STUDIA ARCHAEOLOGICA

Institute of Archaeology, Mongolian Academy of Sciences

DOI: https://doi.org/10.5564/sa.v47i1.4344

Tomus XLVII 2025 Fasciculus 4

Guunii Lkhundev[1]✉

[1]*Institute of Archaeology, Mongolian Academy of Sciences*
Ulaanbaatar, Mongolia

Paleolithic stone tools of Khovd River Valley: A techno-typological study from the surface collection

Abstract: The Khovd River - the largest fluvial system originating from the glaciers of Altai Tavan Bogd peak of the Mongol Altai Mountains - played a significant role in the geomorphology and paleoenvironment of western Mongolia. Its extensive drainage basin encompasses broad intermontane valleys, gorges, and tectonic depressions situated between the high-altitude mountain ranges of the region. The area's distinctive geological features, coupled with an abundance of diverse lithic resources, created an ecologically favorable setting for prehistoric human occupation which facilitated early technological and subsistence adaptations. Archaeological surveys conducted in the eastern part of the Mongol Altai Mountains have resulted to the discovery of numerous Stone Age sites. The majority of these sites are associated with the Upper Paleolithic period. These sites predominantly represent open-air sites, where lithic artifacts are distributed across the surface. This article presents the results of an analysis conducted on 53 lithic artifacts recently collected from the lower mouth of the Shijigt Gorge and the eastern bank of the Khovd River, located in Myangad soum, Khovd province. The artifacts contribute to the broader understanding of Paleolithic technological organization and raw material utilization in the region. When classified according to traditional methods of lithic analysis, the collected assemblage can be divided into two primary categories: core reduction (n=8 specimens) and tool production (n=45 specimens). Our observations indicate that early stone tool makers utilized locally abundant raw materials found in the river basin, including siliceous rocks, silicified sandstone, and pebbles, to manufacture their tools. A comparative analysis of the lithic assemblage also suggests that the artifacts can be chronologically attributed to a temporal span ranging from the late Lower Paleolithic to the late Upper Paleolithic period.

Keywords: *open-air site, core, pebble tools, raw material, artifact, reduction technique*

Email: glkhundev11@gmail.com,https://orcid.org/0000-0001-6718-8026

Introduction

Site Location: The site from which the artifact assemblage was collected is situated in Myangad soum, Khovd province, specifically at the lower mouth of the Shijigt Gorge on the eastern bank of the Khovd River (Figure 1).

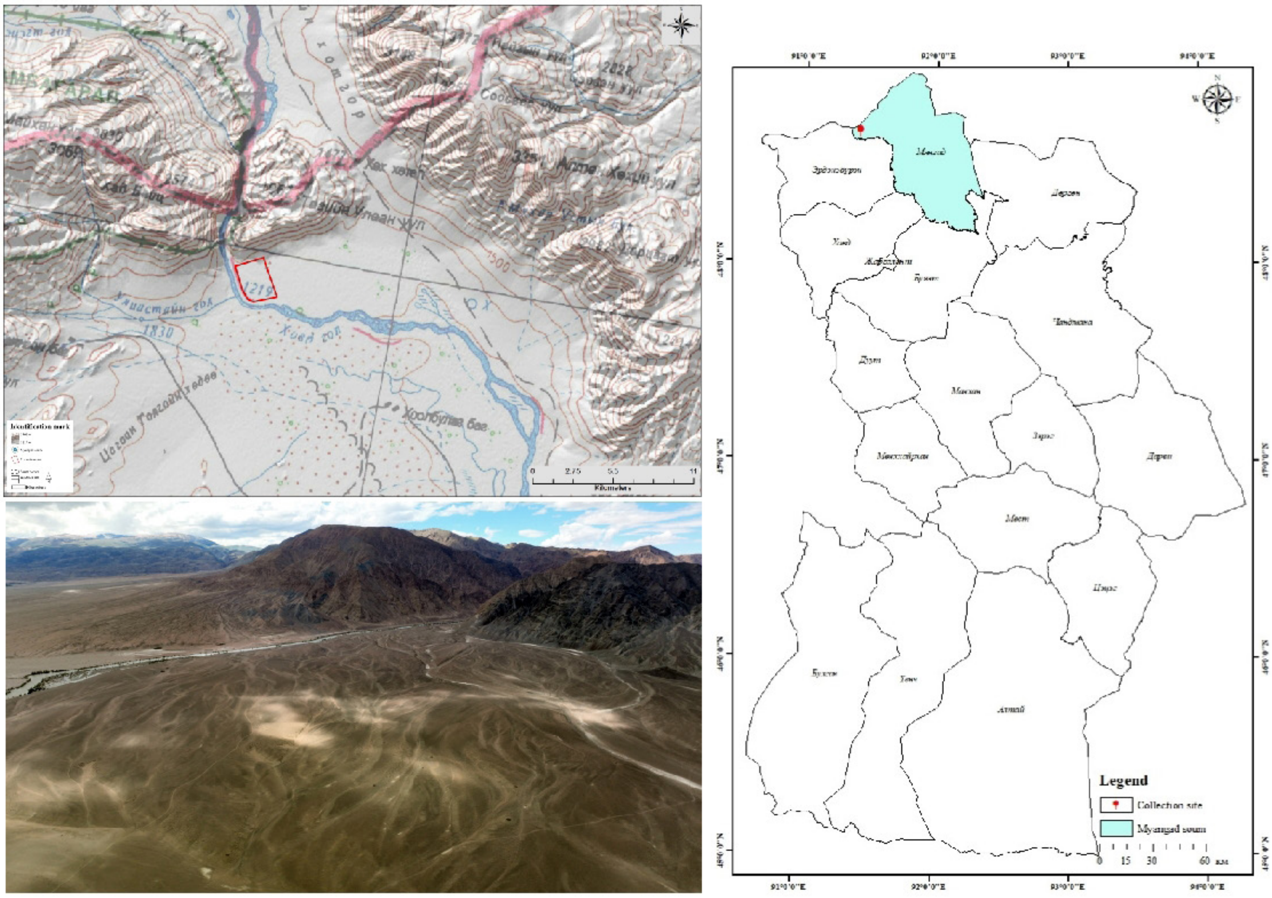

Figure-1. Map of the site where the lithic artifact assemblage was collected.

The Khovd River originates from the glaciers on the southeastern slopes of Tavan Bogd, the highest peak of the Mongol Altai, with its main tributaries being the Tsagaan Khovd and Khar Khovd Rivers. It flows into Khar Us Lake, located in the Great Lakes Depression. The river extends over a total length of 516 km (Tsegmid 1969, 176-177). Owing to the region's predominantly mountainous landscape, the geomorphology of the river valleys that intersect or delineate these mountain ranges exhibits considerable variation. The longitudinal valleys, which follow the orientation of the mountain ranges, consist of alternating wide and narrow sections. In several sections of the Buyant and Sogoog River valleys, which flow into the Khovd River, the valley widens to approximately 10 km, with remnants of ancient lake or river terraces clearly visible along the edges. In some broad valleys, there is now a lake, and a river flows through that lake. The narrow valleys are generally shorter but reach depths of 700-800 meters, forming gorge-like landscapes with steep, rocky riverbanks. These valleys are particularly common in the region, typically measuring 1-3 km in width and extending to depths of 400-500 meters, with extremely steep slopes characterized by abundant rock outcrops and cliffs. The valley floors contain abundant evidence of past glacial activity, including moraine ridges, hummocky terrain, and erratic boulders, while river terraces are relatively rare (Tsegmid 1969, 366).

One such landscape feature is the Shijigt gorge. Beginning at the lower section of the gorge, the river terraces and dry channels widen, a formation attributed to the effects of ancient glaciation and intense fluvial activity. On the eastern bank of the Khovd River, three distinct terrace levels are observable above the present-day river level. Each terrace has an average height of 2 to 2.5 meters. The first and second terraces contain abundant granite debris and erratic boulders, while the third terrace, located at a greater distance, has comparatively fewer rock fragments. Among these, the second terrace is the widest and features multiple dry stream channels. Along the banks of these channels, large rock fragments, accumulated due to the effects of strong fluvial currents, are prevalent, whereas smaller pebbles and gravel dominate other sections.

Research Summary: The discovery and study of Paleolithic sites along the Khovd River basin are associated with the 1966 joint Mongolian-Soviet Stone Age research expedition, as well as the surveys conducted by the Stone Age Research Unit of the Mongolian-Soviet Joint Historical and Cultural Expedition in 1979-1980 and 1983-1984. These research teams identified numerous archaeological sites along the Khovd River valley, including Sagsai, Buyant, Khar Us, Achit Lake, Khovd, Bayan-Ölgii, Bayan Gol, Bayan Nuur, Olon Nuur, Salkhit, Ulaan Khus, Uushigtai, and Altan Tsögts, among many others. More than 200 archaeological sites containing Stone Age artifacts have been discovered throughout the Mongol Altai region. Extensive research has been conducted on these sites, focusing on their geomorphological features, ancient geographical conditions, geological characteristics, and stone tool production techniques. Through these investigations, scholars concluded that lithic technology exhibited a continuous and unified developmental trend from the Lower Paleolithic through the Mesolithic and into the Neolithic period (Derevyanko et al., 1990, pp. 60-72; 479).

After the aforementioned research expeditions, no Stone Age surveys were conducted in the Khovd River basin until the mid-1990s. However, since 1995, joint projects and specially commissioned studies have led to the discovery and bringing them into academic circulation of new Paleolithic artifacts from the Khovd River and its tributaries (Kungurov, Tishkin 2008, pp. 73-84; Semibratov, Tishkin 2016, pp. 94-108; Tserendagva 2024, p. 7). This is further expanding our understanding of the methods used by Paleolithic human groups in this region to produce stone tools. One such significant archaeological site is the lower mouth of the Shijigt Gorge, located on the eastern bank of the Khovd River.

Research Methodology

Sampling and Collection Method: The lithic artifacts were identified on river terraces and dry streambeds, where they were found scattered across the surface. Such sites are classified as open-air surface sites (including site, locus, and workshops). Several research methodologies have been developed for studying data from Paleolithic sites in Mongolia and the arid regions of Asia (Derevyanko, Markin, Vasiliev 1994, pp. 74-76; Derevyanko, Petrin, Taimagabetov 1998, pp. 99-119; Derevyanko et al. 1998, pp. 10-11). Among these methodologies, the simplest-sample collection was employed here. The selection of this method was directly influenced by the available research timeframe, the distribution of artifacts, and human resource constraints. Not all stone artifacts visible on the ground surface were collected; only selected cores, flakes, and tool kits were systematically sampled. The sampled collection area covered 2.5 km². The boundaries of the area were determined using a GPS eTrex20 Garmin (Global Positioning System) device. The area was defined based on the outermost points of the collected artifacts.

Processing Methodology: In the laboratory setting, the artifacts were analyzed using the traditional classification methodology for lithic assemblages (Inizan et al., 1999, pp. 89-100; Tserendagva 2017. pp. 156-167). First, the artifacts were classified by type. Then, the technological reduction techniques were analyzed, and finally, their chronological association was proposed. Additionally, the degree of abrasion and surface modification of the stone tools was taken into consideration.

Research Materials

Primary Sources: In 2023, researchers from the Institute of Archaeology, Mongolian Academy of Sciences, conducted archaeological excavation and preservation work at the construction site of the "Erdenebüren Hydroelectric Power Station" project. During the excavation, more than 50 stone artifacts were collected from the lower mouth of the Shijigt Gorge and the first and second terraces on the eastern bank of the Khovd River (Erdene-Ochir et al., 2023, pp. 122-124). These lithic artifacts serve as the primary sourse materials for this article.

Raw Material Types: Most of the stone artifacts were made from pebbles that are abundant in the river valley. These pebbles are characterized by their fine-grained texture and high durability, likely due to their significant quartz content. Some artifacts were made from coarse-grained (granular) sandstone. This type of sandstone is structurally very similar to graywacke, a fine-grained igneous rock.

The pebbles exhibit brown, yellow, dark gray, and orange hues, which can be attributed to the presence of iron oxide and calcite. Some stones display distinct layered structures and various mineral veins. The altered coloration on the surface of certain rocks indicates that they have undergone substantial weathering processes.

Surface preservation: The stone artifacts exhibit varying degrees of abrasion and weathering. This variation in wear does not appear to be solely determined by the hardness and durability of the rock material. Even minerals and rocks with similar compositions, which have been exposed to identical environmental conditions for thousands of years on the ground surface, exhibit differing degrees of weathering. Therefore, these variations in abrasion and weathering should be considered in relation to the time of initial tool production and the processes of use and exposure over time.

When classified based on the surface preservation condition of the stone tool artifacts we observe four categories: heavily abraded (n=23), moderately abraded (n=13), lightly abraded (n=15), and non-abraded (n=2).

Collected Assemblage

Types of Stone Artifacts: The sample artifacts are classified as follows (Table 1). Among the artifacts representing primary core reduction, 8 specimens are classified, and a total of 45 artifacts subsequently belong to the tool kit production category.

Cores - 8 specimens. All cores are classified as pebble cores. Among them, one is a discoidal core, while the others have single striking platforms. The discoidal core was prepared using centripetal flaking, with one side shaped by large detachments to create a flat surface, while the opposite side was shaped with smaller detachments, resulting in a convex form (Figure 2-*1*). Six of the cores have striking platforms sloping towards the dorsal side, while one core has a striking platform sloping laterally. Two of these cores have prominent convex areas at the center of the striking platform. The striking platform of the first core was prepared using two longitudinal flake removals (Figure 2-*6*), while the other was shaped through small-scale detachments. This particular core is relatively larger than the others, with a single flake removal scar on its ventral surface, while the remaining areas retain the original cortical surface of the pebble (Figure 2-*4*). Among the remaining five cores, four were prepared using longitudinal flaking (Figure 2-*3*, *5*, *7*, *8*), while one was shaped through small detachments (Figure 2-*2*). This core has an elongated form, with its basal portion thinned and shaped from three sides. Additionally, only one flake was removed from its flaking surface.

Notched tool - 10 specimens. These tools are predominantly oval or rounded in shape, making them very comfortable and easy to hold in the hand. Notched tool production methods can be categorized into two distinct types:

Minimal modification of raw material - In this method, the natural shape of the raw material was preserved, with only slight modifications to create a functional edge. A total of six notches were made using this technique. Among them, four notches feature working edges on two distinct areas (Figures 2-*10*; 3-*1*, *2*, *3*, *5*, *6*).

Modified flakes or pre-fractured stones - The second method involved repurposing pre-flaked stones or primary flakes to create notches. A total of four notches were produced using this technique. In these cases, the most suitable edge of the stone was selected for modification into a working surface (Figure 2-*9*). One notch features three retouched edges, located on the upper part of the front side, as well as on the lower and lateral sections of the back side (Figure 3-*4*).

Composite tool - 10 specimens. These composite tools include hammer stone-knives (Figure 3-*9*), a notched-hammer stone (Figure 3-*12*), a side scraper-hammer stone (Figures 3-*10*, *11*, *14*; 4-*2*), a notched-awl (Figure 3-*13*), notched-scrapers (Figure 3-*7*, *8*), and a side scraper-nosed scraper (Figure 4-*1*).

Side scraper - 5 specimens. These tools can be classified into longitudinal (Figure 4-*3*), transverse (Figures 4-*4*, *7*), and concave (Figure 4-*5*). One of the transverse notches i**s** circular in shape and exhibits vertical retouch (Figure 4-*6*).

Adzes - 1 specimen. A flat, roughly rectangular-shaped stone has been thinned and sharpened on one of its transverse edges from both sides. This transverse edge is slightly curved, making it an ideal shape for use as an adze-like tool. The opposite transverse retouched edge has been repeatedly flaked from both sides, creating a sloped surface. A pointed projection has been formed in the central part, likely intended for hafting onto a wooden handle (Figure 4-*8*).

Pebble tool - 1 specimen. Double retouched pebble tool**.** A oval-shaped stone has been thinned and repeatedly flaked along both its transverse and longitudinal edges, creating sharp cutting edges. The opposite side of the edge is comfortable to grip by hand (Figure 4-*9*).

Scraper - 1 specimen. This artifact was made on a secondary spall. Vertical retouch was applied at the end and on the sides of the flake. As a result of a large flake removal at the end, a “nose-like” carrinated shape was formed (Figure 4-*10*).

Uniface - 1 specimen. One side of the oval-shaped stone was thinned by flaking from the edge toward the center. Most of the opposite side retains its natural cortex. Two to three short flake scars are visible on this side. The retouched edge and surface of this tool are heavily abraded (Figure 4-*11*).

Denticulate tool - 2 specimen. These were produced using both primary and secondary flakes. The first tool is elongated in shape. Irregular retouch was created on both the ventral and dorsal face of the tool (Figure 4-1*2*). The second tool is oval-shaped. A regular pattern of retouch was created on the inner part of the transverse side, and irregular retouch was applied on the longitudinal side (Figure 4-1*3*).

Chopper - 1 specimen. An oval pebble stone was thinned from one side using longitudinal flaking to produce a sharp edge. The back side of the tool is flat (Figure 5-*1*).

Chopping - 1 specimen. The width side of an oval pebble stone was flaked and thinned from both sides. The base is tapered, making it very comfortable to hold in the hand (Figure 5-*3*).

Hatchet - 2 specimens. The first tool is elongated in shape. One transverse edge was thinned by multiple longitudinal flake removals from both sides. The retouched section has been heavily abraded and damaged by weathering (Figure 5-*2*). The second tool is flat and oval-shaped. The pointed part of the transverse side was flaked with small removals on both sides to form a cutting edge (Figure 5-*4*).

Push-plane - 3 specimens. These tools were produced using the natural shape of the stone. The first is a pointed push-plane. The transverse part was shaped with several large flake removals, forming a point at the center. From the flat side opposite the retouch, small flake removals were made to produce a steep, vertical retouched edge. The tool is convex in the center, and the handle area is tapered and fits comfortably in the hand (Figure 5-*5*). The second tool is round in shape. Two flake removals were made from the edge toward the center to thin it. One edge was shaped with flake removals to produce a semi-vertical retouched edge (Figure 5-*7*). The last tool is elongated in shape. One width side was transversely struck and then trimmed from both sides. This tool can be used on both the front and back surfaces (Figure 5-*8*).

Knives - 3 specimens. The first tool was made by thick primary flaking. On the back side, there is a remnant of previous flaking, which has been heavily abraded. The long, thin edge of the flake was retouched with two transversal flake removals, followed by fine retouching. Due to the transversal flake scars, the retouch appears somewhat wavy. To reduce the thickness of the knife's edge, two transversal flake removals were made (Figures 5-*6*). The next tool was made from an elongated flat stone. A longitudinal flake was removed from the opposite side of the previous flake scars to thin the piece, followed by transversal retouching to sharpen the edge. The retouch scars has been heavily abraded. However, the area of the knife used for gripping was reshaped with longitudinal flaking, making it very comfortable to hold. At the tip of the knife, there is significant wear and previous flake scars, indicating that it was originally made for a different purpose (possibly as a hammerstone; Figures 5-*9*). The final tool was made by wide, flat secondary flaking. The long edge was retouched entirely from the back side with fine retouching. The triangular sharp tip at the longitudinal edge was broken (Figure 5-*11*).

Chisel like - 1 specimen. One end of an elongated flat stone was trimmed and thinned from both sides. The retouch is abraded and rounded. The handle area opposite the edge was thinned using both longitudinal and transverse flake removals (Figure 5-*10*).

Retouched blank - 3 specimens. These were produced using both primary (Figures 4-*14*, *15*) and secondary blanks. The blanks were struck directly from an unprepared, smooth platform (the natural cortex of the stone). On the upper surface of the blanks, traces such as the point of percussion, bulb of percussion, and fracture marks are visible on the inner side. On each blank, an edge was formed by retouching one suitable side. The retouched area is relatively small compared to the overall size of the blank. Along the thin edges of each blank, there is irregular and uneven retouch, which are interpreted here as accidental or unintentional modifications.

Reduction technique

The primary raw material for the stone tools were river pebbles, so the method of stone tool production falls under the pebble-based flaking technique. The main principle of this method is to directly strike and flake the raw material without preparing or shaping it to a specific extent beforehand. In other words, the process involves making small flake removals and retouching tools according to the original shape, size, and form of the raw material selected.

The collected assemblages fully represents the pebble tool-making technique of the Paleolithic. From this, the following methods were used to prepare the cores: The first method is the pebble technique. One core made using this method utilized a narrower part of the raw material as the base, and from the width opposite side, multiple parallel flake removals were performed to create a striking platform. Because this prepared core closely resembles a pebble tool, it is sometimes referred to as a chopping-type core. The second method is the radial flaking technique. One circular core made using this method was found. It has several flake scars directed toward the center. One surface of the core is flat, while the opposite surface is rounded. The third method is the parallel flaking technique. A relatively large number of such cores were found. A suitable surface of the raw material was prepared as a striking platform, and flakes were removed from the flaking surface in a parallel manner.

When splitting and flaking the pebbles, hammer stones were used. The main identifying features of this process-such as the percussion bulb, fracture marks, ripple patterns, and the point remaining on the striking platform-have been preserved on each flake. Many hammer stones used for breaking and flaking stone have been discovered. These show signs of extensive use, including numerous impact marks, surface damage, abrasion, and rounding.

Table 1. Types of stone tool artifacts.

	Types of Artifacts	*Total*	*Percentage*
Primary knapping		8	100.0
	- Discoidal core	1	12.5%
	- Single-platform, single flaking surface core (one core is chopping-type)	2	25.0%
	- Single-platform, double flaking surface core	3	37.5%
	- Single-platform, multiple flaking surface core	2	25,0%
Types of tools		45	100.0
	- *Notched tool*	*10*	*22.2%*
	- *Composite tool*	*10*	*22.2%*
	- *Side scraper*	*5*	*11.1%*
	- *Push-plane*	*3*	*6.7%*
	- *Knives*	*3*	*6.7%*
	- *Hatchet*	*2*	*4.4%*
	- *Denticulate tool*	*2*	*4.4%*
	- *Adzes*	*1*	*2.2%*
	- *Pebble tool (double retouched)*	*1*	*2.2%*
	- *Scraper*	*1*	*2.2%*
	- *Uniface*	*1*	*2.2%*
	- *Chopper*	*1*	*2.2%*
	- *Choppinng*	*1*	*2.2%*
	- *Chisel like*	*1*	*2.2%*
	- *Retouched blank*	*3*	*6.7%*
Total		**53**	**100.0**

Discussion of the Study

One distinctive feature of Paleolithic sites in Mongolia is their widespread distribution across the surface of the land. In such sites, it is common to find artifacts from different periods mixed together. This often makes it challenging to accurately determine the exact period of a given site. Currently, the dating of open-air site and habitation sites is determined by comparing the stone tool production techniques, the shape and design of major tools and tool kits, as well as signs of wear and abraded with those of other related sites.

Comparison: There are 8 cores that represent primary knapping. Among them, one core exhibits an ancient style. This core is a pebble core with a single striking platform, prepared by the single flaking technique. The transversal side of the core was retouched, and a convex striking platform was created in the central part, with a single flake removal from the flaking surface. This core is visually very similar to a chopping tool. Cores of this type have been found at sites such as Sagsai-11, Khovd-4, and Bayangol-3 in the Khovd River valley near the Mongolian Altai Mountains (Figures 2-*4*) (Derevyanko et al., 1990, 116), as well as at Nariin Gol-17b, Baidragiin Gol-6, and Argalant-3 in the southern slopes of the Khangai Mountains (Tserendagva, Derevyanko, Tseveendorj, 2017, 41; Figures 51-3, 115). These sites, such as Nariin Gol-17b, are associated with the Lower Paleolithic, while Argalant-3 and Baidragiin Gol-6 are linked to the Upper Paleolithic period. Therefore, remnants of the above-mentioned form were used over a long period from the Lower Paleolithic to the Upper Paleolithic.

A core that represents the method of stone tool production in the Middle Paleolithic has been found. It is circular in shape and was prepared using the radial flaking technique (Figure 2-*1*). In terms of size, it is average. One side of the core is flat, resulting from several flake removals directed toward the center, while the opposite flake surface is rounded. Several short flakes were removed from this surface. Cores of this type are frequently found at stratified and open-air sites across Mongolia.

Six cores have a single striking platform on one side. Of these, two were prepared using the transversal flaking technique (Figures 2-*7*, *8*), while the others were made using the longitudinal flaking method (Figures 2-*3*, *5*, *6*). The striking platforms of four cores are convex in shape and slanted backward. These platforms were prepared with one or two flakes, and some of the cores show a retouched edge where the edges were smoothed. The base areas of the cores have not been retouched and still retain their original surface. The choice of raw material, the flaking method, and the signs of wear and abraded suggest that these cores can be associated with the Middle Paleolithic period. However, one core has an elongated shape and a backward slanted striking platform (Figure 1-2). The base area has been sharpened, and a single short flake was removed from the flaking surface. This core has non abraded, is small in size, and retains a pointed shape, which provides a clue that it may date to the latter part of the Upper Paleolithic period.

A total of 45 artifacts related to tools are divided into 15 categories. Among these, the most common are notched tool (10 specimen) and composite tool (10 specimen). These two types of tools account for 44.4% of the total tool assemblage. The next most common tools are side scrapers with 5 specimen (11.1%), push-planes with 3 specimens (6.7%), knives with 3 specimens (6.7%), and retouched blanks with 3 specimens (6.7%). The remaining tools include hatchets with 2 specimens (4.4%), denticulate tools with 2 specimens (4.4%), and seven other types of tools, each with 1 specimen (2.2% each).

Features: Among the 45 artifacts related to tools, 31 were made from unflaked stone, 7 were made by spall, 4 were made by pressure flaking, 2 were made from flaked stone, and 1 was modified from a previously used tool. Tools made from unflaked stone, or raw material in its original form, account for 68.9% of the total tools. These tools are easy to hold and use, and most importantly, they indicate that the main focus was on minimal flaking to prepare the tools, highlighting the attention given to efficiency in tool production. On the other hand, this also reflects the knowledge, skills, and experience of the craftsmen of that time in tool-making. The original form of the raw material was highly significant to early artisans, which becomes a distinctive feature of this site.

The abundance of notched tool provides some insight into the tool production and economic conditions of the time. Notched tools were commonly used for processing wood (e.g., stripping bark, sharpening, etc.), indicating a high demand for tools in daily activities, such as working with sticks, reeds, and other materials. This also suggests that the people of that time had a significant need for materials like wood in their everyday lives. On the other hand, it offers a glimpse into the state of the forests and woodlands along the Khovd River, as well as the living conditions and opportunities for settlement in that area. The notched tools found are deeply worn and heavily abraded, with some having three depressions or grooves on a single notch.

Among the 29 paleolithic sites in the Khovd province region, 23 types of tools have been identified, with the most numerous being notched tools (165 specimen) (Tserendagva 2024, 12-14). Additionally, in the eastern part of the Khangai Mountains, in the Orkhon River valley, notched tools make up the majority of artifacts found at the Orkhon-1, Orkhon-7, and Moiltyn Am sites. Chronologically, these artifacts are associated with the early, middle, and late Upper Paleolithic periods (Derevyanko, Kandyba, Petrin 2010, 223-250). A distinctive feature of the artifacts from these sites is that they show no signs of abrasion at all.

Among the other common composite tools, there are 4 specimens of side scraper-hammer stone combinations, and 1 specimen each of hammer stone-knives and hammer stone-notched tool combinations. Three of them are composite tools made from notched tool-awls and notched tool-scrapers, while one is a side scraper-nosed scraper combination. From this, it is evident that composite tools made from notched tools, side scrapers, and hammer stones were predominantly used. The use of two tool configurations on one item makes it more convenient for carrying and using, while also reflecting the dual purpose and specific functions of labor during that time.

Tools such as side scrapers, push-planes, knives, hatchets, denticulate tools are traditional tools that were widely used throughout all periods of the Paleolithic age. One of the knives in the artifact collection was made using a primary flake. The original marks from when the flake was first detached-such as the percussion bulb, ripple marks, and striations-have significantly faded and become indistinct. However, it is clearly evident that the flake was later modified by retouching to form a knife. This suggests that one artifact may be associated with two different time periods.

In addition to the tools mentioned above, tools such as choppers, chopping tools, unifaces, double-edged pebble tools, chisel like tools, scrapers, and notched tools exhibit very ancient characteristics. This is evident from the flaking marks on the surface of the stone tools, the condition of their retouch, the degree of wear and abrasion, as well as the overall shape, form, and size of the tools.

Looking at the condition of the tool retouch, the chopper, chopping tool, hatchet, uniface, double-edged pebble tool, chisel like and some composite tools were shaped by striking and flaking from one or both sides in large flakes, or by step-flaking to sharpen the edges. Side scrapers were retouched to create single or double retouched edges in straight, transverse, or concave forms. The presence of heavy abraded and pitting on the ends or sides of hammer stone tools indicates prolonged use. Additionally, some tools feature serrated retouch, both continuous and discontinuous retouch, concave grooves, and pointed tips-either individually or in combination.

The artifact tools were compared in terms of production style, shape and size, retouch condition, and degree of abrasion with similar implements from open-air sites in the Mongolian Altai Mountains and the southern part of the Khangai Mountains. Based on this comparison, they were attributed to a time range spanning from the end of the Lower Paleolithic to the end of the Middle Paleolithic period.

Research Conclusion

The wide valleys, rocky gorges, and basins between the high mountain ranges in the western part of Mongolia provided favorable conditions for human habitation in prehistory times. The river valleys and rocky areas were rich in raw materials suitable for stone tool production, offering a wide variety of adaptive choices. The discovered stone tools were used for hunting, wood processing, and digging roots and tubers. They exhibit a wide range of forms, types, and craftsmanship.

The significant degree of wear and abrasion observed on the stone artifacts indicates that they date back to a very early period. Some tools feature up to three working edges, and composite tools were commonly produced and utilized. The high proportion of tools among the total finds suggests that early humans were able to achieve high productivity with minimal effort by utilizing the natural form of raw materials. This characteristic sets the site apart as a distinctive feature compared to others.

The wide variety of stone tools and their proximity to raw material sources found at the lower mouth of the Shijigt Gorge indicate that this site served as an open-air site and a workshop area. Comparative research shows that the artifacts date from the Late of the Lower Paleolithic through the Middle Paleolithic and into the early Upper Paleolithic period, representing a long span of occupation. The stone artifacts discovered in the Shijigt Gorge of the Khovd River Valley share similar characteristics in terms of flaking techniques, morphological features, and raw material types with numerous open-air archaeological sites in the Mongol Altai and the southern part of the Khangai mountain range.

Acknowledgements

I would like to thank my friend, Dr. Corey L. Johnson, Postdoctoral Fellow at the Institute of Human Paleontology, Muséum national d'Histoire naturelle (France), for his helpful advice on the English language editing of this manuscript.

https://orcid.org/0000-0001-6718-8026

REFERENCES

Derevyanko, A.P., Dorj, D., Vasilievsky, R.S., Larichev, V.E., Petrin, V.T., Devyatkin, E.V., & Malaeva, E.M. (1990). *The Stone Age of Mongolia: Paleolithic and Neolithic of the Mongolian Altai*. Novosibirsk: "Nauka" Siberian Publishing House.

Derevyanko, A.P., Markin, S.V., & Vasiliev, S.A. (1994). *Paleolithic Studies: Introduction and Fundamentals*. Novosibirsk: "Nauka" Siberian Publishing House.

Derevyanko, A.P., Kandyba, A.V., & Petrin, V.T. (2010). *The Paleolithic of Orkhon*. Novosibirsk: Institute of Archaeology and Ethnography, SB RAS.

Derevyanko, A.P., Petrin, V.T., & Taymagambetov, Zh.K. (1998). Methodology and informativeness of Paleolithic surface sites in the arid zone of Central Asia. *In The Stone Age of Kazakhstan and Adjacent Territories* (Materials of the International Conference dedicated to the 70th anniversary of K.A. Alpyssbaev), Turkestan, pp. 165–196.

Derevyanko, A.P., Olsen, D., Tsevendorj, D., & Petrin, V.T. (1998). Periodization and chronology of the Paleolithic in Mongolia. *Studia Archaeologica*, XVIII(2), 8–18.

Erdene-Ochir, N., Batbold, N., Lkhundev, G., Amgalantugs, Ts., Erdene, B., Delgermaa, L., Tuvshinjargal, T., Sodnomjamts, D., Tsenguun, G., Nandintsetseg, N., & Lkhagvasuren, B. (2023). *Excavation report of archaeological research conducted at the construction site of the "Erdeneburen Hydroelectric Power Plant" project*. Ulaanbaatar: Library and Archive Collection of the Institute of Archaeology, MAS.

Inizan, M.-L., Reduron-Ballinger, M., Roche, H., Tixier, J. (1999). *Technology and Terminology of Knapped Stone*. Nanterre: CREP.

Kungurov, A.L., & Tishkin, A.A. (2008). Location of stone artifacts near Khovd city. *Theory and Practice of Archaeological Research*, 4, 73–84.

Semibratov, D.P., & Tishkin, A.A. (2016). New Stone Age sites in the Mongolian Altai. *Theory and Practice of Archaeological Research*, 2(14), 94–108. https://doi.org/10.14258/tpai(2016)2(14).-07

Tsegmid, Sh. (1969). *Physical Geography of Mongolia*. Ulaanbaatar: State Publishing House.

Tserendagva, Ya. (2017). *Fundamentals of Paleolithic Studies I*. Ulaanbaatar: Munkhiin Useg Print.

Tserendagva, Ya. (2024). The issue of ancient human settlement in Khovd province: Overview of Stone Age research and sites. *Studia Archaeologica*, XLIV(1), 5–25.

Tserendagva, Ya., Derevyanko, A.P., & Tseveendorj, D. (2017). *Paleolithic sites of Bayankhongor aimag*. Ulaanbaatar: Admon Print.

APPENDIX FIGURES

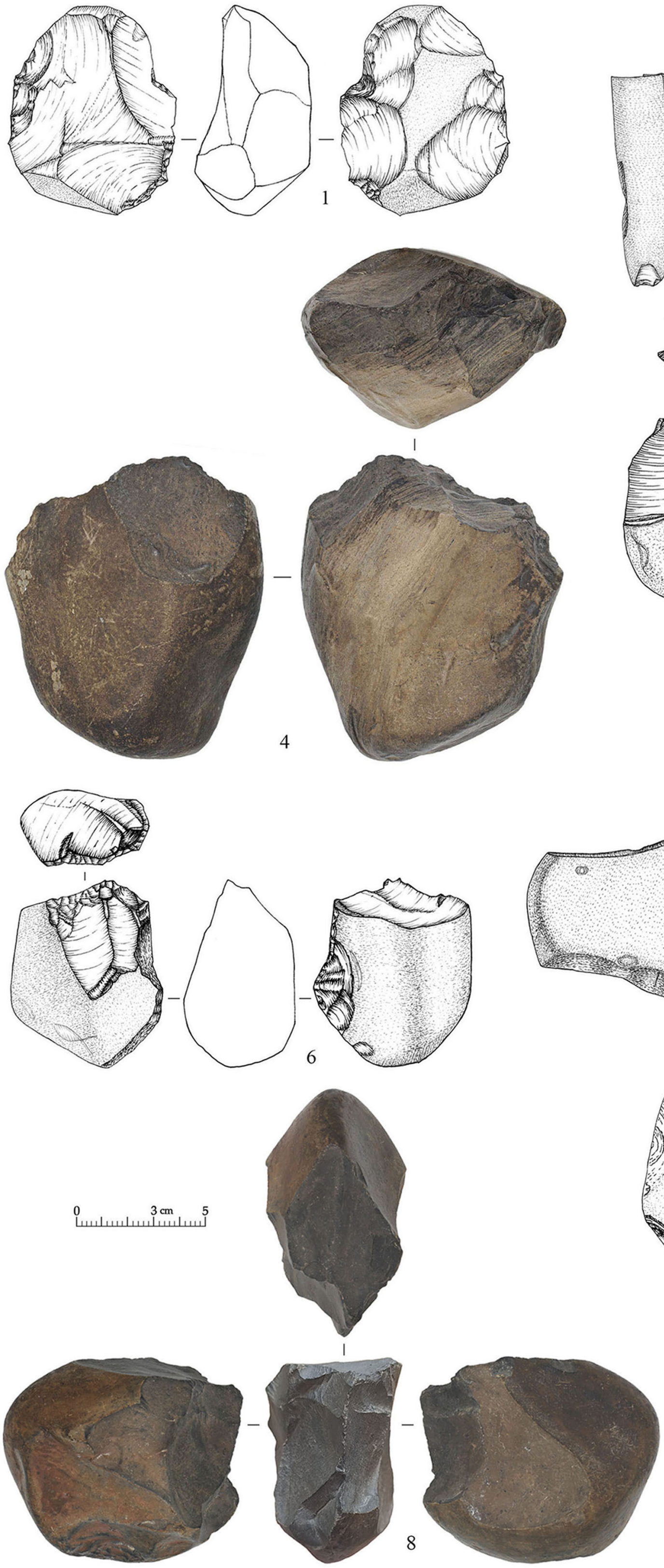

Figure-2. *1 - discoidal core; 2, 4 - single-platform, single flaking surface core;*
3, 6, 8 - single-platform, double flaking surface core;
5, 7 - single-platform, multiple flaking surface core; 9, 10 - notched tools.

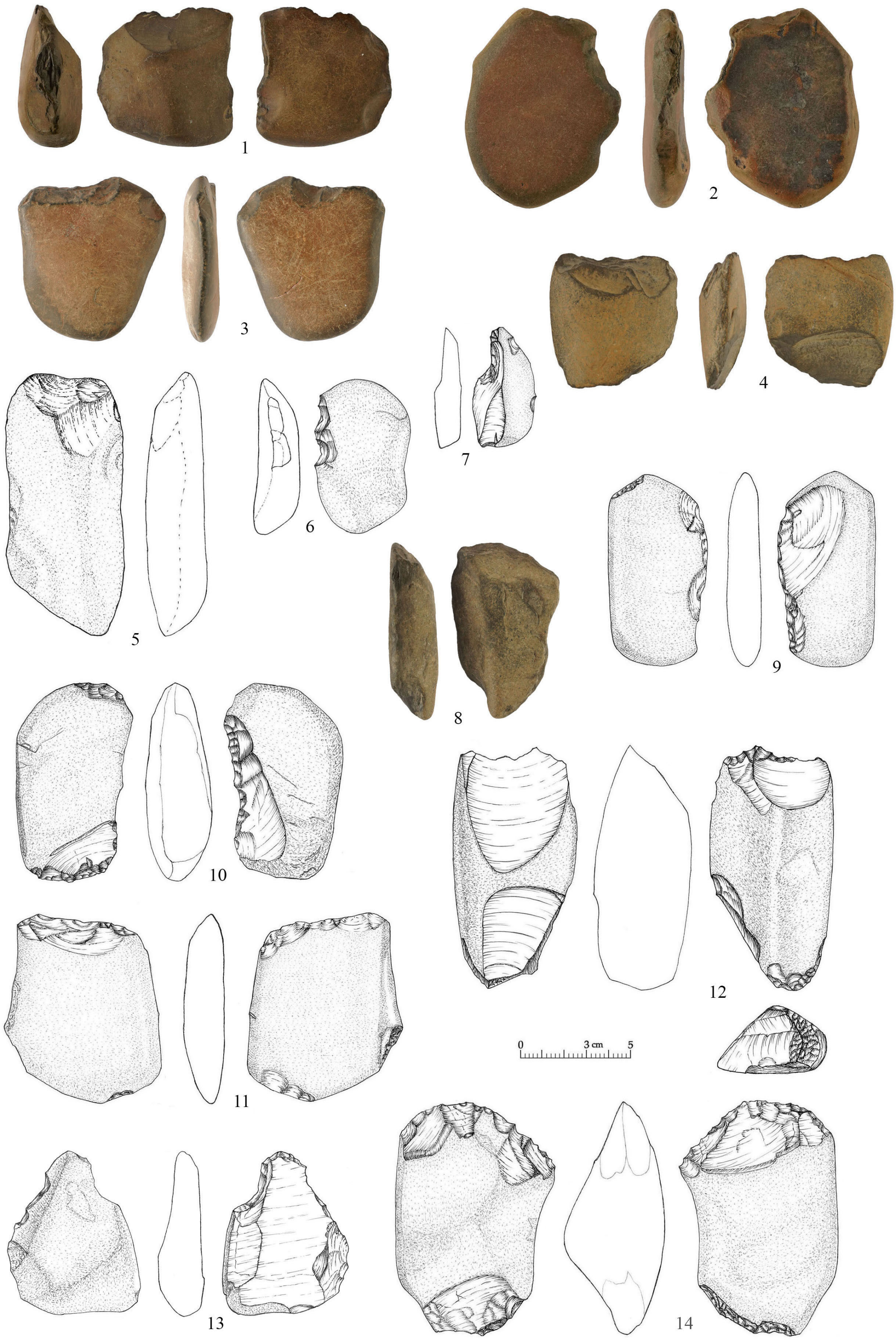

Figure-3. *1, 2, 3, 4, 5, 6 - notched tools; 7, 8 - notched-scraper; 9 - hammer stone-knives; 10, 11, 14 - side scraper-hammer stone; 12 - notched-hammer stone; 13 - notched-awl.*

Figure-4. *1 - side scraper-nosed scraper; 2 - side scraper-hammer stone; 3, 4, 5, 6, 7 - side scraper; 8 - adzes; 9 -* pebble tool; *10 - scraper; 11 - uniface; 12, 13 - denticulate tool; 14, 15 - retouched blank.*

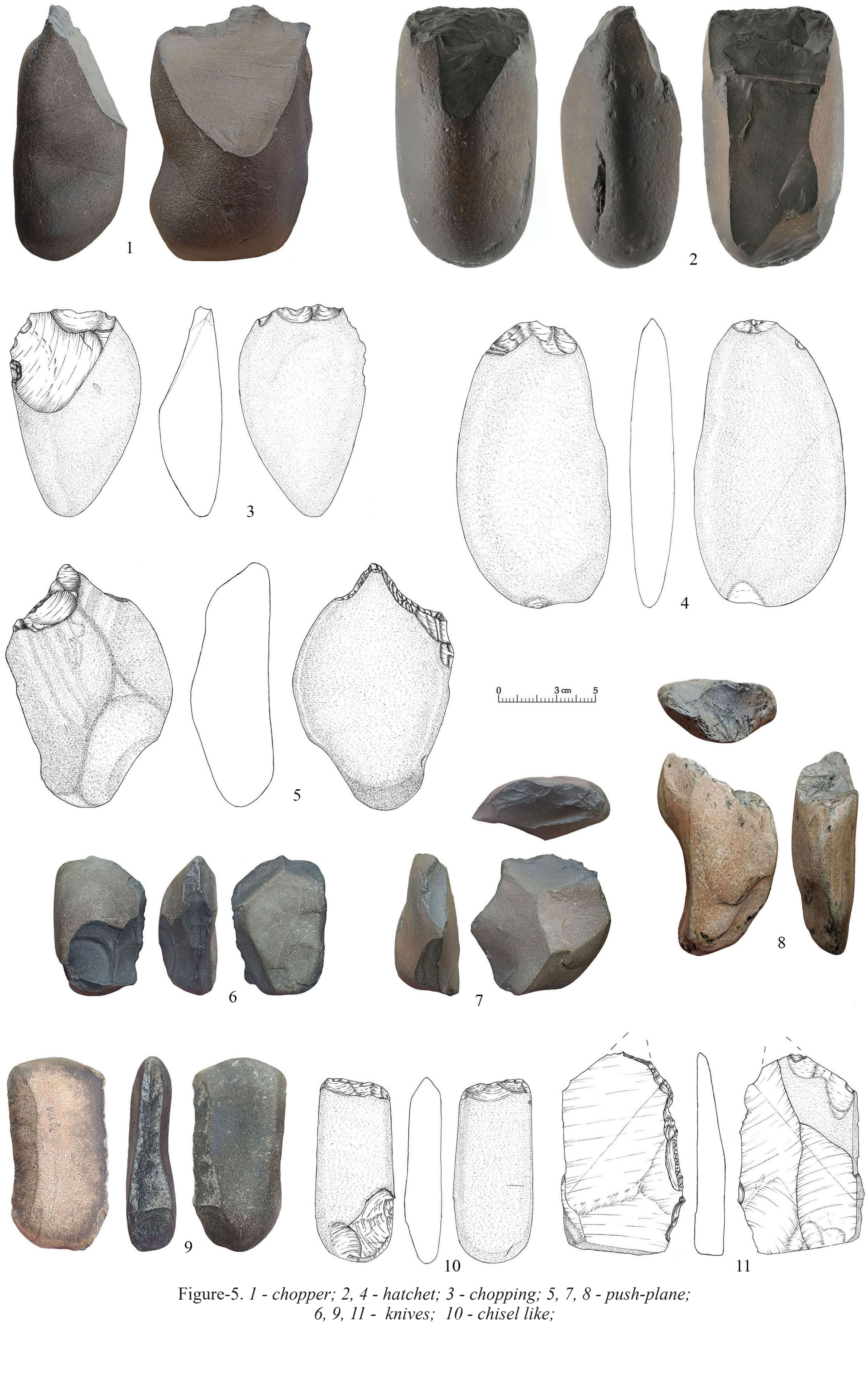

Figure-5. *1 - chopper; 2, 4 - hatchet; 3 - chopping; 5, 7, 8 - push-plane; 6, 9, 11 - knives; 10 - chisel like;*