. In the central portion of the cave, in closer proximity to the entrance, a small excavation pit measuring 1x2 meters was placed, oriented along the long axis in a NW-S direction. Pit 2022 was incorporated into the area of the new excavation. The cave floor is observed to be covered with a layer of cattle feces. Immediately beneath the surface, modern aeolian deposits were identified. These deposits, which are yellow and dusty in nature, were observed to lie in a thin layer, measuring up to 7 cm in thickness. The stratigraphic description of these deposits is provided by the section of the northern wall of the excavation. These were designated as Layer 1 (Fig. 2). Subsequently, a dense, compacted layer of twigs and grass was observed, underlain by a layer of dense, yellow, dusty, sandy loamy sediments saturated with carbonates and containing inclusions of gravel, small stones, reddish and black spots. It is probable that these inclusions are related to burning, and they were observed throughout the entire area of the excavation. The maximum thickness of this layer was recorded at 5-6 cm. This lithologic unit was designated as layer 2. A horizon of sediments, up to 10 cm thick, exhibiting a composition similar to that of layer 2 but with a notable whitish ash saturation, has been designated as layer 2.1. A thick layer of dark dusty loam (layer 3) underlies this unit, with interbeddings of calcinated soil, charcoal stains, sand, and inclusions of animal dung, plant remains, and bones.

In the upper portion of layer 3, a multitude of burrows are present. This layer reaches a thickness of one meter. Between the northern half of the excavation pit and the southern half of the pit (which is situated in closest proximity to the cave entrance), a boundary is formed in the form of a semicircular longitudinal sedimentary structure. This structure is composed of loose, pure, light-yellow sand of aeolian origin, and it resembles the crest of a dune, with a northward slope towards the back wall of the cave. The primary thickness (up to 1 m) of this layer, designated as 3.1, is concentrated in the southern portion of the excavation, with a thickness of 15 to 20 cm observed in the northern wall. The stratum is underlain by the dense reddish sands of layer 4, which includes large blocks of limestone, probably representing the collapse horizon of the cave ceiling. The sediments of layer 4 penetrate between these

blocks, and the visible thickness of the layer was up to 60 cm. The total thickness of uncovered sediments along the northern wall reached 2 m. Further work required an expansion of the excavation area, and at this stage of the research, excavations were halted.

The distribution of findings is characterized by the following features: all layers, starting from layer 1 and ending at the boundary between layers 3 and layer 4, are culture-bearing. In terms of quantity, the distribution of findings between the layers is as follows:

Layer 1: Lithic artifacts (N=7), faunal remains (N=11), ostrich eggshell fragment (N=1). Layer 2 (all subdivisions): Lithic artifacts (N=16), faunal remains (N=11), ostrich eggshell fragment (N=1). In regard to layer 3, the distribution of findings is as follows: lithic artifacts (N=94), faunal remains (N=98), and ostrich eggshell (N=18). With regard to layer 4, the distribution of findings is as follows: lithic artifacts (N=1) and faunal remains (N=24). The data presented here refer to individually recorded artifacts and faunal remains of more than 2 cm in size. They do not include information on the number of findings obtained during the dry sieving of sediments using a 4 mm mesh. It is clear that the numbers will increase significantly as more information on artifacts from the sieving process becomes available. Upon analyzing the vertical distribution of findings, several zones of artifact accumulation were identified (information is provided for the excavation area within 50 cm distance from the northern wall) (Figure 2).

The first zone refers to the area of burned soil and ash in Layers 2.1 and 2. At least three zones of vertical concentration of artifacts and faunal remains can be associated with Layer 3, recorded in its middle and lower parts. These zones are associated with interstratification of reddish, dark charcoal and sandy sediments. In general, layer 3 reflects the existence of several cycles of human occupation of the cave, interrupted by periodic cycles of cave abandonment and intensive visitation by animals. The earliest currently known episode of human occupation of the cave is associated with a phase of aeolian activity, represented in the sandy sediments of layer 3.1. Additionally, the only lithic artifact from layer 4 is located at the boundary with the overlying lithological unit.

The preliminary study of the bone remains from the Khairkhan-1 cave has enabled the identification of several mammalian taxa and ostrich eggshells (see Table). In regard to Layer 3, the presence of a single identifiable remains of bear, hare, horse, and bovinds of different size classes was determined. Two species of mammals were identified in Layer 3.1, with the most notable being a woolly rhinoceros represented by a tooth fragment. The fourth layer yielded the remains of a pika, a bear incisor, and a fragment of an antelope jaw. A significant portion of the remains are fragments of splintered bones belonging to large mammals. The majority of the bones have been well preserved. The rhinoceros tooth fragment and ostrich eggshells can be dated to the Pleistocene, in a broad sense.

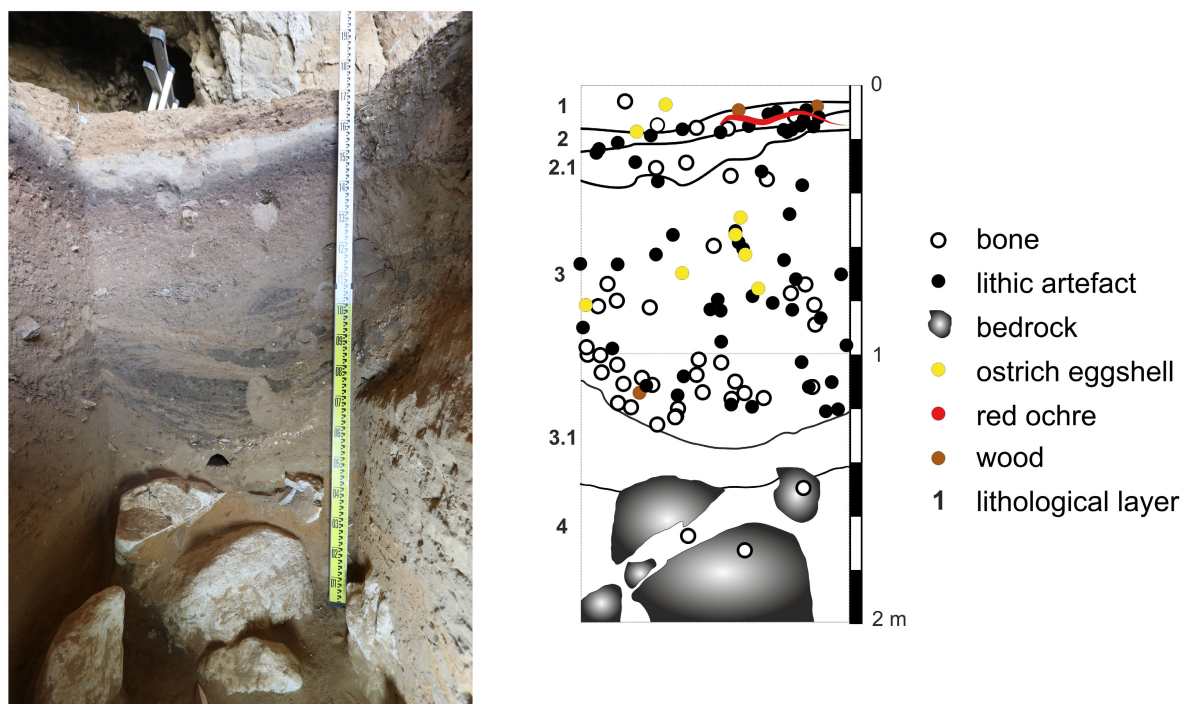


Figure 2. Cross-sectional profile of the northern wall of the Khairkhan-1 cave excavation in 2023 with projection of Lithics and Bones.

Table. Preliminary faunal determinations from the
Khairkhan-1 cave excavation

Species/Layer/	3	3.1	4
Canidae gen.	0	0	6
Ursus sp.	1	0	7
Lepus sp.	1	0	0
Ochotona sp.	0	0	1
Equus sp.	1	2	2
Coelodonta antiquitatis	0	1	0
Caprinae gen.	1	0	0
Bovinae gen.	1	0	0
Antelope	0	0	1
Struthio eggshells	17	1	0

The raw material composition of the lithic industry is primarily comprised of dark gray medium-grained metamorphic rock, with the occasional inclusion of rare flints and chalcedones. The source of the latter was not identified in the vicinity of the cave. The local raw materials are represented by a significant number of quartz artifacts. It is exceedingly uncommon to find cortex on artifacts.

The Layer 3 lithological units exhibit a flake-based industry, with an overwhelming predominance of amorphous and subrectangular flakes, ranging in size from 20 to 50 mm. Only one larger artifact was identified, a cortical flake measuring 100 mm in length. Blades are scarce, and in line with their width, they can be classified into two roughly equal categories: 10 to 20 mm and 20 to 40 mm. It should be noted that microblades are not present. The flakes' striking platforms are predominantly plain and dihedral. The cores (N=5) are represented by centripetal and unidirectional forms. The maximum size is 50 mm. The tools are represented by retouched flakes and blades, two atypical end scrapers, and perforators. We have identified points on flakes and a fragment of a sidescraper.

Discussion and conclusion

The joint Russian-Mongolian archaeological expedition has identified a previously unknown area of Stone Age sites distribution, which has undergone initial survey. The Khairkhan karst massif is situated precisely at the midpoint of the direct route between the northern foothills of the Russian Altai Mountains and central Mongolia. It is believed that one of the potential dispersal routes towards the Valley of Lakes and the northern front of the Gobi Altai may have passed along this region. The archaeological assemblages discovered during the Ikh-Khairkhan-1 cave excavations lack sufficient diagnostic artifacts to unambiguously determine their cultural and chronological affiliation. The limited technological and typological set of industries does not allow for a definitive determination. This may be attributed

to the specific characteristics of the arid ecological environment and the dearth of accessible and consistent water sources, as well as the scarcity of premium stone raw materials, with the exception of quartz. It would appear that visits to the cave by human populations were sporadic. Access to the cave is challenging, and it is likely that it was utilized as a provisional shelter for hunting animals native to the region, including those inhabiting rocky terrain and animals of open spaces that lived on the adjacent plain, covered with typical dry steppe vegetation. At the same time, the stone raw materials brought into the cave were extensively reduced, accompanied by probable transportation of tools and cores outside the cave.

It is clear that a dating program is necessary, and an expansion of the area of the cave under study may also be beneficial. In order to determine the cultural appearance of the Khairkhan-1 complex at this time, we can proceed from a number of indirect evidence sources. The obtained collections do not provide any evidence of pottery use, nor do they contain any data on microblade technology. The complex of layers 2 and 3 contains examples of large-blade production, which is characteristic of the early stages of the Upper Paleolithic. In addition, there is evidence of the use of centripetal and multiplatform reduction technology. However, at this stage of the study, we are unable to make well-founded assumptions about the in situ nature of these artifacts. This is due to the fact that the rocky base of the cave was probably not reached during excavations, and there is also evidence of bioturbation in the upper part of the sediments. It is probable that the formation of the upper part of the section up to layer 3 can be dated to the early Holocene, or the final Pleistocene period. Based on their faunal composition and sediment features, layers 3 and below can be dated to the period of the last glacial maximum, which was associated with climate aridization and increased aeolian activity. The collections from the cave excavations have an archaic appearance and are not comparable to other Holocene complexes in Mongolia. We have identified similarities with the core-and-flake assemblages of northern China, which are known to have existed throughout the entire MIS-3 and early stages of MIS-2 [Li et al. 2014]. Furthermore, there are certain similarities with the final MIS-3 and early MIS-2 assemblages of the Tolbor Valley [Gladyshev et al. 2010]. This assumption is, of course, preliminary and requires further confirmation.

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Captions

Figure 1. Geographical location of Khairkhan-1 cave.

Fig. 2. Cross-sectional profile of the northern wall of the Khairkhan-1 cave excavation in 2023 with projection of



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