MILLSTONES FROM THE NEOLITHIC SETTLEMENT OF ARUKHLO I IN THE SOUTH CAUCASUS: RESULTS OF INTERDISCIPLINARY RESEARCH[1]

სამხრეთ კავკასიის ნეოლითურ ნამოსახლარ არუხლო I-ზე გამოვლენილი ხელსაფქვავები: ინტერდისციპლინარული კვლევების შედეგები

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Abstract

Despite nearly a century of research, the process of the emergence and development of food-producing economy remains a relevant topic of study. Each new interdisciplinary study provides important information about the lifeway of Neolithic population, the first farming community. In this regard, the interdisciplinary study of millstones undoubtedly yields valuable information. As is well known, their primitive forms appeared together with the domestication of cereal crops, at the very emergence of the elements of early agricultural culture, and they subsequently became one of the defining features of early farming societies.

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In the South Caucasus, the Neolithic way of life, characterized by sedentary farming and animal husbandry, emerged in the 6th millennium BCE. This culture is known as the Shulaveri-Shomutepe Culture. One of its most well-known and significant sites is Arukhlo I, located in Georgia, in the Kvemo Kartli region.

The present study reports the results of typological, petrographic, and palynological analyses of millstones discovered at Arukhlo I between 2005 and 2016.

Based on the analysis of interdisciplinary research, we reconstruct certain aspects of economic activity. We discuss the daily practices of the population living in the Kvemo Kartli region of Georgia approximately 8,000 years ago: the types of millstones they used, how they produced them, and the sources of raw material for their production.

The analysis of the studied material clearly demonstrated that, in addition to cereals, millstones were used to grind a variety of plants, including medicinal species, as well as pigments and other products.

Keywords: Arukhlo, quern, grinder, basalt, tuff, rhyolite.

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აბსტრაქტი

თითქმის საუკუნოვანი კვლევის მიუხედავად წარმოებითი მეურნეობის წარმოქმნა-განვითარების პროცესი დღესაც აქტუალურია. ყოველი ახალი ინტერდისციპლინარული კვლევა უმნიშვნელოვანეს ინფორმაციას იძლევა ნეოლითელი ანუ პირველი მეურნე-მიწათმოქმედი ხალხის ყოფაზე. ამ შემთხვევაში ხელსაფქვავების ინტერდისციპლინარული კვლევა უდავოდ ღირებულ ინფორმაციას იძლევა. როგორც ცნობილია მისი პრიმიტიული ფორმები ჩნდება მარცვლეული კულტურების მოშინაურებასთან ერთად, ადრესამიწათმოქმედო კულტურის ელემენტების ჩასახვისთანავე და შემდგომში ის ხდება ადრესამიწათმოქმედო კულტურის ერთერთი გამნსაზღვრელი ნიშანი.

სამხრეთ კავკასიაში ნეოლითური ცხოვრების წესი, რომლისთვისაც დამახასიათებელია დამჯდარი მიწათმოქმედება და მესაქონლეობა, VI ათასწლეულში ჩნდება. აღნიშნული კულტურა შომუთეფე-შულავერის სახელითაა ცნობილი, მისი ერთერთი ყველაზე ცნობილი და საინტერესო ძეგლია არუხლო I, რომელიც საქართველოში, ქვემო ქართლის რეგიონში მდებარეოს.

წარომდგენილ სტატიში მოცემულია არუხლო I - ზე 2005-2016 წლებში აღმოჩენილი ხელსაფქვავების ტიპოლოგიური, პერტოგრაფიული და პალინოლოგიური კვლევის შედეგები.

ინტერდისციპლინარული კვლევების ანალიზის საფუძველზე ვახდენთ სამეურნეო საქმიანობის გარკვეული ასპექტების რეკონსტრუქციას. ვსაუბრობთ საქართველოში, ქვემო ქართლის ტერიტორიაზე, დაახლოებით 8000 წლის წინ მცხოვრები მოსახლეობის ყოველდღიურ საქმიანობაზე: რა ტიპის ხელსაფქვავებს იყენებდნენ, როგორ ამზადებდნენ მათ და საიდან მოჰქონდათ ხელსაფქვავების დასამზადებელი ნედლეული.

შესწავლილი მასალის საფუძველზე ნათლად გამოიკვეთა, რომ მარცვლეულის გარდა, ხელსაფქვავები გამოიყენებოდა სხვადასხვა მცენარის, მათ შორის სამკურნალო მცენარეების, აგრეთვე პიგმენტებისა და სხვა პროდუქტების დასაფქვავად.

საძიებო სიტყვა: არუხლო, ქვედა ქვა, ზედა ქვა, ბაზალტი, ტუფი, რიოლითი.

Introduction

Based on available data, several independent centers for the emergence of agriculture are currently recognized. One of the oldest of these centers was likely located in the Near East, where all the necessary conditions for the “Neolithic Revolution” existed across a number of regions. Within this center, it is possible to identify several independent cores of early farming culture. The earliest agricultural centers have been documented in Syria-Cilicia, Anatolia, northern Iraq, the South Caucasus, and Iran, which are closely related to the early farming culture of Central Asia (ჯაფარიძე და სხვ., 1971: 6–7).

In the Near East, within the Fertile Crescent, the transition from hunting and gathering to farming and animal husbandry occurred in the 10th-8th millennia BCE (Hansen et al., 2017: 195). As for the South Caucasus, excavations and studies conducted since the 1950s [Abibullaev 1981: 16–17] have shown that the Neolithic way of life, characterized by settled farming and animal husbandry, emerged in the 6th millennium BCE (Hansen et al., 2018: 27). This culture is known as the Shulaveri–Shomutepe culture. Its designation was established following the excavations of two key sites conducted in the late 1950s and early 1960s: Shulaveris Gora, in the Marneuli Plain of Georgia, and Shomu-Tepe, in the Gazakh-Tovuz Economic Region of Azerbaijan (Sagona, 2018: 93–94).

Settlements of the Shulaveri-Shomutepe culture are concentrated in southeastern Georgia (Kvemo Kartli), southwestern Azerbaijan, and western Armenia (Fig. 1) (ჩუბინიშვილი, 1973: 102-104; კიღურაძე, 1976; Нариманов, 1987; Джапаридзе, 1989; Hansen et al., 2006: 1-34; Badalyan et al., 2010; Helwing et al., 2017: 2). These settlements are artificial mounds formed as a result of long-term habitation at a single location. They are characterized by unfired mud-brick architecture, circular dwellings and storage rooms of varying sizes (Fig. 2–3). Clay was used at a relatively advanced level in architecture. This culture introduced a number of innovations to the South Caucasus, which were reflected not only in ceramic production, but also in the manufacture of stone and bone tools. The economy of early farming culture was entirely based on stone, antler, and bone implements. Agriculture was highly developed, with a variety of cereal crops, alongside well-established animal husbandry, fishing, and other activities.

Neolithic settlements of the Shulaveri-Shomutepe culture in Georgia are concentrated in the Kvemo Kartli region. These include the sites of Shulaveris Gora, Imiris Gora, Khramis Didi Gora, Arukhlo I, Gadachrili Gora, and Mashaveras Gora (Fig. 1: 1–6). The focus of our research is one of the most prominent of these sites - Arukhlo I.

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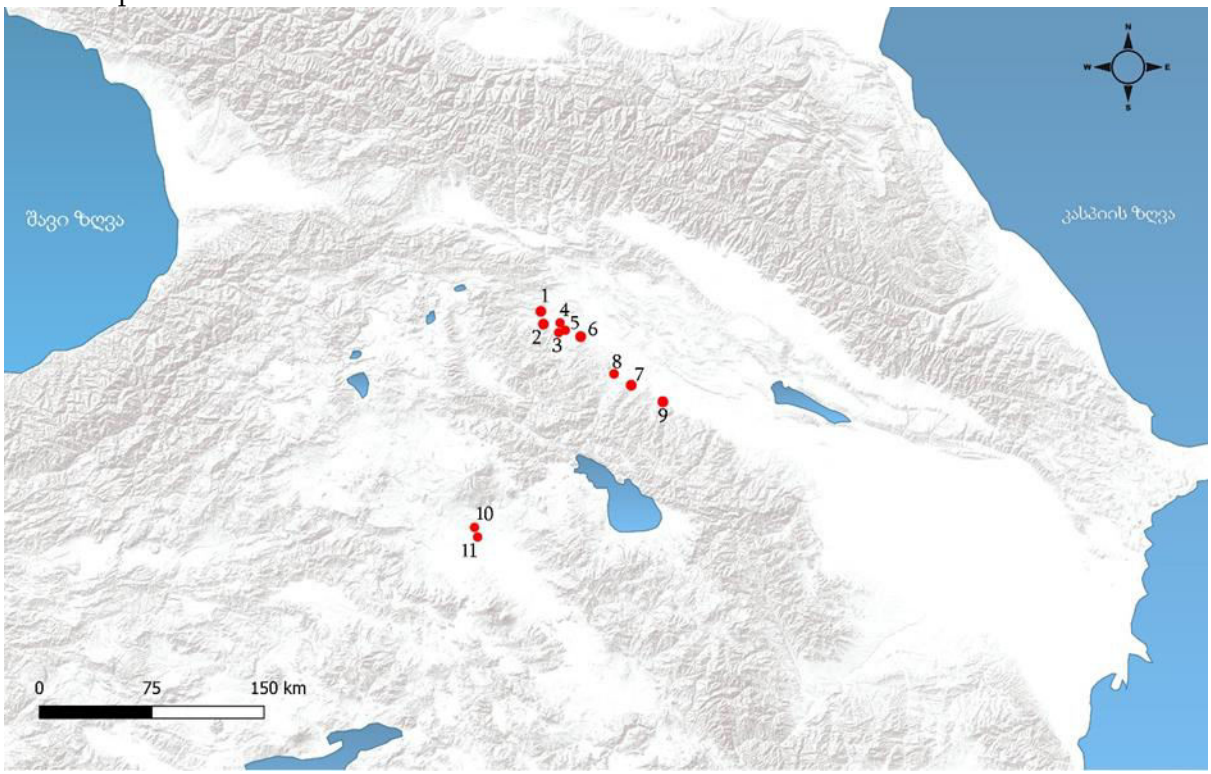

Fig 1. Settlements of the Shulaveri-Shomutepe culture: **1)**Arukhlo I; 2) Mashaveras Gora; 3) Gadachrili Gora; 4) Shulaveris Gora; 5) Imiris Gora; 6) Khramis Didi Gora; 7) Shomu-Tepe; 8) Gargalar-Tepesi; 9) Toira-Tepe; 10) Goytepe; 11) Aknashen-Khaturnakh; 12) Aratashen

Arukhlo I is located in the Bolnisi Municipality, south of the village of Nakhiduri, on the left side of the Tbilisi–Bolnisi highway, approximately 50 km from Tbilisi, within a large triangular area at the confluence of the Khrami and Mashavera rivers. The mound reaches a height of 6 meters and

has a diameter of approximately 300 meters (ჩუბინიშვილი, 1967: 22; Hansen et al. 2006: 4; ჩიქოვანი და სხვ., 2015: 16).

The first archaeological excavations at Arukhlo I began in 1966 and continued until 1985 (ჩიქოვანი და სხვ., 2015). The excavations conducted between 1966 and 1985, together with the individual studies published in connection with them, significantly enhanced the role of Arukhlo I in the study of sites of this culture.

Since 2005, archaeological work at Arukhlo I has been resumed through a joint collaboration between the Eurasia Department of the German Archaeological Institute and the Georgian National Museum (Hansen et al., 2013: 7–8). Archaeological excavations carried out between 2005 and 2016, using new methodological approaches, have provided greater opportunities for a more in-depth study of the architecture, ceramics, agricultural and household tools, and other artifacts. Instead of the stratigraphic horizons distinguished during the earlier excavations, a new stratigraphy was established based on individual buildings and architectural complexes. According to calibrated radiocarbon dating (C14), the occupation of Arukhlo spans the period between 5877 and 5296 BCE (Hansen et al., 2017: 191).

Since the 1950s, excavations of sites of the Shulaveri–Shomutepe culture, as well as earlier and recent investigations conducted at Arukhlo I, together with the publications devoted to this site, have provided extensive information about Neolithic way of life in the South Caucasus. However, a number of issues still require further clarification and more in-depth study. Accordingly, the process of the emergence and development of food-producing economies remains a relevant topic of research. For the reconstruction of economic life during the Neolithic period, the study of subsistence tools, particularly millstones, is of great importance.

Fig. 2. Arukhlo I, earlier excavations, central trench, view from the west (source: Chikovani et al., 2015: 107, Pl. IV-1)

Fig. 3. Arukhlo I, recent excavations, Large round Buildingscircular structures, view from north (source: Hansen et al., 2017: 195)

Methods

The research presented in this article is based on the study of the typology, production techniques, and other principal characteristic features of millstones, drawing on previous scholarship (Hürlimann, 1964: 72–86; Zimmermann, 1988: 569–787; Bauche, 1988:152-155; Wright, 1992: 53–82; Dzidziguri, 2000: 134–137; Hamon, 2008: 85–135). For example, A. Zimmerman singles out 3 main types of millstones according to the working surface (type III has one subtype) (Zimmermann, 1988:569-787). In this typology, he gives the working surface of querns in the longitudinal section and the working surface of grinders in the cross one.

Form 1. The working surface of the quern is convex in cross section, and the working surface of the grinder is concave in longitudinal section. The width of the quern is less than the length of the grinder.

Form 2. Both stones have flat working surfaces. The width of the quern and the length of the grinder are same.

Form 3. The quern is concave (trough-shaped) both in longitudinal and in cross sections. The grinder has a convex working surface. The grinder of the subtype of the third form is placed in the deepened surface of the quern.

Along with this typology, an article of Bauche should be mentioned (Bauche, 1988:152-155), where an interesting analysis of the working surface of Neolithic millstones is given. Here a concave working surface got as a result of the work of the corresponding grinder on the form 1 quern by Zimmermann's typology is a graphically shown. In this instance, the length of the grinder exceeds the width of the quern, and therefore acquires the so-called "saddle" shape.

When studying the typology of millstones, an article on Neolithic millstones from one of the riverine settlements in Switzerland (Greifensee municipality) is also interesting (Hürlimann, 1964:72-86). Here the author (F. Hürlimann) schematically gives the shapes of working surfaces of millstones in longitudinal and cross sections. As a result, on the grounds of materials obtained, he distinguishes 6 types:

I. Convex in longitudinal section, convex in cross section
II. Concave in longitudinal section, convex in cross section
III. Flat in longitudinal section, convex in cross section
IV. Concave in longitudinal section, flat in cross section
V. Flat in longitudinal section, flat in cross section
VI. Concave in longitudinal section, concaved in cross section

One more significant article should be mentioned, namely, that by R. Wright (Wright, 1992: 53-82) on the classification system for massive stone tools from the prehistoric Levant. The article provides detailed information about the technique of processing massive stone tools, their anatomical description, etc.

the studies presented in this article,, the definition of the criteria for millstones, their sketching, and the singling out of working surfaces and other characteristics were carried out precisely on the basis of this method.

Results

Typological and Statistical Analysis

During the archaeological excavations conducted between 2005 and 2016, a total of 340 millstones were identified, of which 136 are querns and 204 are grinders (Diag. 1). Based on this material, the main types of millstones were distinguished: three primary types for the querns and five for the grinders. To facilitate the classification and identification of specific millstone types, Latin letters, placed in parentheses, were assigned to the querns (A) and to the grinders (B). For example, Type 1(A); the number 1 indicates the sequence of the millstone type, while (A) designates a quern. The same principle was applied to the grinders, e.g., 1(B), 2(B), and so on (აბულაძე, 2022: 59-62).

Main Types of Querns

1(A) — quern with a concave working surface (Fig. 6.1).
2(A) — quern with a deepened working surface (Fig. 6.2).
3(A) — quern with a flat working surface (Fig. 6.3).

According to this typology, rather than using ambiguous or vague terms, we adopted relatively simple designations for the querns: 1(A) – concave, 2(A) – deepened, 3(A) – flat.

Main Types of Grinders

1(B) — grinder with a bilateral, flat working surface. This type also includes grinders with a flat surface on one side and a slightly longitudinally concave working surface on the other side (Fig. 7: 1–2).

2(B) — grinder with a single-sided working surface concave in longitudinal section and with a curved back (Fig. 7: 3–4).

3(B) — grinder with a single-sided, flat working surface and with a curved back. The sides, and often the back, have been shaped by flaking to achieve the desired form (Fig. 7: 5–6).

4(B) — grinder with a single-sided working surface, flat in the longitudinal section and slightly rounded edges in the cross-section; the back side is curved (Fig. 8: 1–2).

5(B) — small-sized grinder with convex surfaces in both the longitudinal and transverse sections (Fig. 8: 3–4).

Among the grinders, in addition to these types, there are also transitional forms of various shapes; for example, elongated stones with a double-sided working surface, or, in many cases, with a third working surface and traces of percussion at the ends. These stones functioned both as grinders and as pestles. Small-sized, so-called "free" grinders are also represented; these could be used with querns having working surfaces of various shapes (Abuladze, 2017: 262).

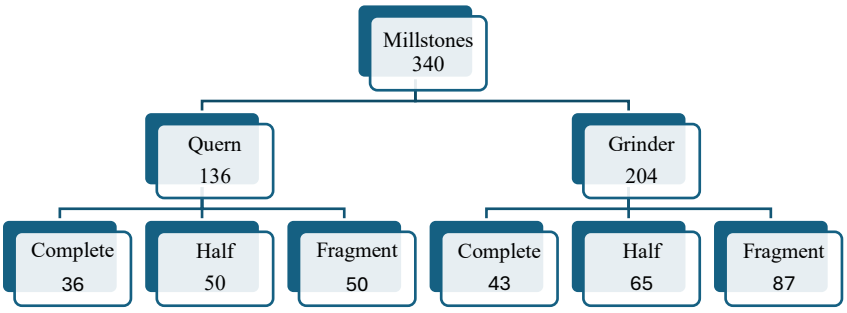

Diagram 1. Total number and state of preservation of querns and grinders.

Results of the Petrographic Analysis

The petrographic analysis of the rocks used for the production of millstones has provided important information about the selection of raw materials and their sources. The study was conducted on six different samples (AR1/24–AR6/24).[2] The obtained results are as follows:

1. AR1/24 – gray-colored, porous, dense, fine-grained rock – basalt.
2. AR2/24 – purplish, uneven-grained, clastic, weakly carbonated rock – tuff (rhyodacitic composition).
3. AR3/24 – pale purplish to yellowish-buff rock, with weakly expressed flow banding, containing quartz and rust-colored inclusions – rhyolite.
4. AR4/24 – pinkish, strongly altered and carbonated rock, containing quartz inclusions – rhyolite.
5. AR5/24 – pinkish, with inclusions, weakly carbonated – rhyolite.
6. AR6/24 – dark lilac, with white grains, strongly altered and carbonated rock – tuff.

The most frequently used gray, porous, and compact rock for the millstones (thin section AR1/24) was confirmed by microscopic analysis to be basalt. The rock exhibited a subophitic texture, in which comparatively large, prismatic laths of plagioclase partially enclosed ferromagnesian minerals – olivine and clinopyroxene. These minerals in the thin section displayed high interference colors (Fig. 4 A, B, C, D). The plagioclase was characterized by polysynthetic twinning (subparallel dark and light gray bands). The edges of olivine crystals were mostly altered to iddingsite (brown rim). Clinopyroxene occured mainly as augite (displaying light green interference colors); titanaugite was rare (with a greenish to purplish hue). The main mass exhibited a microdoleritic texture. Plagioclase was observed as microcrystals (light gray) and displayed a high degree of idiomorphism compared to clinopyroxene. Among the ore minerals, magnetite was present, while apatite occurred as an accessory mineral. Petrographic studies indicated that the

[2] The petrographic analysis was carried out in the Geology and Paleontology Fund of the Georgian National Museum using an OM239P polarizing microscope.

majority of the artifacts were made from porous basalt; a comparatively smaller, but nearly equal number was made from different types of tuff (13 specimens) and rhyolite (17 specimens). Rarely, millstones were made from diorite (3), dacite (2), quartzite (2), and andesite (1) (Diagr. 2–3).

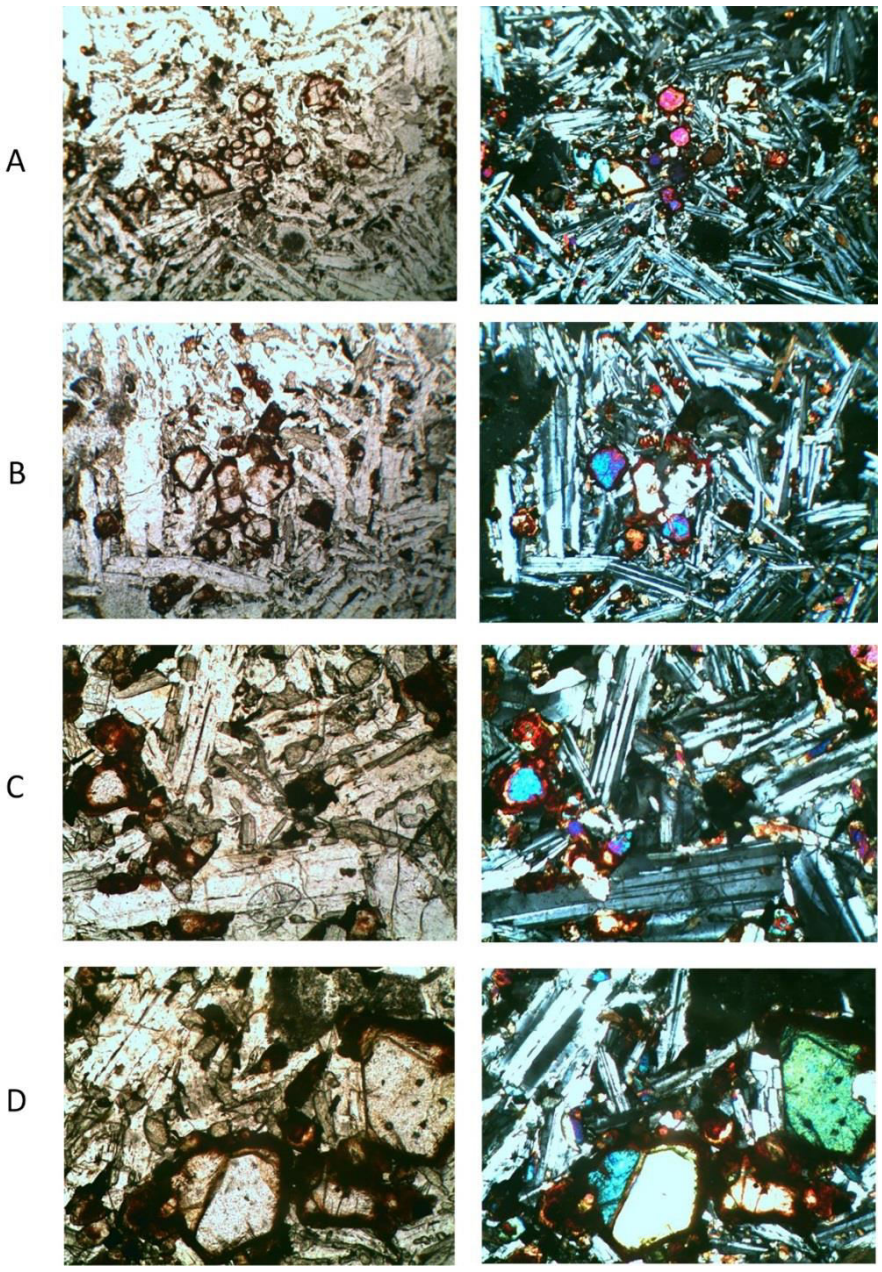

Fig. 4. Photomicrographs of a thin section of basalt (sample AR1/24) in cross-polarized light (XPL) and plane-polarized light (PPL): A) 25× PPL and 25× XPL; B) 40× PPL and 40× XPL; C) 100× PPL and 100× XPL;
D) 250× PPL and 250× XPL.

Source of Raw Material

As noted above, Arukhlo I is located near the confluence of the Mashavera and Khrami rivers. Based on the available geological data and the results of petrographic analysis, it can be concluded that, with few exceptions, the rocks used to make millstones were collected from boulders and cobbles distributed in the alluvial deposits of these rivers. It should be noted, that the settlement is located

approximately 1.4 km in a straight line from the Khrami River and 1.2 km from the Mashavera River (Fig. 5). Therefore, the inhabitants had to travel up to 1.5 km to obtain raw material.

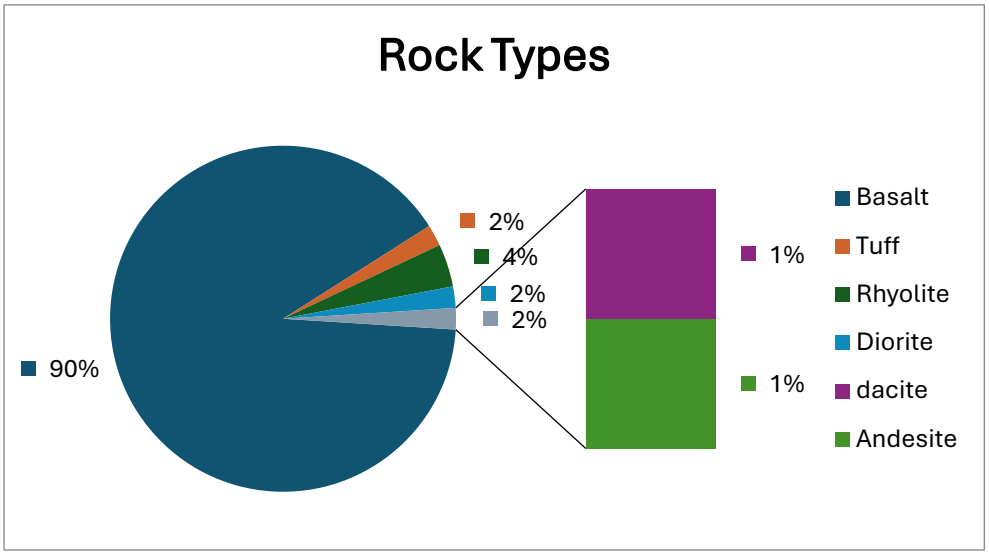

Diagram 2. Percentage composition of rock types used for the production of querns

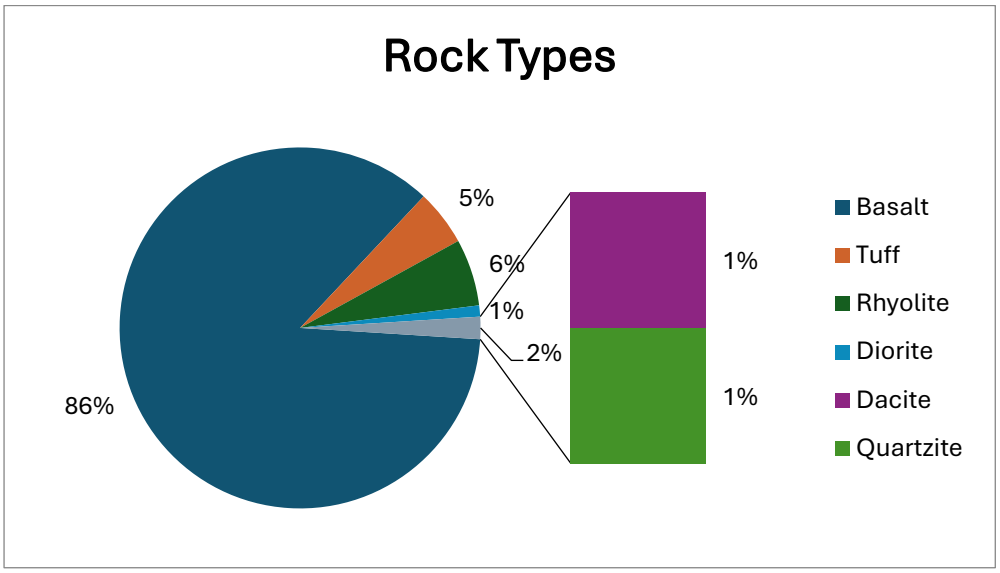

Diagram 3. Percentage composition of rock types used for the production of grinders.

Production technique

The diversity of millstones at Arukhlo I is directly related to the highly developed techniques used in their production. As noted above, the inhabitants deliberately selected stones carried by the Khrami and Mashavera rivers, which had already acquired suitable shapes through natural

processes. The procured raw material was worked by pecking to create the working surface and to obtain the desired form. The dorsal side, as well as the lateral edges and ends, were further modified as needed using point-percussion, flaking, and grinding techniques. In most grinders of the millstones, the edges, sides, and ends were shaped by point-percussion. It should also be noted that both grinders and querns show evidence of periodic renewal of the working surface through pecking, i.e., by point-percussion.

Fig. 5. Confluence of the Khrami and Mashavera rivers. The map indicates the straight-line distance from the Arukhlo I settlement to these rivers, representing the route by which raw materials were transported from the riverbeds to the settlement.

Results of the Palynological Study

From all types of millstones (three types of querns and five types of grinders), two samples were taken from each type for palynological analysis, giving a total of 24 samples. Of these, 13 were found to contain informative material, which is sufficient for drawing conclusions (Diagr. 4). The material was processed in the Palynological Laboratory of the Georgian National Museum according to the standard protocol (Erdtman 1960; Moore et al. 1991). Pollen grains and non-pollen palynomorphs (NPP) were examined using a Motic BA310E microscope. Identification was carried out using reference atlases (Beug 2004; Reille 1992, 1995, 1998; van Geel 1998; van Geel et al. 2006) and modern reference slides.

An interesting observation is that pollen grains of plants of goosefoot family (*Chenopodiaceae*) and wormwood (*Artemisia*) occurred in almost all samples. Both plants are known for their medicinal uses (Bussmann et al., 2016; Bibi et al., 2014), and in addition goosefoot (*Chenopodium*) species are also edible. Furthermore, pollen grains of wheat (*Triticum*) and other cultivated cereals (*Cerealia*) were identified in approximately half of the analysed millstones. Of particular interest is sample No. 12 (AR15/V113/4245), taken from a quern, where clusters of pollen grains were recorded in

addition to individual grains. It is well known that the presence of such clusters of pollen grains indicates local cultivation of cereals and their direct processing, storage, or use (Andersen 1979; Dimbleby 1985; van Geel 2001). This represents a strong anthropogenic marker and also suggests that the plant was processed on the millstone during its flowering period. In addition to its use as food, wheat was also utilized for medicinal and dyeing purposes (Bedianashvili et al., 2022). Therefore, it can be inferred that cereals on the quern were processed during their flowering period not only for food consumption but also for these additional purposes. The same applies to goosefoot (*Chenopodium*), which is abundantly represented in the palynological spectrum of the same millstone.

Other food and medicinal plants were also recorded on the millstones, including hazelnut (*Corylus*), walnut (*Juglans regia*), chestnut (*Castanea*), cornelian cherry (Cornus) mallow (*Malva*), thistle (*Cirsium*), and others.

The spectrum of non-pollen palynomorphs (NPP) is consistent with the palynological data. The presence of phytoliths from cereals, wheat husk phytoliths, and starch grains provides strong evidence for the use of cultivated cereals. Fibres of flax and hemp were also observed on the millstones, which could have two possible explanations: first, that people at the time wore clothing made from flax and hemp textiles, and second, that these plants were used for medicinal purposes. In the present case, these fibres do not exhibit anthropogenic markers (such as traces of spinning or dyeing); none of the fibres showed such features. They were straight in shape and colourless. This allows us to suggest that these plants were also processed on the millstones for medicinal purposes.

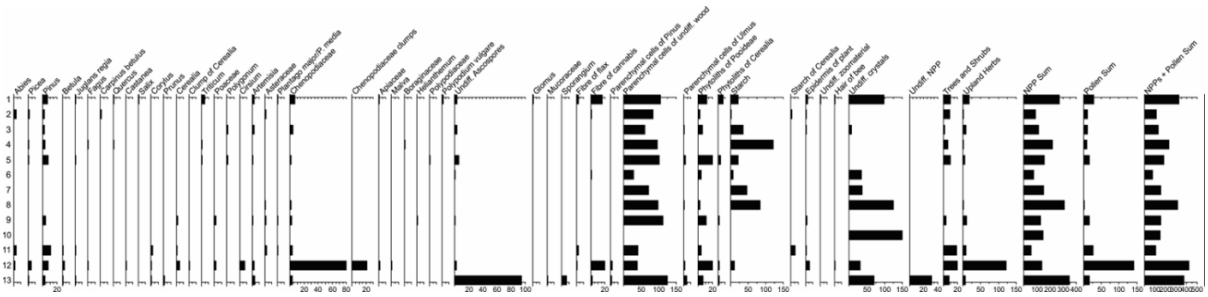

Diagram 4. Palynological diagram of the grinding stones discovered at Arukhlo I.

Millstones with traces of Ochre

Traces of ochre were identified on almost all types of stone tools made of massive stone recovered at Arukhlo I during the 2005–2016 excavations. Regarding millstones specifically, ochre traces were recorded on 62 specimens, of which 29 are querns and 33 are grinders. In total, this accounts for 18% of the millstones (Diagr. 5-6). Ochre processing appears to have been carried out even on damaged tools; for example, after a millstone broke, it was reused for secondary purposes (Fig. 8, 5–7). It is noteworthy that ochre stains and fragments were found both within individual structures at the site and in the areas surrounding them. Ochre may have been used for coloring the walls and floors of dwellings, as well as textiles. It could also have been applied as so-called “make-up” for body decoration (Capitani et al., 2002: 71). It should also be noted that, ochre was spread over the floor of Grave #8, discovered during the earlier excavations at Arukhlo I (Чубинишвили и др. 1978: 9-13), which may indicate its ritual use.

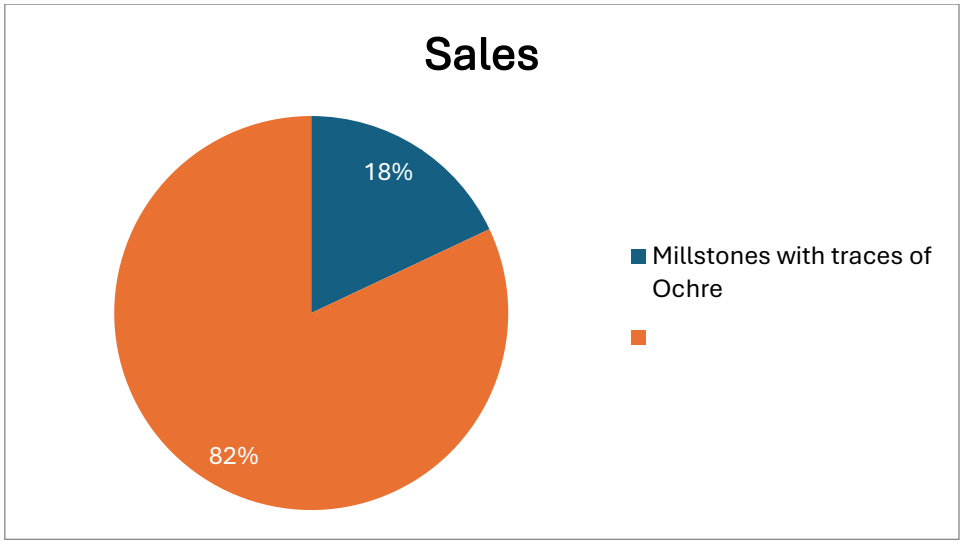

Diagram 5. Percentage of millstones bearing traces of ochre relative to the total number of millstones.

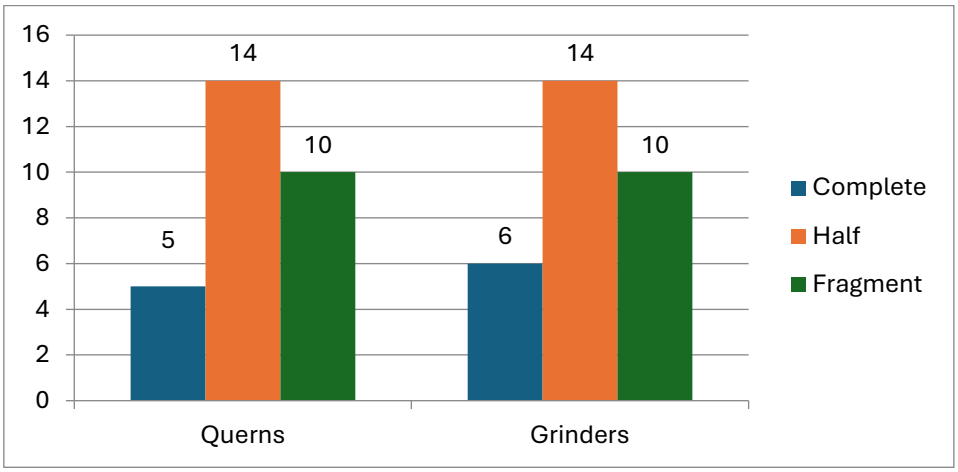

Diagram 6. Querns and Grinders with traces of ochre: state of preservation and quantitative proportions.

Discussion / Conclusion

Thus, the millstones discovered at Arukhlo I, as well as those found throughout the distribution area of the Shulaveri–Shomutepe culture, and the studies conducted on them, provide grounds to conclude that as early as the 6th millennium BCE the populations inhabiting these territories possessed all the technologies characteristic of a developed, sedentary farming culture.

The abundance of millstones and the diversity of their types indicate that the population inhabiting the territory of Kvemo Kartli 8,000 years ago possessed a well-developed knowledge of grinding techniques. For example, millstones with a concave working surface were used for the coarse grinding of cereal grains. However, when finer and higher-quality flour was needed, a Type 2(A) quern with a deepened, so-called “trough-shaped” working surface was used. Grinding with this type of hand-mill required considerably more time and energy and was therefore probably not used in everyday practice.

It should also be noted that the techniques employed in the manufacture of millstones, as well as in the periodic renewal of their working surfaces, were highly developed. The raw material selected

for tool production was worked by means of point percussion, flaking and trimming, grinding, and other methods.

Of particular interest and significance is the fact that a large portion of the millstones bears traces of pigment – ochre. It appears that ochre was actively used not only as a colouring material but also for cosmetic purposes and in ritual contexts.

Based on the available geological data and the results of the petrographic analysis, it can be stated that the rocks used for the production of millstones were sourced from boulders and cobbles distributed in the alluvial deposits of the Mashavera and Khrami rivers. As noted above, the straight-line distance from the settlement to the Khrami River is 1.4 km, and to the Mashavera River 1.2 km; accordingly, the local population had to travel up to approximately 1.5 km to obtain the raw material. The collection of raw material was likely carried out by a well-organized group following a specific method. It should be noted that some of the prepared pieces selected for the querns of millstones recovered from the settlement weighed between 80 and 90 kg. Transporting these massive stones over such distances would have required considerable effort. Even the movement of smaller stones would not have been easily accomplished, as individuals traveling these distances could only carry a limited quantity. This emphasizes the significance of the collective labour required both for transporting the stones and for their subsequent processing into functional tools. Such organized effort represented one of the components of the sophisticated economic system maintained by the communities of the Shulaveri-Shomutepe culture.

On the basis of the palynological analysis, it has been suggested that the studied millstones were used for processing both food and medicinal plants. As mentioned above, the samples contained pollen grains of goosefoot family (*Chenopodiaceae*) and wormwood (*Artemisia*). Both plants are known for their medicinal properties, while species of goosefoot (*Chenopodium*) were also used as food.

The analysed samples also contained remains of other edible and medicinal plants, including hazelnut, walnut, chestnut, cornelian cherry, mallow, thistle, and others.

It is noteworthy that during this period medicinal plants appeared alongside edible plants. This observation is of particular importance for the study of the transition from a hunting-gathering economy to farming and animal husbandry.

The plant remains recovered from Arukhlo I, together with those from Neolithic settlements in Kvemo Kartli and, more generally, within the Shulaveri-Shomutepe cultural horizon, provide firm evidence for the existence of a developed agricultural tradition in this region during the 6th millennium BCE. The diet of the population during this period included wheat, barley, legumes, and grapevine. The genus *Triticum* (wheat) was already botanically differentiated, and along with hulled forms, naked wheats were also present, indicating a long preceding period of agricultural development.

In conclusion, it should be noted once again that the studies conducted on the millstones from Arukhlo I, together with the information obtained from various sites of the Shulaveri–Shomutepe culture, significantly enrich our knowledge of economic activities in the South Caucasus, particularly in the Kvemo Kartli region of Georgia, 8,000 years ago.

The results of this study further confirm that the economy of the populations belonging to the Shulaveri–Shomutepe culture was already productive in character even at its earliest stage. This again highlights its connections with the cultures of the southern regions, the Near East, and Anatolia.

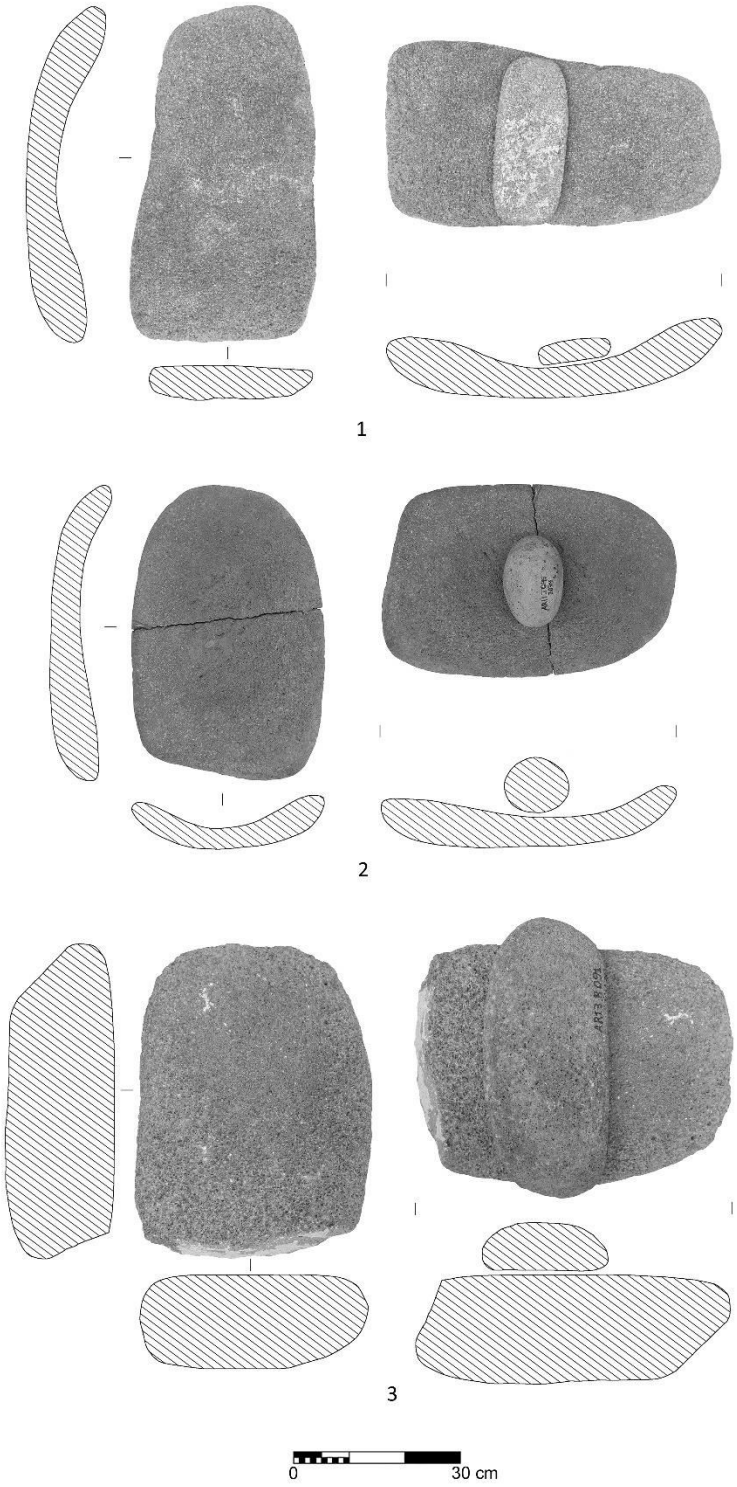

Fig. 6. Types of querns together with their corresponding grinders.

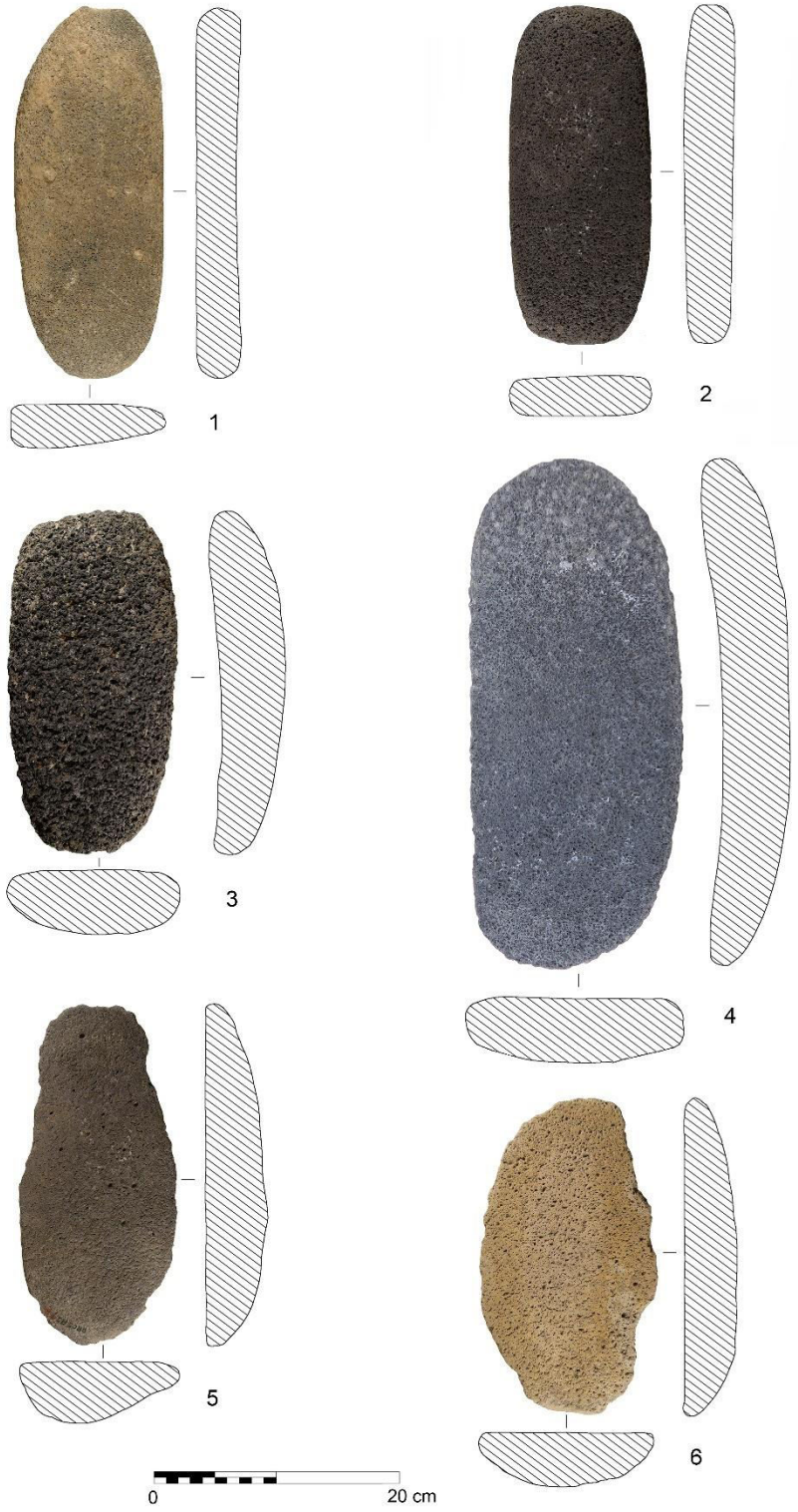

Fig. 7. Types of grinders: 1 - 2 — 1(A); 3 - 4 — 2(A); 5 – 6 — 3(A)

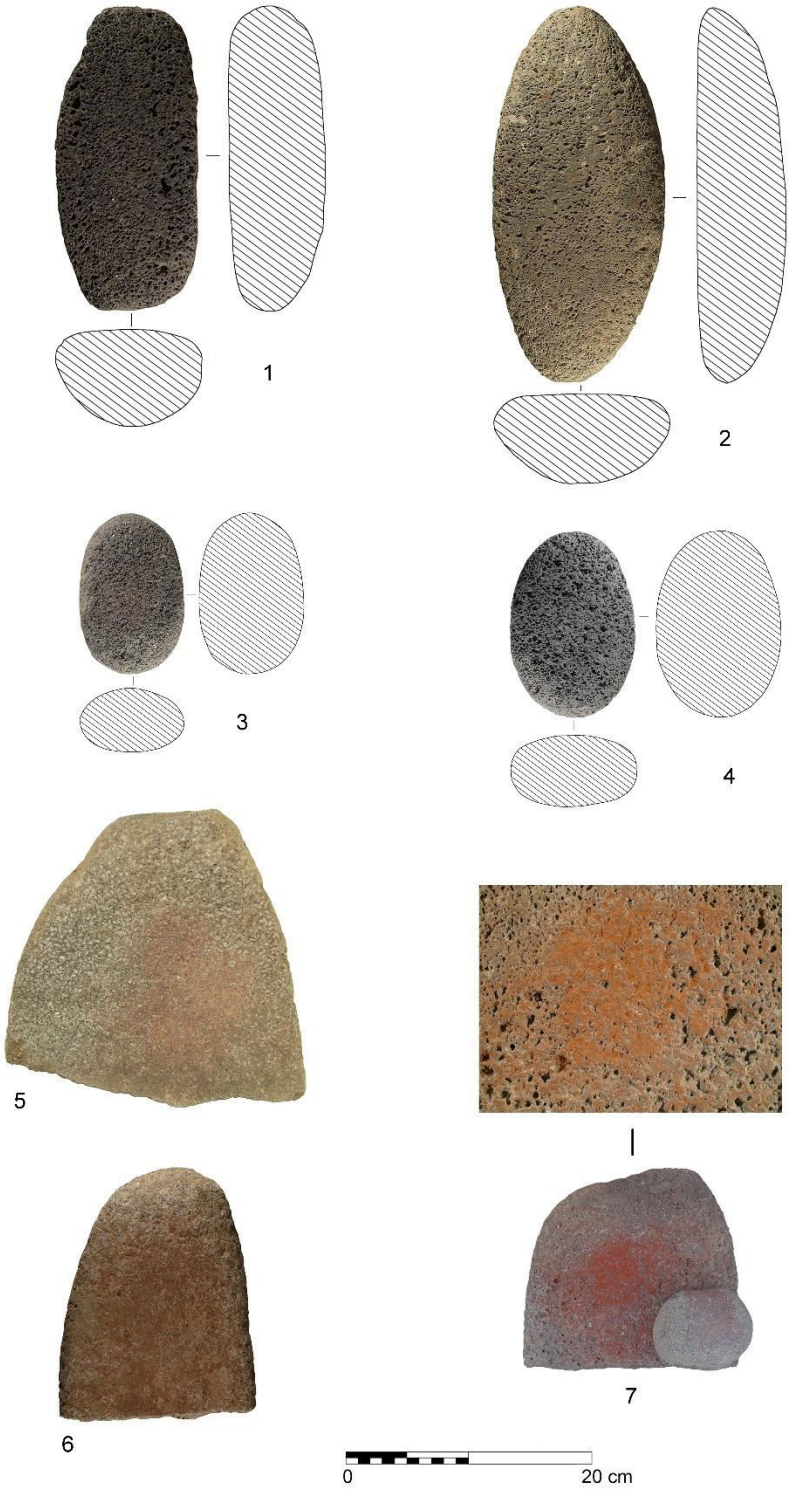

Fig. 8. 1–4 — Types of grinders: 1–2 — 4(A); 3–4 — 5(A).
5–7 — querns with traces of ochre.

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