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STONE AGE OF ARMENIA

Kanazawa University

2014

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Kanazawa University

Institute of Archaeology and Ethnography of
the National Academy of Sciences of
the Republic of Armenia

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Center for Cultural Resource Studies, Kanazawa University

STONE AGE OF ARMENIA

A Guide-book to the Stone Age Archaeology in the Republic of Armenia

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Makoto ARIMURA

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Monograph of the JSPS-Bilateral Joint Research Project

Center for Cultural Resource Studies,
Kanazawa University

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Stone Age of Armenia. A Guide-book to the Stone Age Archaeology in the Republic of Armenia.
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CHALCOLITHIC

Introduction

Our initial reason for producing this volume was to publish the proceedings of the workshop titled "Stone Age in Armenia". This workshop was organized by staff at the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia, and Kanazawa University, Japan, with the support of the Armenian Branch of the Gfoeller fund of America Corporation. The main aim of the workshop was to share and exchange a growing body of knowledge emerging from archaeological investigations by researchers in Armenia. Additionally, organizers – who included the authors of this paper – invited young researchers and graduate students to make presentations at the workshop, since it was thought their involvement would be indispensable to the future development of the field of archaeology. The workshop was held in the library at the Institute of Archaeology and Ethnography, Republic of Armenia, on 5 March 2013 (Figure 1). Fifteen talks were given, introducing the latest results from field studies and scientific analyses dating from the Paleolithic, Neolithic, and Chalcolithic periods. Although the workshop was quite long and tiring, participants filled the room with a palpable sense of excitement (Figures 2-8).

Figure 1
Announcement posters for the workshop in Armenian and English.

Since some authors prepared their papers after the workshop's conclusion, and others not in attendance expressed interest in contributing to the series of papers, we decided to prepare a monograph presenting recent findings of archaeological research conducted on the Stone Age sites in the Republic of Armenia.

By means of this publication, we hope that readers will become aware of our achievements to date, and come to understand the future prospects for Stone Age archaeology in Armenia. In addition, this workshop marks the beginning of cooperative efforts between Armenian and Japanese archaeologists - after all, both countries have unique and long-standing historical-cultural traditions in this field.

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Director of the Center for Cultural Resource Studies, Kanazawa University, Japan

Figure 2
Participants and audince in the workshop.

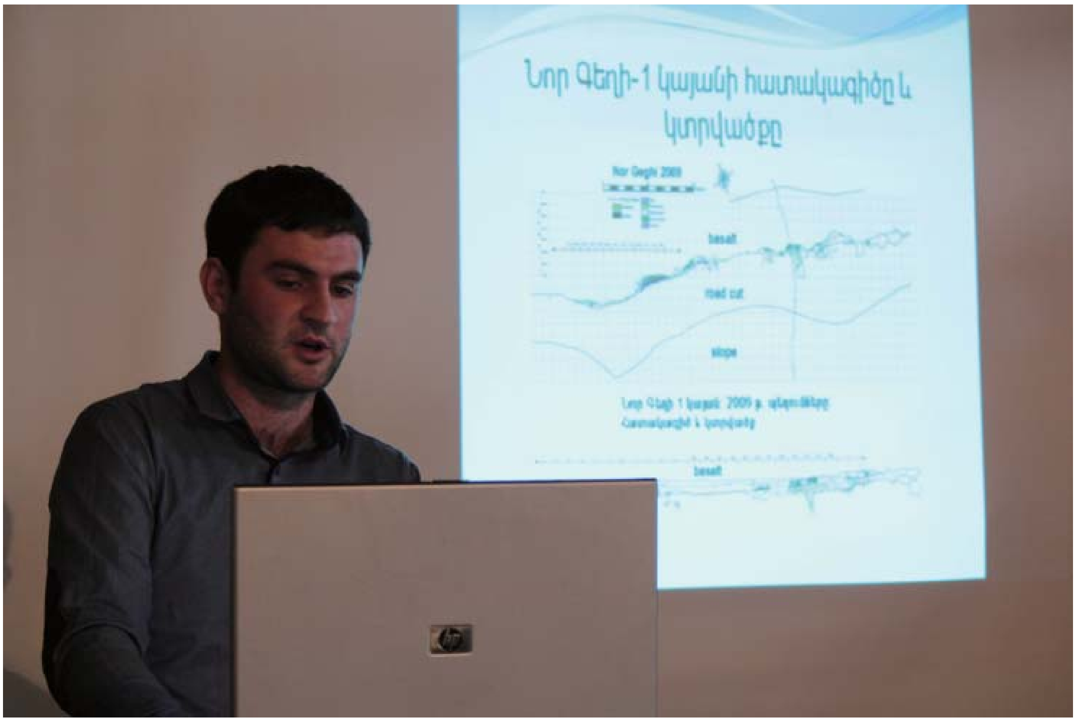
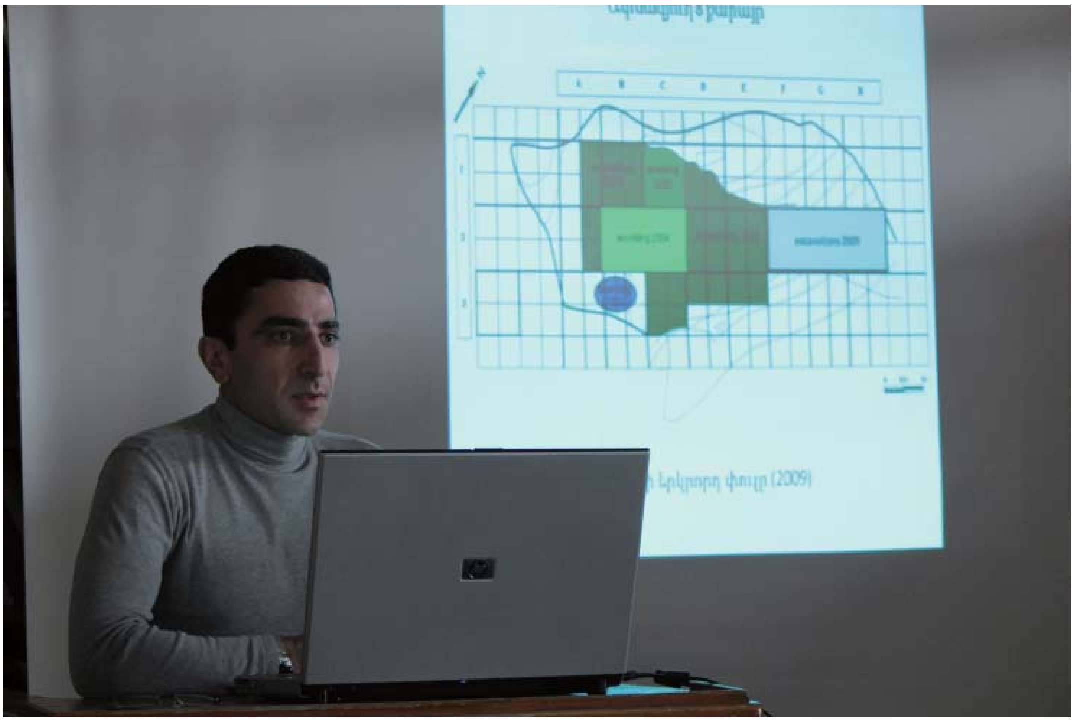


Figure 3
Presentation by Karen Azatyan.



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Study of the Stone Age in the Republic of Armenia. Achievements and Perspectives

Boris Gasparyan and Makoto Arimura

1. Introduction

The area encompassing the modern Republic of Armenia lies within the Armenian Highlands and is situated at the very core of a dynamic corridor between Africa and Eurasia. As such, Armenia will prove critical for understanding the initial stages of human settlement and the formation of ancient civilizations in the Near East and beyond. Stone Age artifacts have been known to exist within the territory of Armenia since the end of the 19th century, and they indicate that the area attracted a variety of Stone Age populations, from early hominids to early complex societies of the Chalcolithic. The reason for this deep record of human habitation probably stems from the region's rich natural resources (fauna, flora, minerals, water, etc.) and the horizontal and vertical diversity of its ecological zones. While Soviet-era archaeologists reported numerous Stone Age sites in the country (e.g. Piotrovskiy 1949; Zamyatnin 1947; 1950; Panichkina 1950; Sardaryan 1954; 1967; Lyubin 1970; 1984; 1989; 1998; Yeritsyan 1970; 1975; Ghazaryan 1986; 1991; Martirosyan 1967; 1969; 1971; 1974; Torosyan 1971; 1976; Munchayev 1975; 1982; Korobkova 1987; Kushnareva 1997, and others: Figure 1), much of this research is published in either Armenian or Russian and is based on a very limited number of well-excavated stratified sites. For these and other reasons, the Armenian Stone Age is poorly known to Western scholars and has not contributed significantly to recent regional and pan-regional syntheses.

2. Recent investigations

While a great many "missing links" in our knowledge still exist, a new wave of research is now beginning to lay a robust theoretical, chronological, and paleoenvironmental foundation for understanding the country's Stone Age occupations. This is due largely to the establishment of international cooperation and long term joint missions with systematic projects. Since 1999, the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia has conducted studies of Stone Age sites with seven such joint expeditions: Armenian-French, three Armenian-American, Armenian-German, Armenian-British-Irish, as well as Armenian-Austrian (Sagona 2010; Avetisyan and Bobokhyan 2012). The goals of these projects are twofold: first, to apply modern archaeological and analytical methods to the study of Armenia's Stone Age sites and, second, to train the next generation of Armenian scholars through their direct involvement with the projects. The efforts of these expeditions have illuminated the Stone Age occupations in the Kasakh River canyon and the Aparan Depression, the Hrazdan River canyon and the Hrazdan-Kotayk Plateau, the Ararat Depression in central Armenia, the Aghstev River canyon and its tributaries, the Akhurian River basin and the Shirak Depression, the Debed River basin, the Lori Depression and the Tashir Plateau in northern Armenia and, finally, the Arpa and Vorotan River canyons in southern Armenia. This cooperation has increased our knowledge of the chronological and cultural distribution of Stone Age sites in Armenia (Table 1, Figure 2).

3. Paleolithic period

Among the most important goals of the collaborative projects is the search for and excavation of stratified **Lower Paleolithic** archaeological sites. Efforts on this front are very close to bearing fruit, as possible *in situ* Pre-Acheulian sites have been discovered in the Debed River valley (Armenian-American joint expedition, co-directors B. Gasparyan, IAE and C.P. Egeland, University of North Carolina at Greensboro), the Ararat Depression (Armenian-American joint expedition, co-directors B. Gasparyan and D.S. Adler, University of Connecticut), the Arpa River Valley (Armenian-American-Irish joint expedition, co-directors B. Gasparyan IAE, R. Pinhasi, University College Cork and G.E. Areshian, Cotsen Institute of Archaeology, UCLA), and the Shirak Depression (Armenian-French joint expedition, co-directors C. Chataigner, Maison de l'Orient et de la Méditerranée, Lyon, and H. Khachatryan, Shirak Regional Museum). New data on Acheulian occupations, especially those located in the neighborhood of obsidian and dacite raw-material sources, have emerged as well. The Aghavnatun group of sites in the Ararat Depression and the Hatis group in the Kotayk Plateau (Armenian-Austrian joint expedition, co-directors H. Avetisyan, Yerevan State University, B. Gasparyan and D. Schaefer, University of Innsbruck) are particularly noteworthy. Perhaps the most significant findings have been made by the Armenian-American-Irish joint expedition studying the Paleolithic sites of the Hrazdan River canyon and the Hrazdan-Kotayk

Plateau (co-directors B. Yeritsyan and B. Gasparyan, IAE, D.S. Adler, University of Connecticut and R. Pinhasi, University College Cork) related with the discovery and study of the open-air site of Nor Geghi-1. This stratified and securely dated Late Middle Pleistocene site (>300 ka) in the Hrazdan River canyon is elucidating our understanding of the transition from the Late Acheulian to the Middle Paleolithic in Armenia as local technological replacement of bifaces and handaxes by implements produced through the Levallois method (Gasparyan 2007; Egeland *et al*. 2010; Gasparian 2010; Adler *et al*. 2012).

Several well stratified **Middle Paleolithic** archaeological sites have been recorded as well, allowing us to divide the Armenian Middle Paleolithic into three chronological phases – early, middle, and late. Among the early Middle Paleolithic (eMP) sites are Bagratashen-1 in the Debed River valley and Aghavnatun-1 in the Ararat Depression. Both sites are open-air and preliminary analyses suggest that they may represent multi-purpose camps with lithic industries based mainly on dacite raw-materials. Such sites are very rare in the southern Caucasus and one can discern parallels with the elongated points of the "Jruchula-Kudarian" tradition of Caucasian MP sites. The age of the Bagratashen-1 occupation likely falls within the Penultimate Glacial cycle (MIS 7-6). Traces of slightly later MP settlement has been recorded at the high altitude cave site of Hovk-1, where a sparse lithic assemblage indicates a short-term human visit during the Early Glacial period (MIS 5). Hovk-1 cave is the only middle Middle Paleolithic (mMP) site currently known in Armenia, and is likely that humans exploited such high altitude ecological niches for seasonal hunting. The late Middle Paleolithic (lMP) sites discovered or re-excavated during last decade, Lusakert-1 cave (Armenian-American-Irish joint expedition), Angeghakot-1 rock-shelter, Kalavan-2 open-air site (Armenian-French joint expedition, co-directors B. Gasparyan and C. Chataigner), Barozh-12 and Ptghavan-4 open-air sites (Armenian-American joint expeditions) have a wider geographic and functional distribution. Coinciding with the limits of MIS 4 and part of MIS 3, they vary by means of environmental diversity, raw-material source exploitation strategies, and socio-economic behaviors and permit us to reconstruct the life ways of lMP hominins within the territory of Armenia (Fourloubey *et al*. 2003; Liagre *et al.* 2006; Pinhasi *et al*. 2008; 2011; 2012; Ghukasyan *et al*. 2011; Bar-Oz *et al*. 2012).

Important advancements in the discovery and study of the **Upper Paleolithic** of Armenia, which is now represented by at least two well stratified sites (Aghitu-3 cave and Kalavan-1 open-air site), have also been made. Until recently it was hypothesized that the Armenian Highlands were not inhabited during the Last Glacial Maximum, due to its high altitude environment and cold climatic conditions. The Aghitu-3 cave site, excavated by an Armenian-German joint expedition (co-directors B. Gasparyan and A.W. Kandel, Heidelberg Academy of Sciences and Humanities at the University of Tübingen), provides us with a well-preserved environmental and cultural stratigraphic record between 40,000 and 24,000 Cal BP (early to middle Upper Paleolithic). Early Modern Humans began using the cave at the end of MIS 3 and with increasing frequency during MIS 2. Stone tools were produced from obsidian and flint, medium size ungulates and horses were hunted, and bone tools were used for clothing. This ecological niche, located at an altitude of 1,601 m in the Vorotan River valley, was a seasonal camp with increasing frequency of use over time. The Kalavan-1 open-air site, which is located on the northern slopes of the Areguni Range, north-east of Lake Sevan, was excavated by an Armenian-French joint expedition. The site, located at 1,630 m above sea level, has been dated between 16,000–15,000 Cal BC through radiocarbon analysis. It provides us with a well-preserved paleosol layer containing faunal remains, lithics, hearths, and activity areas that structure the settlement. Kalavan-1 was a seasonal hunting camp, showing that the late Upper Paleolithic inhabitants of Armenia produced some cultural features similar to the Epigravettian tradition spread throughout the southern Caucasus since the end of the Last Glacial Maximum (Pinhasi *et al*. 2008; Liagre *et al*. 2009; Kandel *et al*. 2011; Chataigner *et al*. 2012; Montoya *et al*. 2013).

4. Mesolithic and Neolithic periods

The aspects of **Neolithization** in the territory of modern Armenia, and the southern Caucasus in general, continues to be debated due to a large gap in our knowledge of Late Pleistocene/Early Holocene archaeological sites. The earliest farming communities are known from the early 6th millennium BC and are attributed to the of so-called “Aratashen-Shulaveri-Shomutepe” cultural tradition of the Late Neolithic. Investigations in the last decade have brought to light the first Late Pleistocene **Epipaleolithic** and Early Holocene **Mesolithic** sites in Armenia (the Apnagyugh-8/Kmlo-2 cave, Kuchak-1 rock-shelter, and Gegharot-1 open-air site in the Aparan Depression excavated and studied by an Armenian-French joint expedition; Yenokavan-2 cave in the Aghtev River valley test excavated by an Armenian-Irish joint team and several others), all of which show the existence of mobile populations of hunters and gatherers occupying caves and rock-shelters in the river canyons as well as river terraces and plateaus in high mountain depressions. The rich lithic assemblages flaked mainly from obsidian raw-material show the exploitation of multiple sources with a preference for one or two, the relatively thin cultural deposits of these sites lack rich bioarchaeological information. Nevertheless, the limited bioarchaeological materials suggest hunting of wild species (sheep, goat, deer, and kulan) and collecting of wild plants. Signs of domestication and a food producing economy are absent, which does not allow us to place the Early Holocene sites of Armenia in the frame of the Neolithic period but, rather, necessitates consideration of these sites as Mesolithic and/or Proto-Neolithic with a time range of 12,000–7,500 Cal BC (based on a preliminary set of radiocarbon dates). There is, thus, a problematic chronological and cultural gap between these sites and the Late Neolithic sites (Table 1). The lithic assemblage from these sites include a large number of geometric microliths (scalenes, trapeze-rectangles) as well as very special tools with continuous parallel retouch on the lateral edges executed by pressure flaking technology. These unique artifacts, called "Kmlo type" tools in various publications, mark the cultural specification of the time period. They have visual similarities with the so-called "Çayönü type" tools known from the Near Eastern Pre-pottery Neolithic sites, but are different in many aspects of techno-morphological design and appear in Armenia at least from the first half of the 9th millennium BC. The function of these implements has yet to be elucidated. New excavations of "Kmlo type" sites with richer bioarchaeological sequences, which are likely located in the karstic environments of northern Armenia that are more conducive to the preservation of organic materials, should shed additional light on this issue (Arimura *et al*. 2009; 2010; 2012; Chataigner *et al*. 2012).

Recent investigations at three **Late Neolithic** settlements in Armenia – Aratashen, Aknashen-Khatunarkh (Armenian-French joint expedition, co-directors R. Badalyan, IAE and C. Chataigner) and Masis Blur (Armenian-American joint expedition, co-directors P. Avetisyan, IAE and G.E. Areshian, Cotsen Institute of Archaeology, UCLA) brought to light a number of important discoveries. These settlements, located in the Araxes River basin, are round artificial hills (*blur* in Armenian) and date to the first half of the 6th millennium BC (radiocarbon dates cover the time range between 6,000–5,500 Cal BC). They represent the earliest documentation of a food production economy in the territory of Armenia and preserve architecture and ceramic and metal production. The inhabitants of these settlements were farmers and herders who built round plan dwelling structures (3-5 m in diameter) out of *pisé*[1] and mud bricks or clods. The ceramic assemblages of Aratashen and Aknashen-Khatunarkh are represented by an independent production of pottery with mineral, organic, or combination (mineral-organic) tempers; these are sometimes decorated with perforations, notches, and, in the case of chaff-tempered ware, *appliqué* elements (e.g. knobs). The lowermost horizons of these two sites and the excavated horizon of Masis Blur are characterized by the absence of locally made ceramics and rare fragments of imported painted pottery. Finds of two stone seals (Aknashen – Horizon VII and Masis Blur) mark a new phenomenon in the material culture of the Late Neolithic in Armenia. Objects made from bone,

1. Clay mass shaped in bundles or filled and/or pressed between face boards.

horns, and deer antler are common, with a noticeable decline in quantity and variability towards the upper horizons in Aratashen and Aknashen-Khatunarkh. Obsidian implements are represented mainly by blade tools produced with indirect percussion and pressure flaking (with crutch and with lever) techniques. Additionally, while no microliths are present in Aratashen, geometric microliths (transverse arrowheads) are abundant both at Akanashen-Khatunarkh and Masis Blur. Certain basic characteristics of these sites are noticeable; local peculiarities of construction techniques, ceramic and lithic production, and other aspects of the material culture are nevertheless present and can be explained by their different function within the subsistence economy. Overall, the Late Neolithic monuments of Armenia demonstrate a cultural unity with the synchronous sites of the Araxes and the Kura River basins and form a so-called “Aratashen-Shulaveri-Shomutepe” cultural tradition, which highlight obvious contacts with the farming populations of the Near East. The above mentioned sites contain multiple cultural layers and ongoing excavations have the potential to discover new strato-chronological sequences, which will fill in some of the gaps that currently exist between the Neolithic occupation of the Ararat valley and the Early Holocene sites. In addition, these investigations have uncovered remnants of Chalcolithic occupations overlying the Neolithic levels, although the former are, unfortunately, highly disturbed by erosion and modern agricultural leveling activities. Nevertheless, at those settlements where the Chalcolithic layers do overlie the Neolithic, a consistent chronological gap between two occupations of at least 400-500 years is likely present, and the Chalcolithic probably begins around 4,800 BC. However, the archaeological sites reflecting the initial stages of the Chalcolithic Period – in all probability occupying the time range between 5,200–4,800 Cal BC, still remain unknown (Badalyan *et al*. 2004b; 2007; 2010; Lombard and Chataigner 2004; Palumbi 2007; Chabot *et al*. 2009; Arimura *et al.* 2010; Chabot and Pelegrin 2012).

5. Chalcolithic period

Scientific investigations of the last decade have made significant strides towards the study of the **Chalcolithic period** in Armenia, especially its middle and late (or final) phases with the discovery of numerous archaeological sites dating between 4,800–3,400 Cal BC. Among the most significant of these sites are the Mushakan-4 settlement in the Ararat Depression (excavated by the team of IAE directed by B. Gasparyan), the Nerkin Godedzor settlement in the Vorotan River valley, southern Armenia (excavated by the Armenian-French joint expedition, co-directors P. Avetisyan, IAE and C. Chataigner), and the Areni-1 cave in the Arpa River valley (excavated by the Armenian-Irish-American expedition, directed by B. Gasparyan, co-directors R. Pinhasi and G.E. Areshian).

Test excavations at Mushakan-4 indicate the existence of at least two Chalcolithic horizons represented by ceramics, a lithic industry, metal implements, and shell beads. However, there is an obvious hiatus between the two horizons. The pottery sherds and the lithic artifacts from the Upper Horizon are characteristic of the so-called Sioni cultural complex known from the excavations of a Chalcolithic site in eastern Georgia. The Second Horizon contains pottery which is characteristic of the so-called "Adablur" tradition, known from the type site Adablur excavated in the Ararat valley. Most probably Mushakan-4 belongs to the middle Chalcolithic sequence of the southern Caucasus and must date somewhere between 4,800–4,300 BC. The recent discovery of the Aknalich tomb with a burial inventory similar to the Upper Horizon of Mushakan-4 is dated between 4,400–4,100 Cal BC, with the upper boundary of calibration the most likely date.

The next step in sequence of the **final phase of the Chalcolithic period** in Armenia is reflected in the Areni-1 cave excavations, which recorded the existence of three Chalcolithic horizons with a set of dates between 4,300–3,400 Cal BC. Horizon III, which has noticeable parallels with the Mushakan-4 pottery complex, is dated between 4,300–4,000 Cal BC, Horizon II dates to 4,000–3,800 Cal BC, and Horizon I to 3,700–3,400 Cal BC and is synchronous with the Chalcolithic layers of the Nerkin Godedzor settlement. Besides this securely dated sequence, the site is unique in its exceptional preservation of perishable organic materials (archaeobotanical remains, textile and basketry, leather, bone and wooden artifacts, human and other organic remains) and by its ritual function. While revealing aspects of the development of local material culture (ceramic and metal production, lithic industry), it also sheds light on the religious practices of the Chalcolithic population of Armenia as well as their craft and technological skills, their level of agricultural development, and various questions regarding food production based on previously unknown finds and belonging to the time period between the last quarter of the 5th and first half of the 4th millennium BC. The discovery of the world's oldest leather shoe and wine producing facility are among these newly discovered categories. Areni-1 is also notable by the presence of a group of artifacts representing the Kura-Araxes cultural tradition of the Early Bronze Age. This finding places the threshold of the Kura-Araxes phenomenon at the end of the 5th and the beginning of the 4th millennium BC, which requires a reassessment of the currently accepted chronology and allows us to delineate the area of its origin.

Similar observations related to the question of the local origin of the Kura-Araxes cultural phenomenon are made from the excavations of Nerkin Godedzor, which represents a semi-permanent or seasonal settlement with a subsistence economy based on animal herding. The scarcity of architectural remains, the composition of heard, the limited role of agriculture, evidence of obsidian exchange, location of the settlement along migration routes, and domestic production based on the exploitation of secondary products (e.g. milk, wool), all indicate that nomadism and pastorialism developed in southern Armenia at the end of the Chalcolithic period (a set of radiocarbon dates from Godedzor fall between 3,700–3,400 Cal BC). Among the abundant finds from Godedzor (lithics, bone tools, copper implements) are locally produced pottery represented by rough, hand-made pots dominated by chaff-tempered ware as well as the presence of a small sample of painted sherds, a minority of which are akin to the Ubaid tradition and a majority of which compare favorably to examples known from the Lake Urmia basin. Some examples of local Chalcolithic ware share morphological similarities with Kura-Araxes pottery. The presence of Urmian and Ubaid painted pottery and the evidence for a mobile lifeway indicate wide interactions between the Godedzor inhabitants and those occupying northwestern territories of Iran. This makes the settlement of Nerkin Godedzor the northernmost point within the Ubaid interaction sphere. In addition to rich local biological resources, it was probably the existence of numerous obsidian and copper ores that attracted these groups to the Syunik Highlands and stimulated long-distance relations. At the same time, analysis of the ceramic complex of Areni-1 shows close relations with synchronous sites of the southern Caucasus and beyond (Ovçular Tepesi, Mentesh Tepe and the sites of "Leylatepe cultural tradition" in Azerbaijan, Berikldeebi in Georgia, Tilki Tepe I in the Lake Van basin, and the Maikop culture), indicating increasing interactions throughout the region.

Small scale Late Chalcolithic hunting camps, such as Tsaghkahovit-1 rock-shelter, Barepat-1 and Getahovit-2 caves, Hovk-1 and Hovk-3 rock-shelters and others, have also been recorded and excavated by the Armenian-French and Armenian-Irish joint expeditions in the Aghtev River valley and on the slopes of Mt. Aragats, which yielded dates with a time range between 4,300–4,000 Cal BC. Sometimes abundant with lithic artifacts (mainly arrowheads) or with few lithic finds and an accumulation of faunal remains, these sites reveal the existence of small groups that continued the lifeway of earlier hunters and gatherers parallel to societies practicing a farming and herding economy. Overall, the current status of the study of the Chalcolithic sites in Armenia shows a very complex story of local social organization with varying cultural and economic practices and landscape organization, including elements characteristic of complex societies up to the lifeways of early nomads (Avetisyan *et al*. 2006; Chataigner and Barge 2010; Chataigner *et al*. 2010; Pinhasi *et al*. 2010; Barnard *et al*. 2011; Areshian *et al*. 2012; Arimura *et al*. 2012; Kalantaryan *et al*. 2012; Wilkinson *et al*. 2012).

6. Development of archaeological science

In addition to archaeological investigations, the last two decades has seen growth in the systematic **study of the obsidian sources of Armenia** and beyond and their exploitation from the Paleolithic period to the Iron Age. As a result, different models have been suggested for the procurement of obsidian and the exploitation of obsidian rich landscapes by various social and cultural groups over time. Determination of primary and secondary sources and variation in the exploitation of obsidian raw material over time and space provide additional sources of information on economic boundaries and the complexity of local and pan-regional interactions. In the meantime, new analytical methods for obsidian source identification are underway.

A parallel series of **metallographic analyses** and **geochemical and isotope characterization** of Armenian Neolithic through Bronze Age copper-based artifacts and their possible relation to the local and regional copper ores have been performed as well. These investigations demonstrate the early appearance of metallurgy in Armenia and the southern Caucasus, likely linked to the abundance of copper and polymetallic ores, which makes this region particularly important for archaeometallurgical studies. During the last decade in particular important evidence of early metalworking has been discovered at a number of Late Neolithic and Chalcolithic sites such as Aratashen, Aknashen-Khatunarkh, Areni-1, Nerkin Godedsor, and Mushakan-4, the study of which sheds light on the early development of copper based metal production in Armenia (Blackman *et al*. 1998; Oddone *et al*. 2000; Karapetyan *et al*. 2001; 2010; Chataigner *et al*. 2003; Badalyan 2010; Badalian *et al*. 2001; 2004a; Cherry *et al*. 2008; 2010; Courcier *et al*. 2008; Meliksetian *et al*. 2007; 2008; 2011; Arimura *et al*. 2010; Chataigner and Barge 2010; Gasparian 2010; Varoutsikos and Chataigner 2012; Chataigner and Gratuze 2013a; 2013b; Montoya *et al*. 2013; Courcier 2014; Frahm *et al*. 2014).

7. Paleoenvironmental studies

As climate is considered a major driving factor of evolution and modulates the availability of life supporting resources by influencing the vegetation and animal distribution in human landscapes, numerous projects have been established in Armenia and the neighboring regions that attempt the **reconstruction of Pleistocene and Holocene climates**, vegetation development, and environmental history. Investigations have been carried out on the diatomite lacustrine sediments of the Sisian formation in the Vorotan River valley (dated to 1.4–0.9 ma) and the Holocene period geological sequences of Armenia (Zarishat fen in the Ashotsk Depression, travertine formations, etc.), as well as plant and animal fossils and palynological analysis in combination with geomorphologic and dating studies. Preliminary results show that Pleistocene and Holocene climates fluctuated widely over time, which in turn strongly affected the environmental setting of the inhabitants of the territory of Armenia (Bruch and Gabrielyan 2002; Joannin *et al*. 2011; 2013; Ollivier *et al*. 2011).

8. Rock-art studies

The last decade also marked the discovery of shelters with rock-art on the southern slopes of Mt. Aragats and in the Kasakh River canyon in addition to the systemic documentation of the other rock-art monuments on the slopes of Mt. Aragats and the Syunik Highlands (the project is directed by B. Gasparyan and A. Khechoyan, IAE, in collaboration with French and British colleagues). Analyses of this rock-art, in combination with that of nearby monuments, now allow the dates and cultural affinity of these phenomena to be more accurately assessed. Based on this recent work, the earliest evidence of rock-art (represented by rock-paintings) in Armenia can probably be attributed to the cultures of the Early Holocene and Neolithic periods. Some of these paintings, like most of the engravings found throughout Armenia, must, based on relative chronology, date to the end of the Chalcolithic period through Iron Age, between 4th–1st millennia BC. Investigations are showing that the phenomenon of petroglyphs survived through the Hellenistic Period and even extended into the Middle Ages (Feruglio *et al*. 2005; Khechoyan *et al*. 2007).

9. Future research

While this volume covers many of the above mentioned achievements, a single volume simply cannot touch on all aspects of this ongoing work. There are, and likely will always be, numerous research questions that require additional investigations. The most pressing are: the initial habitation of Armenia, the MP-UP transition in Armenia and the southern Caucasus, Epipaleolithic occupation at the final phases of the Pleistocene, the Neolithization process during the Early Holocene, the initial steps of the Chalcolithic Period and many others.

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References

Adler, D.S., Yeritsyan, B., Wilkinson, K., Pinhasi, R., Bar-Oz, G., Nahapetyan, S., Mallol, C., Berna, F., Bailey, R., Schmidt, B.A., Glauberman, P., Wales, N. and Gasparyan, B. (2012) The Hrazdan Gorge Palaeolithic project, 2008-2009. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15–17, 2009 in Yerevan.* Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 21–37.

Areshian, G.E., Gasparyan, B., Avetisyan, P.S., Pinhasi, R., Wilkinson, K., Smith, A., Hovsepyan, R. and Zardaryan, D. (2012) The Chalcolithic of the Near East and south-eastern Europe: discoveries and new perspectives from the cave complex Areni-1, Armenia. *Antiquity* 86, pp. 115–130.

Arimura, M., Gasparyan, B. and Chataigner, C. (2012) Prehistoric sites in Northwest Armenia: Kmlo-2 and Tsaghkahovit. In: Matthews, R. and Curtis, J. (eds.), *Proceedings of the 7th International Congress of the Archaeology of the Ancient Near East, 12 April – 16 April 2010, The British Museum and UCL, London, Volume 3: Fieldwork and Recent Research Posters*. Wiesbaden: Harrassowitz Verlag, pp. 135–149.

Arimura, M., Badalyan, R., Gasparyan, B. and Chataigner, C. (2010) Current Neolithic Research in Armenia. *Neo-Lithics* 1/2010, pp. 77–85.

Arimura, M., Chataigner, C. and Gasparyan, B. (2009) Kmlo-2, An Early Holocene Site in Armenia. *Neo-Lithics* 2/2009, pp. 17–19.

Avetisyan, P. and Bobokhyan, A. (2012) Archaeology of Armenia in Regional Context: Achievements and Perspectives. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 7–20.

Avetisyan, P., Chataigner, C. and Palumbi, J. (2006) The results of the excavations in Nerkin Godedzor (2005–2006). Preliminary report. *Aramazd* 1, pp. 6–18, 263–264, 282–283.

Badalian, R., Bigazzi, G., Cauvin, M.-C., Chataigner, C., Jrbashyan, R., Karapetyan, S.G., Oddone, M. and Poidevin, J.-L. (2001) An international research project on Armenian archaeological sites: fission-track dating of obsidians. *Radiation Measurements* 34, pp. 373–378.

Badalyan, R.S. (2010) Obsidian in the Southern Caucasus: The use of the raw-materials in the Neolithic to Early Iron Age. In: Hansen, S., Hauptmann, A., Motzenbäcker, I. and Pernicka, E. (eds.), *Von Maikop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr*. Beiträge des Internationalen Symposiums in Berlin vom 1.-3. Juni 2006. Bonn: Habelt Verlag, pp. 27–38.

Badalyan, R., Chataigner, C. and Kohl, Ph. (2004a) Trans-Caucasian obsidian: The exploitation of the sources and their distribution. In: Sagona, A. (ed.), *A view from the Highlands. Archaeological studies in honor of Charles Burney*. Ancient Near Eastern Studies Supplement 12. Herent: Peeters, pp. 437–465.

Badalyan, R.S., Harutyunyan, A.A., Chataigner C., Le Mort, F., Chabot, J., Elie Brochier, J., Balasescu, A., Radu, V. and Hovsepyan, R. (2010) The settlement of Aknashen-Khatunarkh, A Neolithic site in the Ararat Plain (Armenia): Excavation results 2004–2009. *TÜBA-AR* 13, pp. 185–218.

Badalyan, R., Lombard, P., Avetisyan, P. and Chataigner, C. (2004b) The Neolithic and Chalcolithic phases in the Ararat Plain (Armenia): The view from Aratashen. In: Sagona, A. (ed.), *A view from the Highlands. Archaeological studies in honor of Charles Burney*. Ancient Near Eastern Studies, Supplement 12. Herent: Peeters, pp. 399–420.

Badalyan, R., Lombard, P., Avetisyan, P., Chataigner, C., Chabot, J., Emmanuelle, V., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New data on the late prehistory of the southern Caucasus. The excavations of Aratashen (Armenia): Preliminary report. In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe-IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS Editions, pp. 37–61.

Barnard, H., Dooley, A.N., Areshian, G., Gasparyan, B. and Faull, K.F. (2011) Chemical evidence for wine production around 4000 BCE in the Late Chalcolithic Near Eastern highlands. *Journal of Archaeological Science* 38, pp. 377–384.

Bar-Oz, G., Weissbrod, L., Gasparyan, B., Nahapetyan, S., Wilkinson, K. and Pinhasi, R. (2012) Taphonomy and zooarchaeology of a high-altitude Upper Pleistocene faunal sequence from Hovk-1 Cave, Armenia. *Journal of Archaeological Science* 39, pp. 2452–2463.

Blackman, J., Badaljan, R., Kikodze, Z. and Kohl, Ph. (1998) Chemical characterization of Caucasian obsidian geological sources. In: Cauvin, M.-C., Gourgaud, A., Gratuze, B., Arnaud, N., Poupeau, G., Poidevin, J.-L. and Chataigner, C. (eds.), *L'Obsidienne au Proche et Moyen Orient. Du volcan a l'outil*. BAR International Series 738. Oxford, pp. 205–231.

Bruch, A.A. and Gabrielyan, I.G. (2002) Quantitative data on the Neogene climatic development in Armenia and Nakhichevan. *Acta Universitatis Caroline – Geologica* 46 (4), pp. 41–48.

Chabot, J., Badalyan, R. and Chataigner, C. (2009) A Neolithic obsidian industry in the Southern Caucasus region: origins, technology and traceology. In: Moreau, J-F., Auger, R., Chabot, J. and Herzog, A. (eds.), *Proceedings of the 36th Symposium on Archaeometry*. Quebec: CELAT, pp. 151–160.

Chataigner, C., Avetisyan, P., Palumbi, J. and Uerpman, H.-P. (2010) Godedzor, A late Ubaid-related settlement in the Southern Caucasus. In: Carter, R.A. and Philip, G. (eds.), *Beyond the Ubaid. Transformation and integration in the late prehistoric societies of the Middle East*. Studies in Ancient Oriental Civilization, Volume 63. Chicago-Illinois: The University of Chicago Press, pp. 391–409.

Chataigner, C., Badalian, R., Bigazzi, G., Cauvin, M.-C., Jrbashian, R., Karapetyan, S.G., Norelli, P., Oddone, M. and Poidevin, J.-L. (2003) Provenance studies of obsidian artefacts from Armenian archaeological sites using the fission-track dating method. *Journal of Non-Crystalline Solids* 323, pp. 167–171.

Chataigner, C. and Barge, O. (2010) GIS (Geographic Information System) and obsidian procurement analysis: pathway modelisation in space and time. In: Hansen, S., Hauptmann, A., Motzenbäcker, I. and Pernicka, E. (eds.), *Von Maikop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr*. Beiträge des Internationalen Symposiums in Berlin vom 1.-3. Juni 2006. Bonn: Habelt Verlag, pp. 1–14.

Chataigner, C., Gasparyan, B., Montoya, C., Arimura, M., Melikyan, V., Liagre, J., Petrosyan, A., Ghukasyan, R., Colonge, D., Fourloubey, K., Arakelyan, D., Astruc, L., Nahapetyan, S., Hovsepyan, R., Balasescu, A., Tome, K., and Radu, V. (2012) From the Late Upper Palaeolithic to Neolithic in North-Western Armenia: Preliminary results. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 52–63.

Chataigner, C. and Gratuze, B. (2013a) New data of the exploitation of obsidian in the Southern Caucasus (Armenia, Georgia) and Eastern Turkey, Part 1: Source characterization. *Archaeometry*, pp. 1–23 (doi: 10.1111/arcm.12006).

Chataigner, C. and Gratuze, B. (2013b) New data of the exploitation of obsidian in the Southern Caucasus (Armenia, Georgia) and Eastern Turkey, Part 2: Obsidian procurement from the Upper Palaeolithic to the Late Bronze Age. *Archaeometry*, pp. 1–22 (doi: 10.1111/arcm.12007).

Cherry, J.F., Faro, E.Z. and Minch, L. (2008) Field exploration and instrumental neutron activation analyses of the obsidian sources in Southern Armenia. *IAOS* (International Association for Obsidian Studies) Bulletin No. 39, Summer, pp. 3–6.

Cherry, J.F., Faro, E.Z. and Minch, L. (2010) Field survey and geochemical characterization of the Southern Armenian obsidian sources. *Journal of Field Archaeology* 35/2, pp. 147–163.

Courcier, A. (2014) Ancient Metallurgy in the Caucasus from the Sixth to the Third Millennium BCE. In: Roberts, B.W. and Thornton, C.P. (eds.), *Archaeometallurgy in Global Perspective*. New York: Springer Science+Buiseness Media, pp. 579–664.

Courcier, A., Kuparadze, D. and Pataridze, D. (2008) Archaeometallurgical Researches on the Early Beginnings of Metallurgy (VI-III Millennia BC) in the Caucasus: An Example of Interdisciplinary Studies. *Metalla (Bochum)* 15/1, pp. 35–50.

Egeland, C.P., Nicholson, C.M. and Gasparian, B. (2010) Using GIS and ecological variables to identify high potential areas for paleanthropological survey: an example from Northern Armenia. *Journal of Ecological Anthropology* 14/1, pp. 89–98.

Feruglio, V., Khechoyan, A., Gasparyan, B. and Chataigner, C. (2005) The Geghamavan-1 painted shelter, Aragatsotn Province, Republic of Armenia. *International Newsletter on Rock Art (INORA)* 41, pp. 1–7.

Fourloubey, C., Beauval, C., Colonge, D., Liagre, J., Ollivier, V. and Chataigner, C. (2003) Le Paléolithique en Arménie: état des connaissances acquises et donnees récentes. *Paléorient* 29/1, pp. 5–18.

Frahm, E., Schmidt, B.A., Gasparyan, B., Yeritsyan, B., Karapetyan, S., Meliksetyan, Kh. and Adler, D.S. (2014) Ten seconds in the field: rapid Armenian obsidian sourcing with portable XRF to inform excavations and surveys. *Journal of Archaeological Science* 41, pp. 333–348.

Gasparian, B. (2010) Landscape organization and resource management in the Lower Palaeolithic of Armenia. *TÜBA-AR* 13, pp. 159–183.

Gasparyan, B. (2007) *Dans les montagnes d'Arménie, 500 000 ans d'histoire avant notre ére*. Fichet de Clairfontaine, F. (ed.). Rouen: Musée archéologique de Saint-Raphael; Musée départemental des antiquités, pp. 47–51, 130–133.

Ghazaryan, H.P. (1986) Verkneashel'skoe mestonakhozhdenie Atis I (Upper Acheulian Site Hatis I). In: Shilov, V.P. (ed.), *Arkheologicheskie Otkritiya 1984 goda* (Archaeological Discoveries for year 1984). Moscow: "Nauka" Publishing House, pp. 433–434 (in Russian).

Ghazaryan, H.P. (1991) Hatis V paleolityan arhestanotsy (Paleolithic workshop Hatis V). In: Tiratsyan, G.A. (ed.), *Hayastani Hanrapetutyunum 1989–1990 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to Archaeological Fieldwork Results in the Republic of Armenia in 1989-1990). Yerevan: Armenian Academy of Sciences Press, pp. 3–4 (in Armenian).

Ghukasyan, R., Colonge, D., Nahapetyan, S., Ollivier, V., Gasparyan, B., Monchot, H. and Chataigner, Ch. (2011) Kalavan-2 (North of Lake Sevan, Armenia): A New Late Middle Paleolithic Site in the Lesser Caucasus. *Archaeology, Ethnology and Anthropology of Eurasia* 38/4, pp. 39–51.

Joannin, S., Ali, A.A., Ollivier, V., Roiron, P., Peyron, O., Chevaux, S., Nahapetyan, S., Tozalakyan, P., Karakhanyan, A. and Chataigner, C. (2013) Vegetation, fire and climate history of the Lesser Caucasus: a new Holocene record from Zarishat fen (Armenia). *Journal of Quaternary Science* 29/1, pp. 70–82 (doi: 10.1002/jqs.2679).

Joannin, S., Cornee, J-J., Munch, P., Fornari, M., Vasiliev, I., Krijgsman, W., Nahapetyan, S., Gabrielyan, I., Ollivier, V., Roiron, P. and Chataigner, C. (2010) Early Pleistocene climatic cycles in continental deposits of the Lesser Caucasus of Armenia inferred from palynology, magnetostratigraphy, and 40Ar/39Ar dating. *Earth and Planetary Science Letters* 291, pp. 149–158.

Kalantaryan, I., Arimura, M., Hovsepyan, R. and Chataigner, C. (2012) The archaeological investigations of Getahovit-2 cave (Armenia) in 2011–2012: The preliminary results. *Aramazd* VII/1, pp. 7–23, 144–145, 154, 157–165.

Kandel, A.W., Gasparyan, B., Bruch, A.A., Weissbrod, L. and Zardaryan, D. (2011) Introducing Aghitu-3, the first Upper Paleolithic site in Armenia. *Aramazd* VI/2, pp. 7–23, 220–221, 235–236, 239–247.

Karapetyan, S.G., Jrbashian, R.T. and Mnataskanyan, A.Kh. (2001) Late collision rhyolitic volcanism in the north-eastern part of the Armenian Highland. *Journal of Volcanology and Geothermal Research* 112, pp. 189–220.

Karapetyan, S.G., Jrbashyan, R.T., Mnatasakanyan, A.Kh. and Shirinyan, K.G. (2010) Obsidian sources in Armenia – The Geological background. In: Hansen, S., Hauptmann, A., Motzenbäcker, I. and Pernicka, E. (eds.), *Von Maikop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr*. Beiträge des Internationalen Symposiums in Berlin vom 1.-3. Juni 2006. Bonn: Habelt Verlag, pp. 15–25.

Khechoyan, A., Feruglio, V., Gasparyan, B. and Chataigner, C. (2007) The Rock Art of the Mt. Aragats System. In: Bloom, M., Giorgi, P. and Pietroboni, G. (eds.), *Rock art in the frame of the cultural heritage of humankind*. Capo di Ponte: CCSP & UNESCO., pp. 247–252.

Korobkova, G.F. (1987) *Khozyaystvenniye kompleksi rannikh zemledel'chesko-skotovodcheskikh obshchestv yuga SSSR* (Economic complexes of the early farming-cattle-breading societies of the South of the USSR). Leningrad: "Nauka" Publishing House, Leningrad Branch (in Russian).

Kushnareva, K.Kh. (1997) *The Southern Caucasus in Prehistory, Stages of Cultural and Socioeconomic Development From the Eight to the Second Millennium B.C.* University Museum Monograph 99. Philadelphia: the University Museum, University of Pennsylvania.

Liagre, J., Arakelyan, D., Gasparyan, B., Nahapetyan, S. and Chataigner, C. (2009) Mobilité des groupes préhistoriques et approvisionnement des matières premières à la fin du Paléolithique supérieur dans le Petit Caucase: données récentes sur le site de plein air de Kalavan 1 (nord du lac Sevan, Arménie). In: Djindjian, F., Kozlowski, J. and Bicho, N. (eds.), *Le concept de territoires dans le Paléolithique supérieur européen – UISPP, Proceedings of the XV World Congres (Lisbon, 4-9 September 2006)*. BAR International Series 1938. Oxford: ArchaeoPress, pp. 75–84.

Liagre, J., Gasparyan, B., Ollivier, V. and Nahapetyan, S. (2006) Angeghakot 1 (Armenia) and the identification of the Mousterian cultural facies of "Yerevan points" type in the Southern Caucasus. *Paléorient* 32/1, pp. 5–18.

Lombard, P. and Chataigner, C. (2004) Le Néolithique et le Chalcolithique en Transcaucasie: l'exemple des bassins de la Kura et de l'Araxe. In: Guilaine, J. (ed.), *Aux marges des grands foyers du Néolithique: Périphéries débitrices ou créatrices*. Collection "Séminaires du Collège de France". Paris: Errance, pp. 61–84.

Lyubin, V.P. (1970) Nizhniy Paleolit (Lower Paleolithic). In: Formozov, A.A. (ed.), *Kamenniy vek na territorii SSSR* (Stone Age in the territory of USSR). Moscow: "Nauka" Publishing House, pp. 19–42 (in Russian).

Lyubin, V.P. (1984) Ranniy Paleolit Kavkaza (Early Paleolithic of Caucasus). In: Boriskovskiy, P.I. (ed.), *Paleolit SSSR* (Paleolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 45–93 (in Russian).

Lyubin, V.P. (1989) Paleolit Kavkaza (Paleolithic of Caucasus). In: Boriskovskiy, P.I. (ed.), *"Paleolit Kavkaza i Severnoy Azii"*, iz serii "Paleolit Mira, Issledovaniya po Arkheologii Drevnego Kamennogo Veka" ("The Paleolithic of Caucasus and Northern Asia", from Series of "The Old Stone Age of the World, Studies in the Paleolithic Cultures"). Leningrad: "Nauka" Publishing House, Leningrad Branch, pp. 7–142 (in Russian).

Lyubin, V.P. (1998) *Ashel'skaya epokha na Kavkaze* (The Acheulian Epoch in the Caucasus). Rossiyska Akademia Nauk, Institut Istorii Material'noy Kul'turi, Arkheologicheskie iziskaniya, 47, Paleolit Kavkaza, kn. 1 (Russian Academy of Sciences, Institute for the Material Culture History, Archaeological Studies, 47, Paleolithic of Caucasus, book1). St. Petersburg: "Peterburgskoe Vostokovedenie" Publishing House (in Russian).

Martirosyan, H.A. (1969) Hayastani nakhnadaryan mshakuyti nor hushardzanner (New sites of the Prehistoric Culture of Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) N3 (46), pp. 191–208 (in Armenian).

Martirosyan, H.A. (1971) Hayastany eneoliti (pghndzekaredaryan) zhamanakashrjanum (Armenia during Eneolithic [Chalcolithic] Period). In: Yeremyan, S.T., Martirosyan, H.A., Sargsyan, G.Kh. and Tirstayan, G.A. (eds.), *Hay zhoghovrdi patmutyun* (History of Armenia). Volume 1. Yerevan: Armenian SSR Academy of Sciences Press, pp. 110–125 (in Armenian).

Martirosyan, H.A. (1974) Hayastani hnaguyn mshakuyti usumnasirutyuny ev nra zargatsman herankarnery (Study of Ancient Culture of Armenia and perspectives of its development). *Lraber hasarakakan gitutyunneri* (Herald of Social Sciences) N7 (379), pp. 25–39 (in Armenian).

Martirosyan, H.A and Torosyan, R.M. (1967) Hayastani eneolityan mshakuyti meknabanman hartsi shurj (About the question of interpretation of the Eneolithic culture of Armenia). *Lraber hasarakakan gitutyunneri* (Herald of Social Sciences) N3 (286), pp. 52–62 (in Armenian).

Meliksetian, Kh., Pernicka, E. and Badalyan, R. (2007) Compositions and some considerations on the provenance of Armenian Early Bronze Age copper artefacts. In: Papers presented at the Archaeomettalurgy in Europe, 2nd International Conference, 17–27 June, 2007, Aquileia, Italy, pp. 125–134.

Meliksetian, Kh., Pernicka, E., Badalyan, R. and Avetisyan, P. (2008) Trace element and lead isotope composition of some Armenian Neolithic and Eneolithic copper objects. In: program and abstracts presented at the 37th International Symposium on Archaeometry, May 12th – 16th, 2008, Siena, Italy, Publicato con il contributo della Fondazione Monte dei Paschi di Siena, pp. 394–395.

Meliksetian, Kh., Kraus, S., Pernicka, E., Avetisyan, P., Devejian, S. and Petrosyan, L. (2011) Metallurgy of Prehistoric Armenia. In: Yalcin, U. and Wirth, C. (eds.), *Anatolian Metal V*. Veröfentlichungen aus dem Deutchen Bergbau-Museum Bochum Nr. 180. Bochum: WAZ-Druck GmgH & Co. KG, pp. 201–210.

Montoya, C., Balasescu, A., Joanin, S., Ollivier, V., Liagre, J., Nahapetyan, S., Ghukasyan, R., Colonge, D., Gasparyan, B. and Chataigner, C. (2013) The Upper Paleolithic site of Kalavan-1 (Armenia): An Epigravettian settlement in the Lesser Caucasus. *Journal of Human Evolution* 65, pp. 621–640.

Munchayev, R.M. (1975) *Kavkaz na zare bronzovogo veka. neolit, eneolit, rannyaya bronza* (The Caucasus on the Threshold of The Bronze Age. Neolithic, Eneolithic, Early Bronze Age). Moscow: "Nauka" Publishing House (in Russian).

Munchayev, R.M. (1982) Eneolit Kavkaza (Eneolithic of Caucasus). In: Masson, V.M. and Merpert, N.Ya. (eds.), *Eneolit SSSR* (Eneolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 100–164 (in Russian).

Oddone, M., Biggazi, G., Keheyan, Y. and Meloni, S. (2000) Characterisation of Armenian obsidians: Implications for raw material supply for prehistoric artifacts. *Journal for Radioanalytical and Nuclear Chemistry* 243/3, pp. 673–682.

Ollivier, V., Nahapetyan, S., Roiron, P., Gabrielyan, I., Gasparyan, B., Chataigner, C., Joannin, S., Cornee, J-J., Guillou, H., Scaillet, S., Munch, P. and Krijgsman, W. (2010) Quaternary volcano-lacustrine patterns and paleobotanical data in South Armenia. *Quaternary International* 223–224, pp. 312–326.

Palumbi, J. (2007) A preliminary analyses of the prehistoric pottery from Aratashen (Armenia). In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe-IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS Editions, pp. 63–76.

Panichkina, M.Z. (1950) *Paleolit Armenii* (Paleolithic of Armenia). Leningrad: State Hermitage Press (in Russian).

Pinhasi, R., Gasparian, B., Areshian, G.E., Zardaryan, D., Smith, A., Bar-Oz, G. and Higham, T. (2010) First direct evidence of Chalcolithic footwear from the Near Eastern Highlands. *PLOS ONE* 5 (6) (http://www.plosone.org/article/info:doi/10.1371/journal.pone.0010984).

Pinhasi, R., Gasparian, B., Nahapetyan, S., Bar-Oz, G., Weissbrod, L., Bruch, A.A., Hovsepyan, R. and Wilkinson, K. (2011) Middle Paleolithic human occupation of the high altitude region of Hovk-1, Armenia. *Quaternary Science Reviews* 30, pp. 3846–3857.

Pinhasi, R., Gasparyan, B., Nahapetyan, S., Bar-Oz, G., Weissbrod, L., Bruch, A., Hovsepyan, R. and Wilkinson, K. (2012) Middle Palaeolithic occupation at Hovk-1, Armenia. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences "Gitutyun" Publishing House, pp. 38–51.

Pinhasi, R., Gasparyan, B., Areshian, G.E.,Wilkinson, K., Bailey, R., Bar-Oz, G., Bruch, A., Chataigner, C., Hoffmann, D., Hovsepyan, R., Nahapetyan, S., Pike, A.W.G., Schreve, D. and Stepehens, M. (2008) Hovk-1 and the Middle and Upper Paleolithic of Armenia: a preliminary framework. *Journal of Human Evolution* 55/5, pp. 803–816.

Piotrovskiy, B.B. (1949) *Arkheologiya Zakavkaz'ya, s drevneyshikh vremen do I tisyacheletiya do n.e., Kurs Lektsiy* (Archaeology of the Transcaucasus from the Ancient times to the I Millennium BC, Course of lectures). Leningrad: A.A. Zhdanov Leningrad State University Press (in Russian).

Sagona, A. (2010) Past and present directions in the archaeology of the Transcaucasus. *TÜBA-AR* 13, pp. 143–157.

Sardaryan, S.H. (1954) *Paleolit v Armenii* (Paleolithic in Armenia). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Sardaryan, S.H. (1967) *Nakhnadaryan hasarakutyuny Hayastanum* (Primitive Society in Armenia). Yerevan: "Mitk" Publishing House (in Armenian, with Russian and English Resume).

Torosyan, R.M. (1971) Neolit-eneolityan hoghamshakutyan mi kani gortsikner (Some farming tools of Neolithic-Eneolithic). *Patma-Banasirakan Handes* (Historical-Philological Journal) N2 (53), pp. 240–250 (in Armenian).

Torosyan, R.M. (1976) *Teghuti vagh erkragortsakan bnakavairy (m.t.a. IV hazaramyak)* (The Early Farming Settlement of Teghut [IV Millennium BC]). Hnagitakan peghumnery Hayastanum (Archaeological excavations in Armenia) N14. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian with Russian Resume).

Varoutsikos, B. and Chataigner, C. (2012) Obsidatabase: collecter et organiser les données relatives à l'obsidienne préhistorique au Proche-Orient et en Transcaucasie. In: Henry, O. (ed.), *Archéologies et Espaces parcourus. Premières Rencontres d'Archéologie de l'IFEA, Istanbul, 11-13 Novembre 2010*. Istanbul: Institut Français d'Études Anatoliennes Georges Dumézil, p. 11–22.

Wilkinson, K., Gasparyan, B., Pinhasi, R., Avetisyan, P., Hovsepyan, R., Zardaryan, D., Areshian, G.E., Bar-Oz, G., and Smith, A. (2012) Areni-1 cave, Armenia: A Chalcolithic-Early Bronze Age settlement and ritual site in Southern Caucasus. *Journal of Filed Archaeology* 37/1, pp. 20–33.

Yeritsyan, B.G. (1970) *Yerevanskaya peshchernaya stoyanka i ee mesto sredi drevneyshix pamyatnikov Kavkaza* (Yerevan cave site and its place among the ancient monuments of the Caucasus). Avtoreferat dissertatsii na soiskanie uchenoy stepeni kandidata istoricheskix nauk (Synopsis of Candidate Dissertation). Moscow (in Russian).

Yeritsyan, B.G. (1975) Novaya nizhnepaleoliticheskaya peshchernaya stoyanka Lusakert 1 (Armeniya) (New Lower Paleolithic cave site Lusakert 1 [Armenia]). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N141*, *Kamenniy vek* (Stone Age). Moscow: "Nauka" Publishing House, pp. 42−50 (in Russian).

Zamyatnin, S.N. (1947) Nakhodki nizhnego paleolita v Armenii (Findings of the Lower Paleolithic in Armenia), *Izvestiya Akademii Nauk Armyanskoy SSR, Seriya Obshchetvennie Nauki* (Bulletin of the Academy of Sciences of the Armenian SSR, Social Sciences) 1, pp. 15–25 (in Russian).

Zamyatnin, S.N. (1950) Izucheniye paleoliticheskogo perioda na Kavkaze za 1936-1948 gg. (Study of the Paleolithic period in the Caucasus for the years 1936-1948). *Materiali po izucheniyu Chetvertichnogo perioda* (Materials for Study of the Quaternary Period) 2, pp. 127−139 (in Russian).

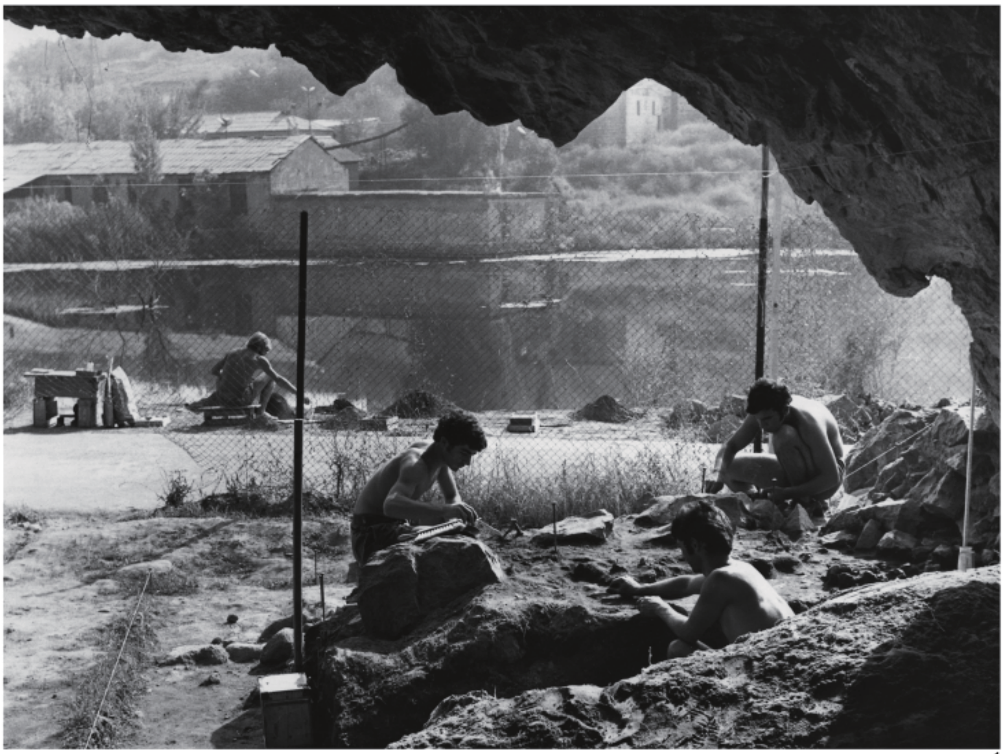

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Figure 1

Photos of excavations during the Soviet period (provided by B. Yeritsyan).

1. Excavations of Yerevan-1 cave in 1969; 2. First visit to the Lusakert-1 and 2 caves in 1968.

Table 1

Chronological chart of the Stone Age in Armenia with ages based on radiometric dating (After B. Gasparyan, M. Arimura, R. Badalyan, P. Avetisyan and A. Bobokhyan).

Period	Sub-Period	Phase	Date	Cultural-Historical Entity (Tradition)	Key sites
Chalcolithic	Late	late	3,700 – 3,400 BC	"Godedzor" tradition	Areni-1 cave, Horizon I, Nerkin Godedzor settlement
		middle	4,000 – 3,700 BC	"Areni" tradition	Areni-1 cave, Horizon II, Teghut settlement
		early	4,300 – 4,000 BC		Areni-1 cave, Horizon III, Tsaghkahovit-1 rock-shelter
	Early – Middle		5,200 – 4,300 BC	"Adablur" and "Sioni" traditions	Aratashen, Horizon 0, Aknashen, Horizon I, Masis Blur, Upper Horizons, Adablur, Artashat, Mushakan-4 settlements
Neolithic	Late		6,000 – 5,200 BC	"Aratashen-Shulaveri-Shomutepe" tradition	Aratashen, Aknashen, Masis Blur settlements
	Early		7,500 – 6,000 BC		
Mesolithic (Early Holocene)			10,000 – 7,500 BC		Apnagyugh-8/Kmlo-2 cave, Kuchak-1 rock-shelter, Gegharot-1 open-air
Paleolithic	Upper	epi-	12,000 – 10,000 BC		Apnagyugh-8/Kmlo-2 cave, Karkarer open-air
		late	23,000 BP – 12,000 BC		Kalavan-1 open-air
		middle	31,000 – 23,000 BP		Aghitu-3 cave
		early	40,000 – 31,000 BP		Aghitu-3 cave
	Middle	late	71,000 – 40/35,000 BP		Yerevan-1,2, Lusakert-1,2, Angeghakot-1 caves Barozh-12, Kalavan-2 open air
		middle	128 000 – 71 000 BP		Hovk-1 cave
		early	300/270,000 – 128,000 BP		Bagratashen-1, Aghavnatun-1 open-air
	Lower		2,000,000 – 300/270,000 BP	Oldowan (Pre-Achulian), Acheulian	open-air sites of the Ararat, Shirak and Lori Depressions, Nor Geghi-1 open-air

Figure 2

Map of Armenia showing location of sites mentioned in the publication.

Paleolithic

Recently Discovered Lower Paleolithic Sites of Armenia

Boris Gasparyan, Daniel S. Adler, Charles P. Egeland and Karen Azatyan

1. Introduction

Situated within a natural cul-de-sac between the Black and Caspian Seas and the Greater Caucasus, the southern Caucasus, a term that commonly refers to the modern republics of Armenia, Azerbaijan, and Georgia, lies at the meeting point of Africa, Europe, and Asia. The region's favorable climate and rich natural resources have attracted human populations throughout Paleolithic times, which is borne out by an extremely prolific record of Paleolithic occupation (Lyubin 1984; 1989; 1998). It is also thought that the southern Caucasus was an important refuge for humans during Pleistocene glacial periods and, thus, served as a core from which recolonizations of Eurasia occurred (Bar-Yosef 1994; Finlayson 2004; Dennell *et al*. 2011; Dalén *et al*. 2012).

The modern Republic of Armenia is located at the heart of this corridor and will therefore play a pivotal role in our understanding of the Paleolithic settlement of the southern Caucasus and, indeed, beyond. Until recently, the Lower Paleolithic record of Armenia was based exclusively on open-air artifact scatters situated directly on, or in close proximity to, obsidian outcrops that lacked any stratigraphic context. These sites were nonetheless widely considered from the late 1940s and early 1950s through the early 1980s as the oldest evidence of human occupation within the borders of the Soviet Union (Panichkina 1950b, pp. 22, 68, 99; Zamyatnin 1950, p. 128; Sardaryan 1954, pp. 72, 170; Okladnikov 1956, pp. 26-29; Yefimenko *et al*. 1956, pp. 18-19; Pershits *et al*. 1982, p. 83; Praslov 1984, p. 42). While the importance of stratified Lower Paleolithic sites was certainly recognized, all attempts by Soviet scholars (S. Sardaryan, M. Panichkina, V. Lyubin, H. Ghazaryan) to discover such evidence proved unsuccessful (Panichkina 1950, pp. 24-25; Klein 1966, pp. 4-5; Ghazaryan 1986).

The spectacular record from Dmanisi in late 1980s (Georgian Republic), dated to between 1.85 and 1.78 million years ago, demonstrates that the southern Caucasus was home to Paleolithic peoples by at least the Early Pleistocene (Lordkipanidze 1998; Gabunia *et al*. 2000; de Lumley *et al*. 2002; Tappen *et al*. 2007; Ferring *et al*. 2011). Given the proximity of Dmanisi to Armenia, there is every reason to assume that archaeological sites of similar age would be discovered in Armenia, and this assumption has spurred new archaeological surveys throughout the country (Gasparian 2010).

This article is a preliminary attempt to summarize Lower Paleolithic data from the Soviet period and provide a brief description of the recently implemented surveys and test excavations which reveal that several sites have great potential to preserve *in situ* occupations. Future work will target these areas for systematic excavation.

2. Background on Lower Paleolithic research in Armenia

The collections of lithic artifacts by the French archaeologist Jacques de Morgan near the sources of obsidian and adjacent areas (Mt. Arteni, Hrazdan and Kasakh Rivers valleys) at the end of the 19th century contain some Lower and Middle Paleolithic forms. While thinking that Armenia and the Caucasus as a whole were not populated during the Paleolithic period, Morgan attributed these finds to the end of the Archaeolithic period (Upper Paleolithic by his definition). This opinion hindered further research of the Paleolithic in Armenia by at least 30 years (de Morgan 1909, p. 191-192, Fig. 48-49, 51). In 1933 the geologist A. Demyokhin, who studied mineral springs in the middle stream of the Hrazdan River, discovered a small group of stone artifacts in Arzni containing typical Late Acheulian hadaxes (Bayburtyan 1938, pp. 195, 216, Figures 1 and 4; Zamyatnin 1947, p. 19, Figure 1 a-c; Panichkina 1950b, pp. 74-75, Figure 20: 1-2, Figure 21: 2-3; Demyokhin 1956). Those finds stimulated the further study of the Paleolithic period in Armenia by placing them into a systematic context.

During 1944-1949, re-visiting the areas investigated by Morgan and Demyokhin, S. Sardaryan (Armenian SSR Academy of Sciences), S. Zamyatnin and M. Panichkina (Academy of Sciences of the USSR and Leningrad State Hermitage) surveyed the middle reaches of the Hrazdan River canyon (Arzni, Nurnus and Argel) and Mt. Arteni (Satani-dar, Areguni blur, Yerkaruk blur). They assembled a large collection of Paleolithic artifacts from numerous open-air sites which were located in close proximity to obsidian raw material sources. Based on detailed typological description of the surface collections Sardaryan, Zamyatnin and Panichkina separated over 1,000 lithic artifacts produced from obsidian and dacite (diabase according to Zamyatnin and doleritic basalt according to Panichkina). The collections included different types of handaxes and coarse chopping tools, picks, tools produced on so-called “Clactonian flakes”, discoidal and Levallois cores, discoidal tools, unmodified flakes and blades, retouched flakes, knives, coarse points, Levallois points, side scrapers and coarse borers, all considered characteristic of the Lower Paleolithic (Zamyatnin 1947; Panichkina 1950a; 1950b, pp. 12-14, 23-80, 99-101, Tables V-X; 1951; 1952; 1953; Sardaryan 1954, pp. 16-19, 43-100, 169-171; 1967, pp. 37-60; Klein 1966, pp. 3-14).

Based on classification and typology, as well as comparison of the assemblages to similar sites from the Caucasus, Crimea, Western and Eastern Europe, the Middle East and Africa, Panichkina and Sardaryan attributed the earliest complexes of Satani-dar to the Chellean and Acheulian. While each scholar offered a slightly different interpretation of whether the earlier or later phases of the complexes was present, they placed the division between Chellean and Acheulian at the base of the first chronological chart of the Lower Paleolithic of Armenia. In addition, based on the Western European chronology, Sardaryan suggested an age for the Lower Paleolithic of Armenia between 800,000 – 100,000 (Panichkina 1950b, pp. 23-80, 99-101; Sardaryan 1954, pp. 43-100, 169-171).

Between 1950-1970 numerous Lower Paleolithic finds were recorded in Armenia widening the geographic extent of their distribution. In 1953 geologist A. Aslanyan discovered the Jajur open-air site in the Shirak Depression of northwestern Armenia (Aslanyan 1956; Lyubin 1961, p. 66). In 1959 L. Barseghyan reported finding limestone Acheulian handaxes near the cave of Gheasi-kar on the slopes of the Papakar Range in Noyemberyan district of northeastern Armenia (Barseghyan 1959). Geologist H. Sargsyan discovered the first Acheulian handaxe in the basin of the Urut River near the village of Privolnoe on the Tashir Plateau of northern Armenia in 1965 (Gasparyan *et al*. 2005, pp. 17-18). Lower Paleolithic occupation in the Aparan Depression of central Armenia was recorded by the discovery of the Lusagyugh open-air site by S. Barkhudaryan with surface collection of Acheulo-Mousterian obsidian implements in 1969 (Petrosyants 1988: 37). In any case, all of these finds were fortuitous in nature.

In 1958 continuing the tradition of the Leningrad school, V.P. Lyubin (Institute of Archaeology of the Academy of Sciences of the USSR) conducted new surveys and studies in the area of Mt. Arteni and Mt. Gutanasar (Hrazdan-Kotayk Plateau) in the frame of the Caucasian expedition of the Institute of Geography of the Academy of Sciences of the USSR. Among the finds in the areas of Kaghsi, Matash and Verin Talin, he recorded Lower Paleolithic as well (Lyubin and Balyan 1961). The most significant discoveries by Lyubin were made between 1958-1963 on the slopes of Mt. Gutanasar in close proximity and directly on obsidian outcrops where numerous Acheulo-Mousterian open-air sites of Jraber (I-X), Fontan (I-II) and Kyondarasi (I-IV) were discovered (Lyubin 1961; 1984, pp. 61-62, 76, Fig. 19; 1989, pp. 88-92; 1998, pp. 136-153; Kulakov 1991; Lyubin and Beliaeva 2006). Trying to study the materials of the Acheulo-Mousterian open-air sites of Armenia, Lyubin was the first researcher to combine the methods of technological analyses, formal typology and experimental archaeology developed by S.A. Kulakov and A.E. Matyukhin. He concluded that most of the Late Acheulian open-air sites of Armenia lying in close proximity or directly on obsidian outcrops represented long and short-term specialized workshops for specific types of blank production (Lyubin 1965; 1978; Kulakov 1991; Matyukhin 1981; 2001). Lyubin also made the first attempts to analyze the materials of the Caucasian Paleolithic from the regional perspective, discussing general questions such as site formation, environment, climate, chronology and social behavior (Lyubin 1970; 1972; 1981; 1984; 1989; 1998).

A new wave of systematic study of Lower Paleolithic sites in Armenia began with the expedition for the study of the Stone Age sites of Armenia based on the decision of the Presidium of the Academy of Sciences of the Armenian SSR in 1967 headed by Professor H.A. Martirosyan. The most important finds made by the members of the expedition during two years of intensive investigation from 1967-1968 in the canyons of the Hrazdan, Azat and Ughtakunk Rivers (tributaries of the Araxes River) and adjacent areas was the discovery of the Yerevan and Lusakert groups of Middle Paleolithic caves in the Hrazdan River gorge. In addition numerous Lower Paleolithic open-air sites (Arzni, Dzoraghbyur, Yerablur, Abovyan, Hatis, Akunk) were recorded here and in the surroundings of Mt. Hatis (Martirosyan 1968; 1969; 1970; 1974, pp. 25-28; Karapetyan and Yeritsyan 1969; Karapetyan 1983a; 1983b).

Since 1967 systematic excavations of Yerevan and Lusakert caves started under direction of B.G. Yeritsyan (Institute of Archaeology and Ethnography of NAS RA). Between 1970-1990 the main focus of Paleolithic studies was concentrated in the Hrazdan River canyon and adjacent areas of the Hrazdan-Kotayk Plateau (slopes of Mt. Gutanasar and Hatis) making it the “center of gravity” of such studies in Armenia. Between 1970-1976, in parallel with Lusakert, small scale excavations were implemented in numerous caves of Hrazdan some of which – Hamo-1, Zovuni, Karashamb – yielded Lower Paleolithic finds (Azizyan 1979; 1982; Azizyan *et al*. 1975; Azizyan and Lyubin 1983; Chagharyan *et al*. 1972; Yeritsyan and Ghazaryan 1977). In addition many new open-air sites were discovered and studied in the middle reaches of the Hrazdan River (Argel-1, Argel-2) and along the edge of the Hrazdan-Kotayk Plateau (Zar, Radiokayanin kits gyugh, Kaputan). At some previously known sites (e.g. Jraber, Nurnus, Hatis) additional collections and studies were implemented (Yeritsyan and Ghazaryan 1977; Yeritsyan and Korobkov 1979; Yeritsyan 1991; Yeritsyan *et al*. 1996; 1998).

Starting from 1983 H.P. Ghazaryan (Institute of Archaeology and Ethnography of NAS RA) started investigating a series of open-air sites situated between the villages Akunk and Zar on the southern slopes of Mt. Hatis in direct proximity to obsidian raw material sources. As a result ten open-air sites were discovered and studied – Late Acheulian (Hatis-1-4 and 6-9), Mousterian (Hatis-5) and Neolithic (Hatis-10). The special methodology, spectrum of scientific questionings and scale of investigations of the Hatis open-air sites constituted a new step in the history of study of the Stone Age of Armenia. The main focus was concentrated on the study of Hatis-1, yielding rich collection of handaxes (420 among a total of 2,100 finds), one third of which are finished tools. While attributing the industry of Hatis-1 to at least two phases of the Late Acheulian, Ghazaryan did a test trench at the site, trying to record *in situ* materials. Based on his publication, the thickness of the five lithostatigraphic layers in the trench measured 1.3-1.5 m, and bedrock was not encountered. All the layers were dense with obsidian implements including bifaces that were identical to the ones collected from the surface. In general, the assemblages from each layer are homogeneous (Ghazaryan 1985; 1986; Lyubin 1989, pp. 150, 154, Fig. 87)[1].

In 1990 another Late Acheulian site was documented by G.E. Areshian in the limits of the Aparan Depression, on the left bank of the Kasakh River, between the villages of Kuchak and Vardenis, where obsidian implements (handaxes, Levallois cores, Levallois points, side scrapers, notched tools, knives) were collected. Areshian proposed that this occupation might be related to the shore of a Pleistocene lake formed in the Aparan Depression during the last interglacial. Further investigations of Paleolithic sites in the Aparan Depression confirmed this prediction (Areshian 1991)[2].

During the last decade of the 20th century (1990-2000) because of the collapse of the Soviet Union and lack of funding, intensive study of the Lower Paleolithic sites of Armenia, and the Stone Age as a whole, stopped. Work was implemented through a new strategy of small-scale surveys

1. Unfortunately, most of the research implemented by H. Gazaryan at Hatis remains unpublished.

2. Areshian's dating was based on old representations about the timing of Late or Upper Acheulian in Armenia spanning around 140-100 ka BP, meanwhile his observations about occupation of paleolake shores by Paleolithic inhabitants of Armenia were significant and proved by future investigations in Ararat, Shirak, Lori and Aparan Depressions (see Gasparyan *et al*. 2003; 2004; 2005; 2007b; Gasparian 2010).

and reconnaissance investigations, having the aim to re-examine the location, geomorphological and cultural distribution of previously known sites and discover new and perspective landmarks for future investigation. Such kind of works were implemented by B. Gasparyan in the Hrazdan-Kotayk Plateau (Hatis-11-21, Zar-1-10), the northern flanks of the Ararat Depression (Mushakan, Voskevaz, Agarak, Aghavnatun, Tsaghkalanj, Dalarik), the Shirak Depression (Aghvorik or Yeni-Yel, Tavshut) the Tashir Plateau (Metsavan, Siskyatskaya, Pechka), the Kasakh River basin and the Aparan Depression (Mulki, Aparan). These surveys yielded important records from the Lower Paleolithic as represented by numerous sites and single finds (Gasparyan 2007a; 2007b; Gaspariyan 2010; Gasparyan and Sargsyan 2003; Gasparyan *et al*. 2003; 2004; 2005; Yeritsyan 2010; Yeritsyan and Tadevosyan 2005; Yeritsyan and Gasparyan 2010). Besides Hatis and Zar, where obsidian predominates, mapping of finds represented mainly by implements made of basalt, dacite and flint (massive cores, choppers, picks and other pebble tools, coarse bifaces and handaxes) showed their possible relationship to the shore lines of lakes that existed in those areas during the Pleistocene, traces of which were confirmed by lacustrine deposits (see below). Most of the data that resulted from this work served as the basis for future investigations and was brought to life through international cooperation and joint projects in the time frame of the 21st century (see Gasparyan and Arimura, this volume). In summary, the Lower Paleolithic of Armenia continued to be based on large numbers of unstratified open-air localities. Therefore, subsequent investigations focused on finding *in situ* sites to gain a deeper understanding of the initial stages of habitation in this area.

3. Lower Paleolithic record of Armenia during the 21st century

Recent investigations having the aim to recover Lower Paleolithic stratified sites in Armenia were conducted in 2000 by the team of the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia led by B.G. Yeritsyan at Mushakan-1. The site is located in the northeastern foothills overlooking the Ararat Depression, where rich outcrops of flint exist. Surface collections from an area of about 1.5 ha yielded more than 5,500 implements including artifacts manufactured on jasper, chalcedony, limestone, sandstone, felsite and quartzite. Test trenches excavated in the various parts of the site yielded similar finds but without indications of a clear stratigraphy. The Mushakan-1 complex is dominated by choppers, bifaces, cleavers, and the “archaic” cores and flakes corresponding to them. Given the fact that local flint sources were used for a long time, even by knappers of the Bronze and Iron Ages, separating the Paleolithic artifacts from the entire assemblage is practically impossible, even if there are pebble tools, which typologically can be attributed to the Pre-Acheulian or Early Acheulian (Figure 1). As a whole Mushakan-1 can be interpreted as a repeatedly visited workshop located directly near the flint sources (Gasparian 2010; Yeritsyan and Tadevosyan 2005; Yeritsyan and Gasparyan 2010).

Since 2000 the Armenian-French team has conducted another survey in Aghvorik (once known as Yeni-Yol) looking for new evidence of Lower Paleolithic sites near the obsidian and dacite outcrops on the northern side of the Shirak Depression. A rich record of implements characteristic of Acheulo-Mousterian sites includes some artifacts which can even be attributed to the Early Acheulian with thick bifaces and trihedral pieces. However, these sites lack reliable contextual information (Fourloubey *et al*. 2003, p. 7; Gasparyan 2007a; 2007b; Gasparian 2010). New interesting finds of Acheulian handaxes were collected by the expedition of the Shirak Regional Museum during the excavations of Haykadzor Medieval cave complex in the Akhurian River canyon from 2001-2002. Those finds are presumed to be related with Middle Pleistocene lacustrine deposits underlying the tuff lavas in the proximity of the cave. Numerous finds of Pre-Acheulian and Acheulian implements were systematically collected directly near those deposits in the Shirak Depression which yielded rich collections of Quaternary fauna[3] (Yeganyan and Khachatryan 2002; Gasparyan 2007b; Gasparian 2010).

The potential presence of lake-margin and alluvial environments of Plio-Pleistocene age in Armenia and the region is especially significant given that Dmanisi itself is thought to have been in close proximity to a lake (Gabunia *et al*. 2000), and early hominid occupation of well-watered habitats such as riparian woodlands and lake-margins is well-documented in East Africa at both Olduvai Gorge and sites in the Turkana Basin. Records of Lower Paleolithic sites and single finds in the proximity of lacustrine deposits and potential embankments of paleolakes in the Ararat, Shirak, Lori and Aparan Depressions support the hypothesis that this was one of the main habitation models for the early hominids in the territory of Armenia (Egeland *et al*. 2010). While testing this hypothesis a site called Aghavnatun-1 on the southern foothills of Mt. Aragats, overlooking the Ararat valley at the point of its junction with the main valley was chosen for test

3. The southern Caucasus has experienced volcanic activity more-or-less continuously throughout the late Miocene and well into Holocene times. These processes, in addition to creating dramatic stratovolcanoes like Mt. Aragats (4,095 m) and Mt. Ararat (5,165 m), produced a series of basins (e.g. Aparan, Lori, Pampak, Vorotan) that were filled by lakes during the terminal Pliocene and into the early stages of the Middle Pleistocene. These lakes likely provided habitats conducive to human occupation, and the lacustrine deposits they left behind are generally well-suited to the preservation of macro- and microfossils. Further uplift and volcanic activity along with climatic changes caused the disappearance of most of these lakes after about 1.0 ma. The modern landscape was formed through subsequent river incision and glacial activity (Joannin *et al*. 2010; Ollivier *et al*. 2010, pp. 323-325).

excavations. The area of the site is formed by the Lower to Middle Pleistocene andesite-dacite and dacite lavas that are interspersed with the tuffs and tuff lavas of Mt.Aragats. The Late Pleistocene andesitic-basalt lavas bypassed the area of the site without covering it. The southernmost limits of the tuff cover, starting from the foothills of Aragats, gradually changes into the Ararat Depression. The beds of the tuff covers are cut through by shallow valleys and canyons where, on both sides of the dried-up river beds among sections of redeposited loose sediments, around 160 lithic implements made from low quality dacite were collected. Dacite raw material is present in the area in the form of massive pebbles, boulders, and rolled slabs. The majority of the artifacts collected from the surface are massive cores and flakes without any traces of secondary modification, and pebble tools – choppers, choppings, and picks. Bifacial tools are present as well, including thick and massive handaxes without traces of additional thinning of the working profiles (Figure 2). In general, the Aghavnatun-1 complex of stone implements is distinguished by its massive and archaic character. It is most likely that the site appears as a result of activity of a small group of an Early Acheulian population occupying the banks of a river draining into the Pleistocene lake of the Ararat Depression and settling down directly on the surface of the tuff plateau. The majority of the implements from Aghavnatun are well preserved and the presence of small flakes and irregular pieces and unfinished products opens the possibility of finding *in situ* cultural remains in an undisturbed context (Gasparian 2010). Starting from 2009 excavations of the site discovered *in situ* early Middle Paleolithic occupation in a palesol layer resting on the surface of volcanic ash and pyroclastic material. It is possible that future work will bring to light a stratified record of the Acheulian component of the site, which for now is known only from surface finds, suggesting a complex taphonomic history for the site.

As it was stressed before, the spectacular record from Dmanisi (Georgian Republic), dated to between 1.85 and 1.78 million years ago (Ferring *et al*. 2011), demonstrates that the southern Caucasus was home to Paleolithic peoples by at least the Early Pleistocene. However, additional evidence in the region for what is currently the oldest human presence outside of Africa remains elusive. Besides Dmanisi, in fact, it is not until the Middle Pleistocene with its Late Acheulean technologies that a reasonably secure case for human occupation of the southern Caucasus can be made. Given how rare well-preserved Lower Paleolithic sites are, and the fact that the initial discovery of the Early Pleistocene finds from Dmanisi was made more-or-less by accident during the excavation of the village's Medieval complex, GIS-assisted modeling was employed to help isolate areas for survey. The initial objective was to identify a dispersal corridor through which human groups leaving Africa via the Levant may have passed on their way into the Lesser

Caucasus. A simple least cost path analysis based on slope traced a corridor through the Lori Depression, and it was this result that initially led to consider northern Armenia, and the Debed River Valley in particular, as a general target region. Based on factors such as land cover, slope, and elevation, the next phase of the modeling classified locations along the Debed as being "unsuitable," "suitable," or "very suitable" to the preservation of Paleolithic occurrences (Egeland *et al*. 2010).

The modern Debed River passes through the northern ranges of the Lesser Caucasus and is contained within northeastern Armenia's Lori Depression. While archaeological research has been conducted intermittently along the Debed and its tributaries since the late 19th century (de Morgan 1889; 1909; Yeritsov 1882), it is only within the past decade or so that systematic work on the area's Paleolithic record has emerged. Based on this predictive modeling, a 2009 reconnaissance survey implemented by Lori Depression Paleoanthropological Project (LDPP) in the Debed Valley with particular attention on the Lower Paleolithic, recovered 437 artifacts from a total of 23 open-air scatters. All phases of the Paleolithic are represented among the finds, although nearly 70% of the diagnostic material is of Middle Paleolithic manufacture. Of particular interest for the Lower and Middle Paleolithic record are the Haghtanak sites, which are examined below. The four Haghtanak sites lie between 500 and 512 m asl and are situated to the north and east of the Debed. Like most of the Debed sites, a majority of the diagnostic material (70%) shows Middle Paleolithic affinities. With a total of 117 surface artifacts including diagnostic and undiagnostic pieces, Haghtanak-3, which overlooks the Debed from atop a basalt plateau, is the richest single site in the survey area. Most of the artifacts were probably unearthed by the commercial geological trenches that dot the surface. They furthermore reveal that several meters of artifact-bearing sediments cap some parts of the plateau. The LDPP's ongoing archaeological trenching, which has recovered additional artifacts including an attractive handaxe flaked from limestone, confirms this finding. Of particular note is the hint of a Pre-Acheulean component with the recovery of a handful of pieces reminiscent of Oldowan chopper forms (Figure 3). We stress, however, that this assertion is based on surface finds and we readily acknowledge the difficulty of assigning isolated pieces to this Paleolithic technocomplex. We hope further excavations will securely confirm or refute this hypothesis. No faunal material has yet been identified at Haghtanak-3 or any of the other sites in the Haghtanak group (Egeland *et al*. 2011; 2014).

The Armenian-Russian team, which since 2003 is working in the northern Armenian Tashir Plateau on the southern slopes of the Javakheti Range in the area adjacent to Dmanisi, also recorded a series of Acheulian open-air habitation sites near the lacustrine deposits of the Lori Depression (Dolukhanov *et al*. 2004; Aslanian *et al*. 2006; 2007, Lyubin 1989, pp. 136-168;

Lyubin and Beliaeva 2006; 2010). Recent claims have been made for Early Pleistocene lithic artifacts from the sites of Karakhach (1.94–1.75 Ma or older) and Kurtan (<1.43 Ma) (Presnyakov *et al*. 2012). However, questions exist concerning the authenticity of the published lithic artifacts from Karakhach and their stratigraphic relationship to the dated samples. Likewise, the lithic artifacts from Kurtan, some of which are unambiguously the result of human agency, are not stratigraphically associated with the dated ash that was sampled from the opposite wall of the quarry. Finally, based on Presnyakov *et al*. (2012) it would appear that neither site has undergone detailed geoarchaeolgocal analyses that would provide the critical data necessary to assess the stratigraphic context of the lithic artifacts or the taphonomic processes that affected their final distribution within the excavated sediments. Until these major issues are resolved it will remain impossible to interpret the meaning of these artifacts and their relevance to debates on the earliest occupation of the southern Caucasus.

Another open-air site, Dashtadem-3 in northern Armenia, was studied by the same team and represents the best excavated and documented site of its kind. The site is reported to contain bifaces and Levallois artifacts within a thin deposit (<1m thick) of homogeneous "humusized" brown loamy "soil" sitting on porphyritic andesite bedrock (Kolpakov *et al*. 2009). The excavators argue that these artifacts are *in situ* and contemporaneous, and based on techno-typological analyses they attribute them to the Late Acheulian (Kolpakov *et al*. 2009). However, in the absence of direct chronometric estimates and detailed geoarchaeological analyses it might alternatively be suggested that the artifact accumulation at Dashtadem-3 resulted from discrete hominin activities, separated perhaps by tens of thousands of years, that were repeatedly eroded, sometimes down to the underlying bedrock and later incorporated into a thin deposit of sediment. Subsequent pedogenic processes, perhaps dating to the Holocene produced the impression of a "stratified" site in which bifaces, Levallois technology, and pottery appear to be archaeologically contemporaneous when in fact it represents a geological palimpsest.

An interesting collection of Oldowan type tools (mainly choppers) manufactured from local pebbles washed by the Arpa River (limestone, sandstone, granite) was discovered while excavating the front slope of the Areni-1 cave (Figure 4). Stratigraphic observations showed that those implements did not appear to be *in situ* with a stratigraphic position between the slope colluvium and the Chalcolithic occupation horizons. Meanwhile their excellent state of preservation, the existence of small flakes and debris, and refitting have shown that the initial source of those implements is nearby and that they are washed from a very short distance. Such a potential location can be the platform-like area near the entrance of the cave, which, based on geomorphological observations around the cave might represent the Lower Pleistocene terrace of the Arpa River[4]. Future excavations are targeted to open the surface of the terrace with preserved sediments containing Lower Paleolithic occupations. If so, Areni-1 would be the first cave site with traces of the earliest human occupations in Armenia (Gasparian 2010).

During the last decade impressive progress was made in the direction of study of Acheulo-Mousterian sites located in close proximity or directly at the obsidian raw-material sources in the area of the Hrazdan-Kotayk Plateau and the Hrazdan River canyon. Especially new efforts in re-examining the Hatis group of Paleolithic open-air sites was undertaken by the American-Austrian team (Gasparian 2010). In addition, the Armenian-American joint expedition in the framework of the Hrazdan Gorge Paleolithic Project discovered new potential localities and sites for future investigation in the areas of Kaghsi, Fontan and Jraber on the Hrazdan-Kotayk Plateau. Another significant finding was the recently discovered (2008) site of Nor Geghi-1, located in the Hrazdan Gorge. Nor Geghi-1 is a stratified, open-air site along a former river channel which is tentatively ascribed to the late Middle Pleistocene. The low-energy alluvial deposits containing the archaeological material have undergone pedogenesis and are sandwiched between two basalts. The lithic artifacts come from a buried paleosol within the alluvial strata and document the variable technological behaviors of the site's late Middle Pleistocene occupants prior to and including OIS 9c. The assemblage contains an unexpected mix of techno-typological elements often associated with either the Late Acheulian (e.g. ovate and triangular bifaces; large, thick flakes, Mode 2) or the early Middle Paleolithic (e.g. truncated faceting, denticulates, Levallois blades, Mode 3). The sediments at Nor Geghi-1 were completely decalcified in antiquity, so that no faunal remains are preserved. As this is the first stratified late Middle Pleistocene site in Armenia, and in fact, the broader region as a whole, Nor Geghi-1 holds great potential for our understanding of the earliest phases of the Middle Paleolithic, specifically in terms of the new technological and perhaps cultural adaptations that accompanied the local transition from the Lower to the Middle Paleolithic (Adler *et al*. 2009; 2012; Gasparian 2010).

In addition, the record from Nor Geghi-1 is opening new possibilities for the cultural and chronological interpretation of many Acheulo-Mousterian open-air sites located in the vicinity. The first Soviet scholars, including Zamyatnin, Panichkina and Sardaryan, interpreted these sites by separating the collections into two different chronological-cultural groups or phases – Late Acheulian (handaxes) and Early Mousterian (small handaxes and Levallois products). The next generation of Soviet researchers including Lyubin, Yeritsyan and Ghazaryan preferred to use

4. S. Nahapetyan, personal communications.

the term Acheulo-Mousterian without providing such divisions of the surface materials, but also without considering them as transitional. Meanwhile the view from Nor Geghi-1 is telling us that this might be a single transitional industry. If so, the recently discovered and preliminarily studied open-air site of Jraber-17 may represent the same assemblage combination as in Nor Geghi-1 with a coexistence of Mode 2 (bifaces; large, thick flakes) and Mode 3 (tools manufactured on the bases of Levallois blades) (Figures 5 and 6).

4. Concluding remarks

Recent international collaborative projects for the search and excavation of stratified Lower Paleolithic archaeological sites in Armenia are very close to bearing fruit. Potential *in situ* Pre-Acheulian sites have been discovered in the Debed River valley, the Ararat Depression, the Arpa River Valley, and the Shirak Depression. New data on Acheulian occupations, especially those located in the vicinity of obsidian and dacite raw material sources, have emerged as well. The Aghavnatun group of sites in the Ararat Depression and the Hatis group in the Kotayk Plateau are particularly noteworthy. Perhaps the most significant findings have been made by studying the Paleolithic sites of the Hrazdan River Valley and the Hrazdan-Kotayk Plateau related with the discovery and study of the open-air site of Nor Geghi-1. This stratified and securely dated late Middle Pleistocene site (>300 ka) in the Hrazdan River canyon is elucidating our understanding of the transition from the Late Acheulian to the Middle Paleolithic, i.e. outlining the possible chronological boundary between the Lower and Middle Paleolithic in Armenia.

The current state of Paleolithic research in Armenia remains based almost entirely on surface or shallow sub-surface concentrations recovered from ancient river terraces or hillsides across the country. Presumably early but undated sites are dominated by choppers, bifaces, cleavers, and “archaic” cores and flakes made almost exclusively on dacite, basalt, and limestone, while assemblages attributed to the Late Acheulian are reported to contain evidence of Levallois technology alongside biface production and occasionally the routine exploitation of obsidian (Lyubin 1989; Lyubin and Belyaeva 2006; Doronichev 2008; Doronichev and Golovanova 2003; 2010; Kolpakov 2009; Gasparian 2010).

While bypassing the questions of discussion of the Armenian Lower Paleolithic from the regional perspective or their comparison with the other sites we can stress that the vast majority of known Lower Paleolithic sites in Armenia appear to have been affected to varying degrees by the dynamic interplay between a variety of accretional and erosional forces. As such they represent useful taphonomic case studies but are of limited value for the interpretation of past hominin behavior. Most archaeologists working in the region recognize these interpretive limitations and are aware that such sites contain mixed archaeological material traditionally associated with distinct "cultures" and time periods. Meanwhile the growing body of the newly conducted research inspires a hope for the discovery of more such promising sites as Nor-Geghi-1 with its exceptional stratigraphic and geoarchaeological context.

References

Adler, D.S., Pinhasi, R., Gasparian, B., Tushabramishvili, N. and Yeritsyan, B. (2009) Neanderthal life-ways in the Southern Caucasus. In: Catto, N. (ed.), *The Neanderthal Home: Spatial and Social Behaviors*. Abric Romani (1909-2009) International workshop, Tarragona-Capellades, (Spain), 6-9 October 2009, IPHES (Institut Catala de Paleoecologia Humana i Evolucio Social), pp. 125–126.

Adler, D.S., Yeritsyan, B., Wilkinson, K., Pinhasi, R., Bar-Oz, G., Nahapetyan, S., Mallol, C., Berna, F., Bailey, R., Schmidt, B.A., Glauberman, P., Wales, N. and Gasparyan, B. (2012) The Hrazdan Gorge Palaeolithic project, 2008-2009. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 21−37.

Areshian, G.E. (1991) Ushashelyan norahayt hnavayr Aparani shrjanum (Newly discovered Late Acheulian site in the Aparan district). In: Tiratsyan, G.A. (ed.), *Hayastani Hanrapetutyunum 1989-1990 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to Archaeological Fieldwork Results in the Republic of Armenia in 1989-1990). Yerevan: Armenian Academy of Sciences Press, pp. 4−5 (in Armenian).

Aslanyan, A.T. (1956) Ob otkritii nizhnego paleolita v Leninakanskoy kotlovine i ego geologicheskom znachenni (About discovery of Lower Paleolithic in Leninakan Depression and its geological meaning). In: Dolukhanova, N.I. and Yegoyan, V.L. (eds.), *Voprosi geologii i gidrogeologii Armyanskoy SSR* (Questions of geology and hydrogeology of the Armenian SSR). Yerevan: Armenian SSR Academy of Sciences Press, pp. 14−19 (in Russian).

Aslanian, S.A., Belyaeva, E.V., Kolpakov, E.M., Luybin, V.P and Suvorov, A.B. (2006) Stone Age in Northern Armenia. *Antiquity* 80: Project Gallery (http://www.antiquity.ac.uk/projgall/aslanian308/)

Aslanian, S.A., Belyaeva, E.V., Kolpakov, E.M., Lyubin, V.P., Sarkisyan, G.M. and Suvorov, A.B. (2007) Raboti Armyano-Rossiyskoy Arkheologicheskoy Ekspeditsii v 2003-2006 gg. (The Works of Armenian-Russian Expedition in 2003−2006). *Zapiski Instituta Istorii Material'noy Kul'turi RAN* (Notes of the Institute for the Material Culture History of RAS) 2, pp. 142−154 (in Russian).

Azizyan, H.A. (1979) Paleontologicheskie nakhodki iz peshcheri-obitalishcha v kan'one reki Razdan (Paleontological finds from a cave site in the Hrazdan River canyon). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (85), pp. 277–283 (in Russian).

Azizyan, H.A. (1982) Bratso mardy ev nra ekologyan Hrazdani kirchi karayr-katsarannerum (Early Man and its ecology in the caves of the Hrazdan canyon). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (97), pp. 162–172 (in Armenian).

Azizyan, H.A., Chagharyan, A.D., Simonyan, E.E. and Shaverdyan, S.V. (1975) Raskopki v okrestnostyakh Yerevana (Excavations in surroundings of Yerevan). In: Ribakov, B.A (ed.), *Arkheologicheskie Otkritiya 1974 goda* (Archaeological Discoveries for year 1974). Moscow: "Nauka"Publishing House, p. 477 (in Russian).

Azizyan, H.A and Lyubin, V.P. (1983) Obsidianoviy bifas iz Armenii (Obsidian biface from Armenia). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N173*, *Kamenniy vek* (Stone Age). Moscow: "Nauka" Publishing House, pp. 71–73 (in Russian).

Barseghyan, L. (1959) Paleolityan kayan Hayastani hyusisum (Paleolithic site in the north of Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2-3 (5-6), pp. 396–397 (in Armenian).

Bar-Yosef, O. (1994) The Contribution of Southwest Asia to the Study of Modern Human Origins. In: Nitecki, M.H. and Nitecki, D.V. (eds.), *Origins of Anatomically Modern Humans*. New York: Plenum Press, pp. 23–66.

Bayburtyan, Ye.A. (1938) Ashkhatanki gortsiknery Hin Hayastanum (Yst Haykakan KSH Petakan Patmakan Tangarani nyuteri) (Tools in Ancient Armenia [Based on the materials of Armenian SSR State Historical Museum]). *HKSH Patmutyan ev Grakanutyn Iinstituti Teghekagir, Girk I* (Bulletin of the Institute of History and Literature of the Armenian SSR, Book I), pp. 193–231 (in Armenian).

Chagharyan, A.D., Yeritsyan, B.G. and Karapetyan, K.I. (1972) Ob issledovanii peshcheri Zovuni (About investigation of Zovuni cave). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1971 goda* (Archaeological Discoveries for year 1971). Moscow: "Nauka" Publishing House, p. 492 (in Russian).

Dalén, L., Orlando, L., Shapiro, B., Brandström-Durling, M., Quam, R.,Thomas, M., Gilbert, P., Carlos Díez Fernández-Lomana, J., Willerslev, E., Luis Arsuga, J. and Götherström, A. (2012) Partial Genetic Turnover in Neandertals: Continuity in the East and Population Replacement in the West. *Molecular Biology and Evolution*, April (http://mbe.oxfordjournals.org, doi:10.1093/molbev/mss074).

de Lumley, H.D., Lordkipanidze, D, Féraud, G., Garcia, T., Perrenoud, C., Falguères, C., Gagnepain, J., Saos, T., Vinochet, P. (2002) 40Ar/39Ar dating of the Dmanisi (Georgia) hominid-bearing volcanic ash level (Layer VI): 1.81 Ma. *Comptes Rendus Palevol* 1, pp. 181–189.

de Morgan, J. (1889) *Mission scientifique au Caucase: Études archéologiques & historiques*. Tome I. Paris: Ernest Leroux.

de Morgan, J. (1909) Les stations préhitoriques de l'Alagheuz (Arménie Russe). *Revue de l'école d'anthropologie de Paris*, pp. 189–204.

Demyokhin, A.P. (1956) O nakhodke obsidianovikh orudiy paleoliticheskogo tipa v Armenii (About finding of Paleolithic type obsidian tools in Armenia). In: Dolukhanova, N.I. and Yegoyan, V.L. (eds.), *Voprosi geologii* *i gidrogeologii Armyanskoy SSR* (Questions of geology and hydrogeology of the Armenian SSR). Yerevan: Armenian SSR Academy of Sciences Press, pp. 11−13 (in Russian).

Dennell, R.W. and Roebroeks, W. (2005) An Asian Perspective on Early Human Dispersal from Africa. *Nature* 438, pp. 1099−1104.

Dolukhanov, P.M., Aslanian, S.A., Kolpakov, E.M. and Belyaeva, E.V. (2004) Prehistoric Sites in Northern Armenia. *Antiquity* 78: Project Gallery (http://antiquity.ac.uk/projgall/dolukhanov301/).

Doronichev, V.B. (2008) The Lower Paleolithic in Eastern Europe and the Caucasus: A Reappraisal of the Data and New Approaches. *PaleoAnthropology* 2008, pp. 107−157.

Doronichev, V. and Golovanova, L. (2003) Bifacial tools in the Lower and Middle Paleolithic of the Caucasus and their contexts. In: Soressi, M. and Dibble, H.L. (eds.), *Multiple Approaches to the Study of Bifacial Technologies*. Phildelphia: University of Pennsylvania Museum of Archaeology and Anthropology Press, pp. 77−107.

Doronichev, V. and Golovanova, L. (2010) Beyond the Acheulean: A view on the Lower Paleolithic occupation of Western Eurasia. *Quaternary International* 223–224, pp. 327−344.

Egeland, C.P., Gasparian, B., Arakelyan, D., Byerly, R.M., Nicholson, C.M. and Zardaryan, D. (2011) Multiperiod archaeological reconnaissance in the Debed River valley, north-eastern Armenia. *Antiquity* Volume 085, Issue 329, September (http://antiquity.ac.uk/projgall/egeland329/).

Egeland, C.P., Gasparian, B., Arakelyan, D., Nicholson, C.M., Petrosyan, A., Ghukasyan, R., Byerly, R.M. (2014) Reconnaissance survey for Palaeolithic sites in the Debed River Valley, northern Armenia. *Journal of Field Archaeology* 39/4, pp. 370−386.

Egeland, C.P., Nicholson, C.M. and Gasparian, B. (2010) Using GIS and ecological variables to identify high potential areas for paleanthropological survey: an example from Northern Armenia. *Journal of Ecological Anthropology* 14(1), pp. 89−98.

Ferring, R., Oms, O., Agustí, J., Berna, F., Nioradze, M., Shelia, T., Tappen, M., Vekua, A., Zhvania, D. and Lordkipanidze, D. (2011) Earliest Human Occupations at Dmanisi (Georgian Caucasus) Dated to 1.85–1.78 Ma. *Proceedings of the National Academy of Sciences* 108, pp. 10432–10436.

Finlayson, J.C. (2004) *Neanderthals and Modern Humans: An Ecological and Evolutionary Perspective*. Cambridge: Cambridge University Press.

Fourloubey, C., Beauval, C., Colonge, D., Liagre, J., Ollivier, V. and Chataigner, C. (2003) Le Paléolithique en Arménie: Etat de connaissances aquises et données récentes. *Paléorient* 29/1, pp. 5−18.

Gabunia, L., Vekua, A. and Lordkipanidze, D. (2000) The environmental contexts of early human occupation of Georgia (Transcaucasia). *Journal of Human Evolution* 40, pp. 785–802.

Gasparian, B. (2010) Landscape organization and resource management in the Lower Paleolithic of Armenia. *TÜBA-AR* 13, pp.159−183.

Gasparyan, B. (2007a) In: de Clairfontaine, F.F. (ed.), *Dans les montagnes d' Arménie, 500 000 ans d'histoire avant notre ére*. Rouen, Saint Raphaël, pp. 47–51, 130–133.

Gasparyan, B. (2007b) Le peuplement de L'Armenie au Paleolithique. *Les dossiers d'archéologie* 321, pp. 24–29.

Gasparyan, B., Nahapetyan, S., Arakelyan, D., Colonge, D. and Chataigner, C. (2004) Mestonakhozhdeniya kamennogo veka Aparanskoy kotlovini (Respublika Armeniya) (Stone Age sites of the Aparan Depression [Republic of Armenia]). In: Gambashidze, G. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). International Scientific Conference dedicated to 90th anniversary of the academician A.M. Apakidze. Collection of abstracts of the reports. Tbilisi: "Nekeri" Publishing House, pp. 49–50 (in Russian).

Gasparyan, B. Nahapetyan, S., Jaubert, J., Chataigner, C. and Ollivier, V. (2003) Novoe Paleoliticheskoe mestonakhozhdenie Mulki-4 (Newly discovered Paleolithic open-air site of Mulki-4). In: Kalantaryan, A. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). Materials of International Conference, Yerevan, 17-18 November, 2003. Mother See of Holy Echmiadzin Press, pp. 30–37 (in Russian).

Gasparyan, B., Nahapetyan, S., Sargsyan, G. and Gabrielyan, I. (2005) Kamenniy vek Tashirskogo plato (Stone Age of the Tashir Plateau). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: "Mughni" Publishing House, pp. 17–27 (in Russian).

Gasparyan, B. and Sargsyan, G. (2003) Kasakhi kirchi hnagitakan hushardzanneri usumnasirutyan nakhnakan ardyunknery (Preliminary results of investigation of the archaeological monuments in the Kasakh River Canyon). In: *The Jubilee Conference "Aragatsotn. Spiritual and Cultural Heritage", dedicated to the 1700th anniversary of the unction of the Mother Temple of Holy Ejmiatsin*. Theses of the Conference. Oshakan, pp. 58–59 (in Armenian).

Ghazaryan, H.P. (1985) Khatarvats mshakutayin shertov ashelyan hushardzanneri sotsial-tntesakan erevuytneri verakangnman pordz (Attempt of reconstruction of social-economic processes for the Acheulian sites with disturbed cultural layers). In: Arakelyan, B.N. (ed.), *Haykakan SSH-um 1983-1984 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, april 1985 t., Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to the Archaeological Fieldwork Results in 1983-1984 in the Armenian SSR, April 1985). Yerevan: Armenian SSR Academy of Sciences Press, pp. 3–5 (in Armenian).

Ghazaryan, H.P. (1986) Verkhneashel'skoe mestonakhozhdenie Atis I (Upper Acheulian open-air site Hatis I). In: Shilov, V.P. (ed.), *Arkheologicheskiye otkritiya 1984 goda* (Archaeological Discoveries of the year 1984). Moscow: "Nauka" Publishing House, pp. 433–434 (in Russian).

Joannin, S., Cornee, J-J., Munch, P., Fornari, M., Vasiliev, I., Krijgsman, W., Nahapetyan, S., Gabrielyan, I., Ollivier, V., Roiron, P. and Chataigner, C. (2010) Early Pleistocene climatic cycles in continental deposits of the Lesser Caucasus of Armenia inferred from palynology, magnetostratigraphy, and 40Ar/39Ar dating. *Earth and Planetary Science Letters* 291, pp. 149–158.

Karapetyan, K.I. (1983a) O zarozhdenii znaniy geologicheskogo kharaktera (na primere kamennogo veka territorii Armyanskoy SSR) (On the origins of geological knowledge [on the example of the Stone Age of the territory of the Armenian SSR]). In: Aslanyan, A.T. and Sayadyan, YU.V. (eds.), *Voprosi geologii chetvertichnogo perioda Armenii, K XI kongressu INQUA, Moskva 1982* (Questions of Geology of the Quaternary Period of Armenia, for XI Congress of INQUA, Moscow 1982). Yerevan: Armenian SSR Academy of Sciences Press, pp. 75−84 (in Russian).

Karapetyan, K.I. (1983b) Ob ispol'zovanii dannikh arkheologii pri stratigraficheskom raschlenenii chetvertichnikh vulkanitov Armyanskoy SSR (About using of the archaeological data during stratigraphic division of the Quaternary vulcanite of the Armenian SSR). In: Aslanyan, A.T. and Sayadyan, YU.V. (eds.), *Voprosi geologii chetvertichnogo perioda Armenii, K XI kongressu INQUA, Moskva 1982* (Questions of Geology of the Quaternary Period of Armenia, for XI Congress of INQUA, Moscow 1982). Yerevan: Armenian SSR Academy of Sciences Press, pp. 85−94 (in Russian).

Karapetyan, K.I. and Yeritsyan, B.G. (1969) Novoe Yerablurskoe must'erskoe mestonakhozhdenie v Armenii (New Mousterian open-air site of Yerablur in Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (45), pp. 171−176 (in Russian).

Klein, R.G. (1966) Chellean and Acheulean on the territory of the Soviet Union: A Critical review of the evidence as present in the literature. *American Anthropologist* 68 (2), pp. 1−45.

Kolpakov, E. (2009) The Late Acheulian Site of Dashtadem-3 in Armenia. *PaleoAnthropology* 2009, pp. 3–31.

Kulakov, S.N. (1991) *Nizhnepaleoliticheskie masterskie Kavkaza (tekhniko-morfologicheskiy analiz)* (Lower Paleolithic workshops of the Caucasus). Avtoreferat dissertatsii na soiskanie uchenoy stepeni kandidata istoricheskix nauk (Synopsis of Candidate Dissertation). Leningrad (in Russian).

Lordkipanidze, D. (1998) The Pleistocene Settlement of the Transcaucasus by Hominids. In: Otte M. (ed.), *Préhistoire d'Anatolie: genèse des deux mondes*. Etudes et Recherches Archéologiques de l'Université de Liège 85. Liège: Université de Liège, Service de Préhistoire, pp. 15−28.

Lordkipanidze, D., Jashashvili, T., Vekua, A., Ponce de León, M.S., Zollikofer, C.P.E., Rightmire, G.P., Pontzer, H., Ferring, R., Oms, O., Tappen, M., Bukhsianidze, M., Agusti, J., Kahlke, R., Kiladze, G., Martinez-Navarro, B., Mouskhelishvili, A., Nioradze, M. and Rook, L. (2007) Postcranial Evidence from Early *Homo* from Dmanisi, Georgia. *Nature* 449, pp. 305−310.

Lyubin, V.P. (1961) Verkhneashel'skaya masterskaya Jraber (The Upper Acheulian workshop of Jraber). In: Passek, T.S. (ed.), *Kratkiye soobshcheniya o dokladakh i polevikh issledovaniyakh Instituta Arkheologii* (Abstracts of Reports and Field Investigations of the Institute of Archaeology), *N82. K VI Kongressu INQUA v Varshave 1961* (For the VI Congress of INQUA in Warsaw 1961). Moscow: USSR Academy of Sciences Press, pp. 59−67 (in Russian).

Lyubin, V.P. (1965) K voprosu o metodike izucheniya nizhnepaleoliticheskikh kamennikh orudiy (To the question of the methodology of study of the Lower Paleolithic stone tools). In: Boriskovskiy, P.I. (ed.), *Materiali i Issledovaniya po Arkheologii SSSR, N131, Paleolit i Neolit SSSR, tom 5* (Materials and Investigation of the

Archaeology of the USSR, N131, Paleolithic and Neolithic, vol. 5). Moscow: "Nauka" Publishing House, pp. 7–75 (in Russian).

Lyubin, V.P. (1970) Nizhniy Paleolit (Lower Paleolithic). In: Formozov, A.A. (ed.), K*amenniy vek na territorii SSSR* (Stone Age at the territory of the USSR). Moscow: "Nauka" Publishing House, pp. 19–42 (in Russian).

Lyubin, V.P. (1972) O proyavleniyakh lokal'nikh razlichiy v nizhnem paleolite (po materialam Kavkaza) (On existence of local differences in the Lower Paleolithic [based on the materials from the Caucasus]). In: Masson, V.M. (ed.), *Uspekhi Sredneaziatskoy Arkheologii, Vipusk 2* (Achievements of Middle Asian Archaeology, Issue 2). Leningrad: "Nauka" Publishing House, Leningrad branch, pp. 19–29 (in Russian).

Lyubin, V.P. (1978) K metodike izucheniya fragmentirovannikh skolov i orudiy v paleolite (To the methodology of study of the fragmented flakes and tools in Paleolithic). In: Kropotkin, V.V., Matyushin, G.N. and Peters, B.G. (eds.), *Problemi Sovetskoy Arkheologii* (The problems of Soviet Archaeology). Moscow: "Nauka" Publishing House, pp. 23–32 (in Russian).

Lyubin, V.P. (1981) Nizhniy Paleolit Kavkaza (Istoriya issledovaniya, opornie pamyatniki, mestniye osobennosti) (The Lower Paleolithic of the Caucasus [The history of investigations, basic sites, local features]). In: D'yakonov, I.M. (ed.), *Drevniy Vostok i Mirovaya Kul'tura* (Ancient East and World Culture). Moscow: "Nauka" Publishing House, pp. 12–16 (in Russian).

Lyubin, V.P. (1984) Ranniy Paleolit Kavkaza (Early Paleolithic of the Caucasus). In: Boriskovskiy, P.I. (ed.), *Paleolit SSSR* (Paleolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 45–93 (in Russian).

Lyubin, V.P. (1989) Paleolit Kavkaza (Paleolithic of Caucasus). In: Boriskovskiy, P.I. (ed.), *"Paleolit Kavkaza i Severnoy Azii"*, iz serii "Paleolit Mira, Issledovaniya po Arkheologii Drevnego Kamennogo Veka" ("The Paleolithic of Caucasus and Northern Asia", from Series of "The Old Stone Age of the World, Studies in the Paleolithic Cultures"). Leningrad: "Nauka" Publishing House, Leningrad Branch, pp. 7–142 (in Russian).

Lyubin, V.P. (1998) *Ashel'skaya epokha na Kavkaze* (The Acheulian Epoch in the Caucasus). Rossiyska Akademia Nauk, Institut Istorii Material'noy Kul'turi, Arkheologicheskie iziskaniya, 47, Paleolit Kavkaza, kn. 1 (Russian Academy of Sciences, Institute for the Material Culture History, Archaeological Studies, 47, Paleolithic of Caucasus, book1). St. Petersburg: "Peterburgskoe Vostokovedenie" Publishing House (in Russian).

Lyubin, V.P. and Balyan, S.P. (1961) Noviye nakhodki kul'turi paleolita na vulkanicheskom nagorii Armyanskoy SSR (New findings of Paleolithic culture on the volcanic highlands of the Armenian SSR). *Dokladi Akademii Nauk Armyanskoy SSR* (Report of the Armenian SSR Academy of Sciences) volume XXXIII, N2, pp. 67–72 (in Russian).

Lyubin, V.P. and Belyaeva, E.V. (2006) Cleavers and handaxes with transverse cutting edge in the Caucasus Acheulian. In: Goren-Inbar, N. and Sharon, G. (eds.), *Axe Age: Acheulian Tool-making from Quarry to Discard*. London: Equinox Publishing, pp. 347–364.

Lyubin, V.P. and Belyaeva, E.V. (2010) Noviye dannie o rannem paleolite Armenii (New data on Early Paleolithic of Armenia). In: Vasil'yev, S.A. and Shchelinskiy, V.E. (eds.), *Drevneyshiye obitateli Kavkaza i rasselenie* *predkov cheloveka v Evrazii* (The earliest inhabitants of the Caucasus and dispersal of human ancestors in Eurasia). Trudi Instituta Istorii Material'noy Kul'turi Rossiyskoy Akademii Nauk, t. XXXV (Works of the Institute for the Material Culture History of the Russian Academy of Sciences, v. XXXV). St. Petersburg, pp. 107–126 (in Russian).

Martirosyan, H.A. (1968) Arkheologicheskie otkritiya v Armenii (Archaeological discoveries in Armenia). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1967 goda* (Archaeological Discoveries for year 1967). Moscow: "Nauka" Publishing House, pp. 308–313 (in Russian).

Martirosyan, H.A. (1969) Hayastani nakhnadaryan mshakuyti nor hushardzanner (New sites of the Prehistoric Culture of Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 3 (46), pp. 191–208 (in Armenian).

Martirosyan, H.A. (1970) Issledovanie peshcher v kan'one reki Razdan i naskal'nikh izobrazheniy v Gegamskikh gorakh i Shamirame (Investigations of caves in the Hradan River canyon and petroglyphs in Gagham range and Shamiram). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1969 goda* (Archaeological Discoveries for year 1969). Moscow: "Nauka" Publishing House, p. 384 (in Russian).

Martirosyan, H.A. (1974) Hayastani hnaguyn mshakuyti usumnasirutyuny ev nra zargatsman herankarnery (Investigations of the ancient culture of Armenia and the perspectives of its development). *Lraber Hasarakakan gitutyunneri* (Herald of Social Sciences) 7 (379), pp. 25–39 (in Armenian).

Matyukhin, A.E. (1981) Tekhnologiya izgotovleniya i tipologiya bifasov Satani-Dara (The technology of production and typology of the bifaces of Satani-Dar). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N165, Kamenniy vek* (Stone Age). Moscow: "Nauka" Publishing House, pp. 12–17 (in Russian).

Matyukhin, A.E. (2001) Tekhnologicheskaya kharakteristika makroorudiy iz paleoliticheskoy stoyanki Satani-Dar v Armenii (povtorniy analiz) (Technological characteristics of macrotools from the Paleolithic site of Satani-Dar [repeated analyses]). *Arkheologicheskiy Sbornik* (Archaeological Collection) 35, pp. 15–31 (in Russian).

Okladnikov, A.P. (1956) Vozniknovenie chelovecheskogo obshchestva. Ranniy drevnekamenniy vek (Nizhniy Paleolit) (The origins of human society. Early Ancient Stone Age [Lower Paleolithic]). In: Frantsev, Yu.P. (ed.), *Vsemirnaya Istoriya v desyati tomakh* (World History in ten volumes). Volume I. Moscow: Academy of Sciences of the USSR, State Publishing House of the Political Literature, pp. 17–49 (in Russian).

Ollivier, V., Nahapetyan, S., Roiron, P., Gabrielyan, I., Gasparyan, B., Chataigner, C., Joannin, S., Cornee, J-J., Guillou, H., Scaillet, S., Munch, P. and Krijgsman, W. (2010) Quaternary volcano-lacustrine patterns and paleobotanical data in South Armenia. *Quaternary International* 223-224, pp. 312–326.

Panichkina, M.Z. (1950a) Drevnepaleoliticheskaya stoyanka Satani-Dar v Armenii (Lower Paleolithic camp of Satani-Dar in Armenia). In: Udal'tsov, A.D. (ed.), *Kratkiye soobshcheniya o dokladakh i polevikh issledovaniyakh Instituta Istorii Material'noy Kul'turi* (Abstracts of Reports and Field Investigations of the Institute of History of Material Culture) XXXV, pp. 66–73 (in Russian).

Panichkina, M.Z. (1950b) *Paleolit Armenii* (Paleolithic of Armenia). Leningrad: State Hermitage Press (in Russian).

Panichkina, M.Z. (1952) K voprosu o nazhnachenii Shell'skikh orudiy (po materialam Satani-dara) (To the definition of the function of the Chellean tools [based on the materials of Satani-dar]). In: Udal'tsov, A.D. (ed.), *Kratkiye soobshcheniya o dokladakh i polevikh issledovaniyakh Instituta Istorii Material'noy Kul'turi* (Abstracts of Reports and Field Investigations of the Institute of History of Material Culture), XLVI. Moscow: USSR Academy of Sciences Press, pp. 19–30 (in Russian).

Panichkina, M.Z. (1953) Shell'skiy kompleks drevnepaleoliticheskogo mestonakhozhdeniya Satani-dar (Chellean complex of Lower Paleolithic open-air site of Satani-dar). In: Okladnikov, A.P. (ed.), *Materiali i Issledovaniya po Arkheologii SSSR, N39, Paleolit i Neolit SSSR* (Materials and Investigation of the Archaeology of the USSR, N39, Paleolithic and Neolithic). Leningrad: USSR Academy of Sciences Press, pp. 9–38 (in Russian).

Pershits, A.I., Mongayt, A.L. and Alekseev, V.P. (1982) *Istoriya pervobitnogo obshchestva* (History of the Primitive Society). Moscow: "Visshaya Shkola" Publishing House (in Russian).

Petrosyants, V.M. (1988) *Nig-Aparani patma-chartarpetakan hushardzannery* (Historical-cultural monuments of Nig-Aparan). Yerevan: "Hayastan" Publishing House (in Armenian).

Praslov, N.D. (1984) Vremya i puti drevneyshego zaseleniya territorii SSSR chelovekom (Timing and routes of human habitation of the USSR). In: Boriskovskiy, P.I. (ed.), *Paleolit SSSR* (Paleolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 42–44 (in Russian).

Presnyakov, S.L., Belyaeva, E.V., Lyubin, V.P., Radionov, N.V., Antonov, A.V., Saltykova, A.K., Berezhnaya, N.G. and Sergeev, S.A. (2012) Age of the earliest Paleolithic sites in the northern part of the Armenian Highland by SHRIMP-II U-Pb geochronology of zircons from volcanic ashes. *Gondwana Research* 21, pp. 928–938.

Sardaryan, S.H. (1954) *Paleolit v Armenii* (Paleolithic in Armenia). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Sardaryan, S.H. (1967) *Nakhnadaryan hasarakutyuny Hayastanum* (Primitive Society in Armenia). Yerevan: "Mitk" Publishing House, (in Armenian, with Russian and English Resume).

Tappen, M., Lordkipanidze, D., Bukshianidze, M., Ferring, R. and Vekua, A. (2007) Are You in or out (of Africa)? Site Formation at Dmanisi and Actualistic Studies in Africa. In: Pickering, T.R., Schick, K.D. and Toth, N. (eds.), *Breathing Life into Fossils: Taphonomic Studies in Honor of C.K. "Bob" Brain*. Bloomington: Stone Age Institute Press, pp. 119–135.

Yefimenko, P.P. and Bibikov, S.N. (1956) Drevniy kamenniy vek (Paleolit) (Old Stone Age [Paleolithic]). In: Tret'yakov, P.N. and Mongayt, A.L. (eds.), *Ocherki Istorii SSSR* (Essay of History of the USSR). *Pevobitno-obshchinniy story i drevneyshiye gosudarstva na territorii SSSR* (Primitive society and earliest states on the territory of the USSR). Moscow: USSR Academy of Sciences Press, pp. 15–53 (in Russian).

Yeganyan, L. and Khachatryan, H. (2002) Norahayt hushardzanakhumb Haykadzorum (Newly discovered archaeological complex in Haykadzor). In: Kalantaryan, A.A. and Harutyunyan, S.B. (eds.), *Hin Hayastani Mshakuyty XII* (Culture of Ancient Armenia XII). Republican conference dedicated to the 90th anniversary of the academician Babken Arakelyan. Abstracts of Reports. Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 119−122 (in Armenian).

Yeritsov, A.D. (1882) St’atya A.D. Yeritsova (The article of A.D. Yeritsov). In: Mansvetov, I.D. (ed.), *Prilozheniye B, Pyatiy Arxeologicheskiy S’ezd v Tiflise I, Trudi Predvaritel’nix Komitetov, Pod Redaktsiyey Sekretar’ya Moskovskogo Predvaritel’novo Komiteta* (Fifth Archaeological Meeting in Tbilisi I, Proceedings of Initial Committee, under editing of the Secretary of Moscow Initial Cometee). Moscow: Sinodal’noy Tipografii, pp. 84−93.

Yeritsyan, B.G. (1991) Jraberi kare-dari kayanneri usumnasirutyan ardyunknery (Results of the investigations of the Jraber Stone Age open-air sites). In: Tiratsyan, G.A. (ed.), *Hayastani Hanrapetutyunum 1989-1990 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to Archaeological Fieldwork Results in the Republic of Armenia in 1989-1990). Yerevan: Armenian Academy of Sciences Press, pp. 5−7 (in Armenian).

Yeritsyan, B.G. (2010) Hyusisayin Hayastani karedaryan mshakuyti usumnasirutyan ardi vichaky (Modern state of investigation of the Stone Age of Northern Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 3 (185), pp. 242−250 (in Armenian).

Yeritsyan, B.G. and Ghazaryan, H.P. (1977) Raboti Lusakertskoy ekspeditsii (The works of Lusakert expedition). In: Ribakov, B.A. (ed.), *Arkheologicheskiye otkritiya 1976 goda* (Archaeological Discoveries of the year 1976). Moscow: “Nauka” Publishing House, pp. 498−499 (in Russian).

Yeritsyan, B.G. and Korobkov, I.I. (1979) Issledovanie paleoliticheskikh pamyatnikov v srednem techenii reki Razdan (Study of Paleolithic sites in the middle stream of the Hrazdan River). In: Ribakov, B.A. (ed.), *Arkheologicheskiye otkritiya 1978 goda* (Archaeological Discoveries of the year 1978). Moscow: “Nauka” Publishing House, pp. 519−520 (in Russian).

Yeritsyan, B.G. and Gasparyan, B.Z. (2010) Kompleks galechnikh orudiy mestonakhozhdeniya kamennogo veka Mushakan-1 (Armenia) (Complex of pebble tools from the Stone Age open-air site Mushakan-1 [Armenia]). In: Gambashidze, G. (ed.), *Mezhdunarodnyaya konferentsiya “Arkheologiya, Etnologiya i Fol’kloristika Kavkaza”* (International Conference “Archaeology, Ethnology and Folkloristics of the Caucasus”). Sbornik kratkikh soderzhaniy dokladov (Proceedings of the abstracts of the reports). Tbilisi: “Meridiani” Publishing House, pp. 151−153 (in Russian).

Yeritsyan, B.G. and Tadevosyan, S.V. (2005) Mushavan-1 kayany ev nra olduvayan mshakuyty (Mushavan-1 open-air site and its Oldowan culture). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: “Mughni” Publishing House, pp. 12−16 (in Armenian).

Yeritsyan, B.G., Tadevosyan, S.V. and Gasparyan, B.Z. (1996) Kul’turnie osobenoosti materialov mestonakhozhdeniya kamennogo veka Jraber (Cultural features of the materials from the Stone Age open-air site of Jraber). *Bnaber Yerevani Hamalsarani, Hasarakakan gitutyunner* (Bulletin of Yerevan University, Social Sciences) 3 (90), pp. 125−131 (in Russian).

Yeritsyan, B.G., Tadevosyan, S.V. and Gasparyan, B.Z. (1998) Resul'tati issledovaniya mestonakhozhdeniya kamennogo veka Nurnus (Results of investigation of the Stone Age open-air site of Nurnus). *Lraber Hasarakakan gitutyunneri* (Herald of Social Sciences) 1 (597), pp. 164–169 (in Russian).

Zamyatnin, S.N. (1947) Nakhodki nizhnego paleolita v Armenii (Lower Paleolithic finds in Armenia). *Teghekagir Haykakan SSH Gitutyunneri Akademiayi, Hasarakakan gitutyunner* (Bulletin of the Academy of Sciences of the Armenian SSR, Social Sciences) 1, pp. 15–25 (in Russian).

Zamyatnin, S.N. (1950) Izucheniye paleoliticheskogo perioda na Kavkaze za 1936-1948 gg. (Study of the Paleolithic period in the Caucasus for the years 1936-1948). *Materiali po izucheniyu Chetvertichnogo perioda* (Materials for Study of the Quaternary Period) 2, pp. 127–139 (in Russian).

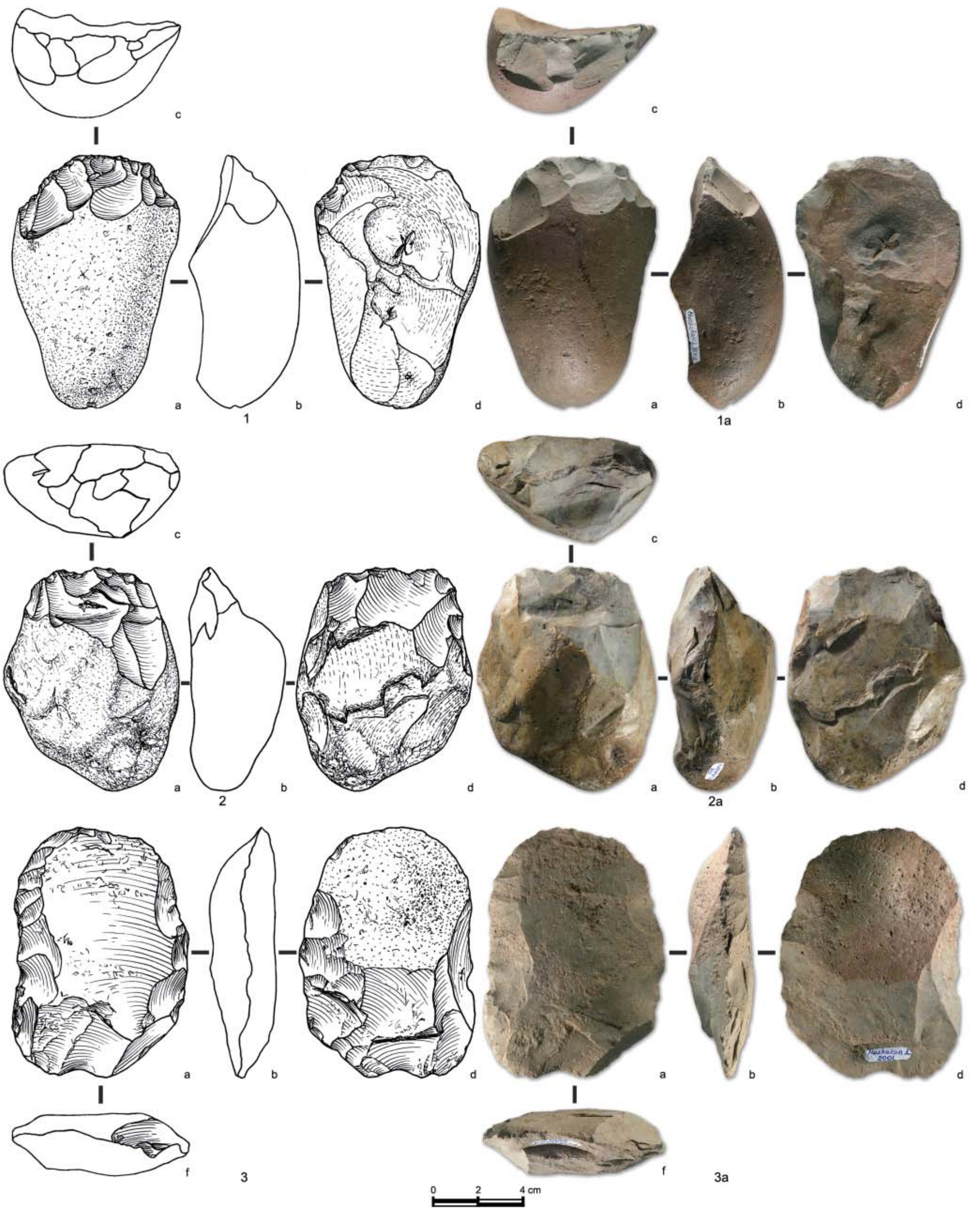

Figure 1
Mushakan-1 open-air site. 1-1a, 2-2a. Choppers (flint); 3-3a. Biface on cortical flake (flint).

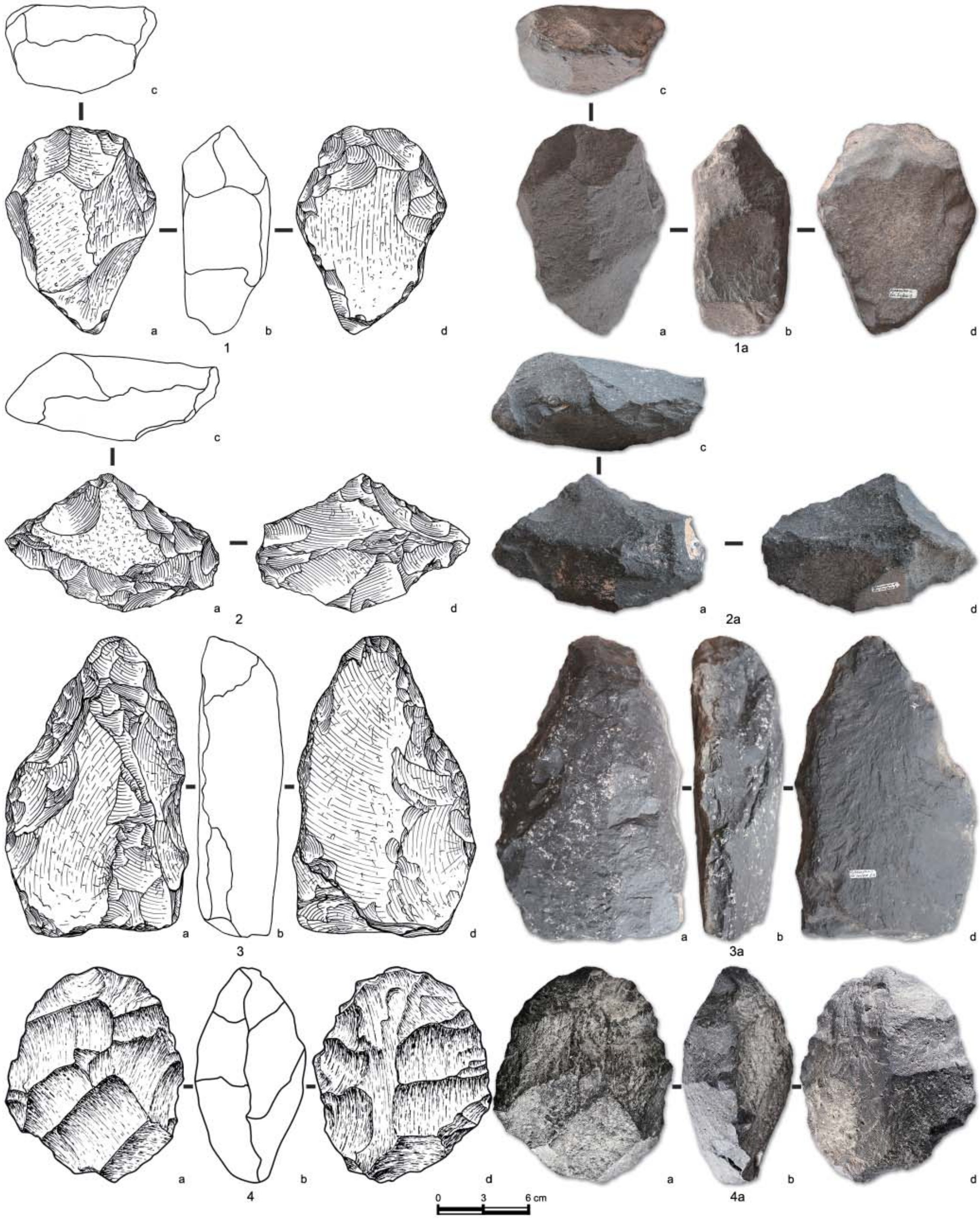

Figure 2

Aghavnatun-1 open-air site. 1-1a. Chopper (basalt); 2-2a. Pick (basalt); 3-3a. Partial biface on a huge flake (dacite); 4-4a. Biface (dacite).

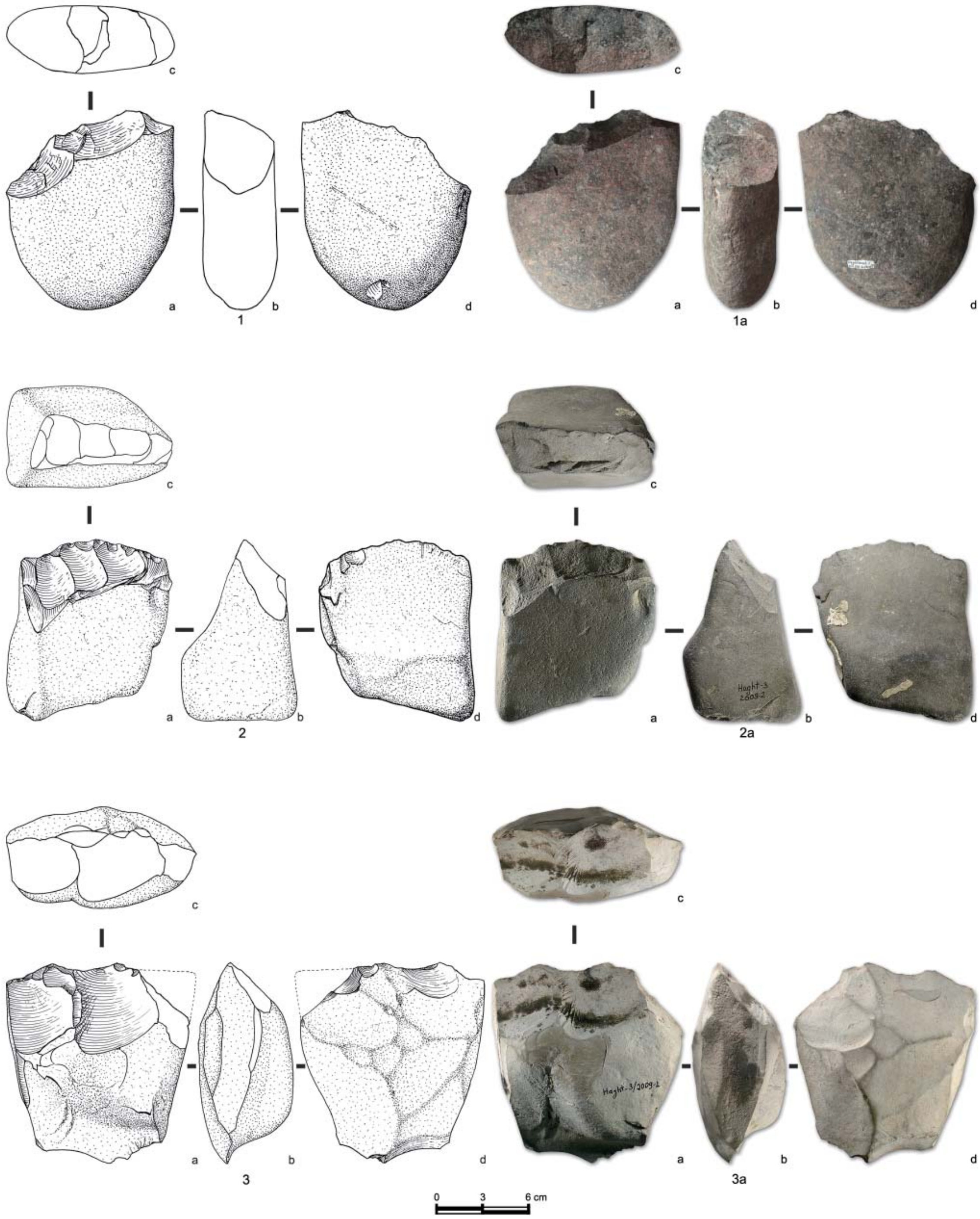

Figure 3
Haghtanak-3 open-air site. 1-1a – 3-3a. Choppers (1-1a, 2-2a: basalt; 3-3a: limestone).

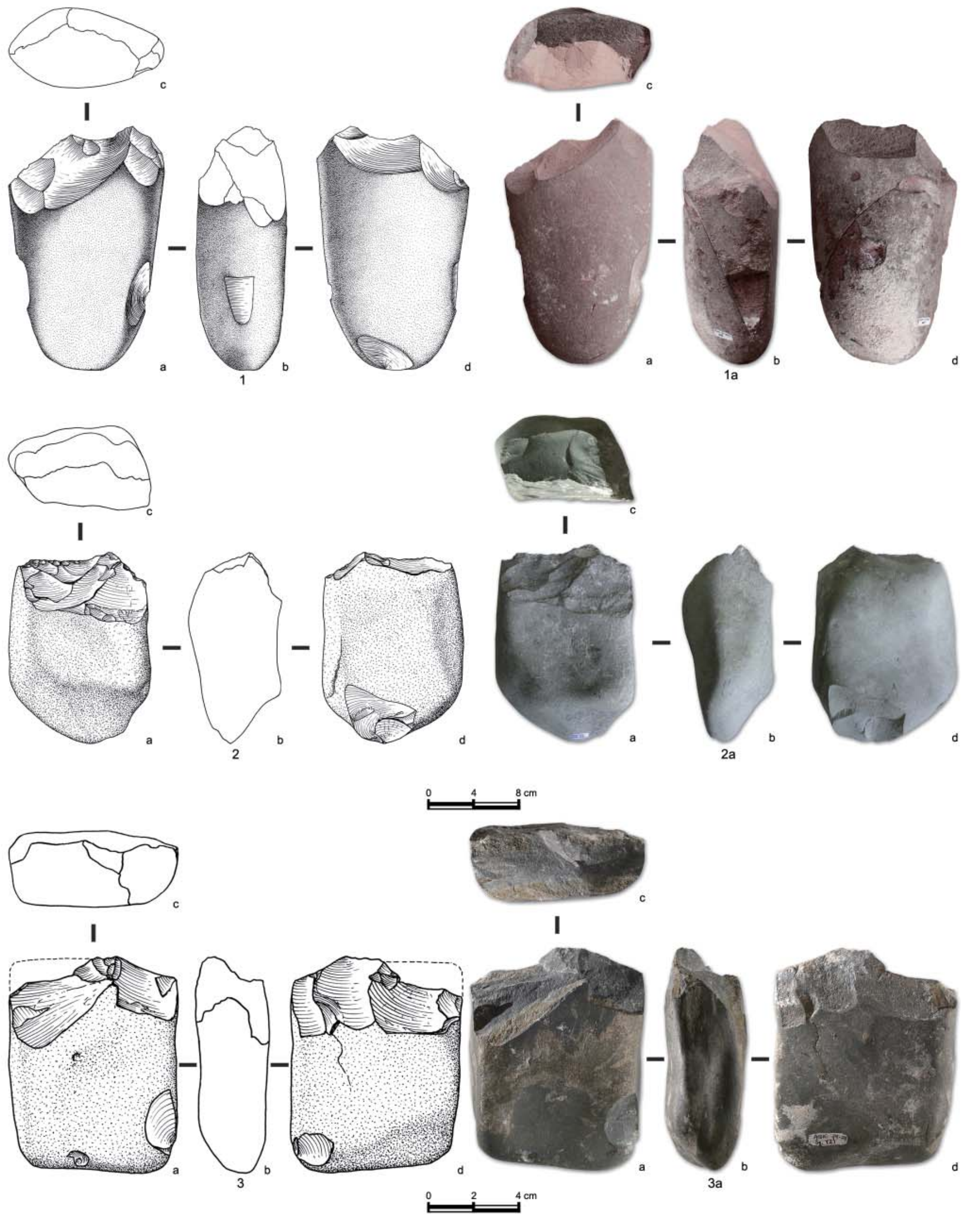

Figure 4
Areni-1 cave. 1-1a – 3-3a. Choppers (limestone).

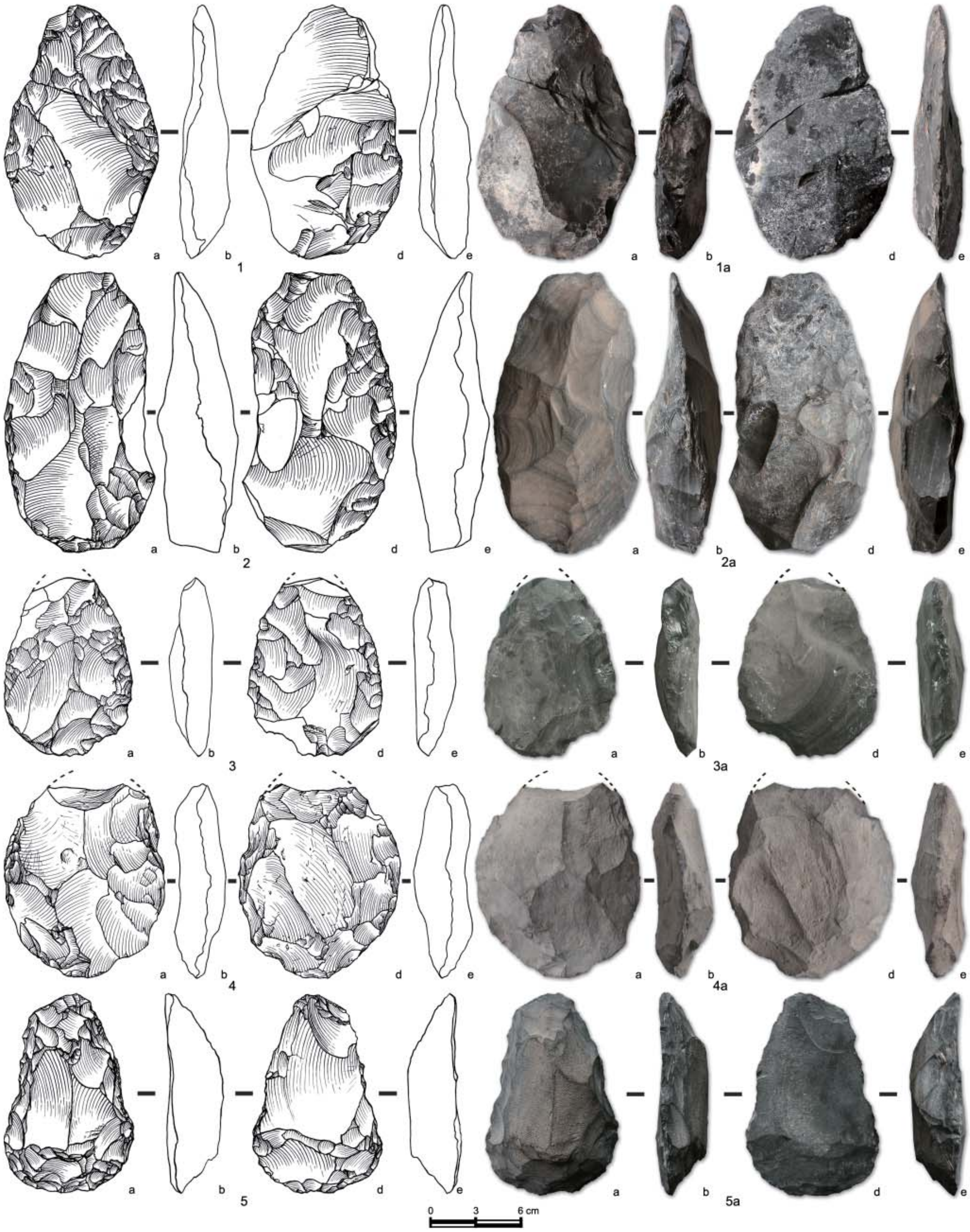

Figure 5
Jraber-17 open-air site. 1-1a – 5-5a. Bifaces (1-1a – 3-3a: obsidian; 4-4a – 5-5a: dacite).

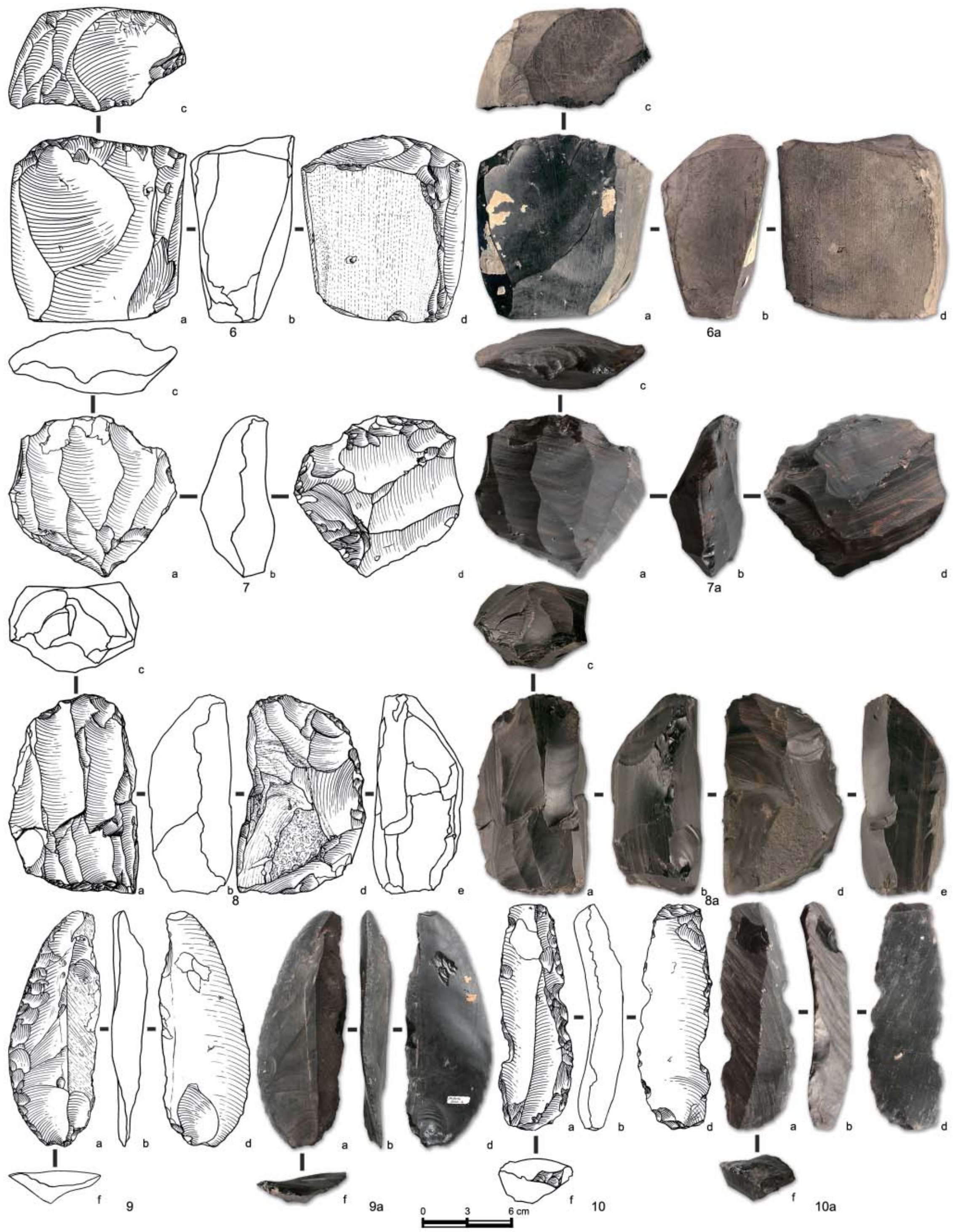

Figure 6
Jraber-17 open-air site. 1-1a – 2-2a. Levallois cores (obsidian); 3-3a. Protoprismatic, bidirectional core (obsidian); 4-4a. Side scraper (obsidian); 5-5a. Retouched flake with truncated and faceted end (obsidian).

The Middle Paleolithic Occupation of Armenia: Summarizing Old and New Data

Boris Gasparyan, Charles P. Egeland, Daniel S. Adler, Ron Pinhasi, Phil Glauberman and Hayk Haydosyan

1. Introduction

The Middle Paleolithic is the mot studied prehistoric period in the Republic of Armenia. Many open-air and cave sites with Middle Paleolithic occupational phases are located either in close proximity to or directly on obsidian outcrops of the Hrazdan-Kotayk Plateau and along the canyon of central Armenia's Hrazdan River. The Hrazdan canyon caves of Yerevan-1 and Lusakert-1 are particularly well known for their excavations from the late 1960s through mid 1970s, which produced hundreds of thousands of lithics and faunal remains. While these two sites became widely recognized in both Soviet and Western circles as being among the most important localities in the Caucasus, the absence of detailed chronometric and stratigraphic information has rendered these and many other Armenian sites of limited value in reconstructing hominin lifeways during the Middle Paleolithic. This is unfortunate given that Armenia's geographic position between Africa, Europe, and Asia and its favorable climate and rich natural resources meant that it had played a major role as a demographically complex region throughout the Paleolithic. Here, we summarize Middle Paleolithic data from the Soviet period and highlight a growing body of research conducted over the past decade which, in addition to reevaluating previously known sites, has identified and excavated new *in situ* sites applying modern methods and techniques.

2. Background on Middle Paleolithic research in Armenia

The first lithic artifacts representing the Middle Paleolithic of Armenia were discovered by the French archaeologist Jacques de Morgan at the end of the 19th century. De Morgan visited the sources of obsidian and areas adjacent to them (Mt. Arteni, Hrazdan and Kasakh Rivers valleys) and made limited surface collections. Unfortunately he was not able to evaluate the finds correctly, thinking that Armenia, and the Caucasus as a whole, were not populated during the Paleolithic period, which he termed the "first or initial industries". Instead, he attributed those finds to the "Archaeolithic" period, or the "Upper Paleolithic" by his definition. Unfortunately, de Morgan's opinion played a negative role in development of the future study of the Paleolithic of Armenia, even though there were some Paleolithic artifacts found by A. Demyokhin and M. Ghukasyan in Arzni in the middle reaches of the Hrazdan River and in Pemzashen on the western slopes of Mt. Aragats in 1933 and 1935 (de Morgan 1909; Bayburtyan 1937; 1938, pp. 195, 216, Figure 3). It was not until 1944-1949 that S. Sardaryan (Armenian SSR Academy of Sciences) and M. Panichkina (Leningrad State Hermitage), while revisiting the areas investigated by de Morgan, surveyed the middle reaches of the Hrazdan River canyon (Arzni, Nurnus, Chatkeran, Ashirabat, Tezhrabak, Argel, etc.) and Mt. Arteni (Satani-dar, Areguni blur, Yerkaruk blur). This work amassed impressive surface collections of Paleolithic artifacts from numerous open-air sites located in close proximity to obsidian raw material sources. More than 1,000 artifacts from these collections, including small handaxes, Levallois and discoidal cores, discoidal tools, flakes and blanks, side scrapers and end scrapers, and Levallois and Mousterian points, were considered by Sardaryan (1954, pp. 102-123; 1967, pp. 61-75) and Panichkina (1950, pp. 12-14, 80-89, 99-101; 1951) on detailed typological grounds to be characteristic of the Middle Paleolithic. Based on comparison of the finds with similar ones from Crimea, Syria, Iraq, Levant and Western Europe, Panichkina and Sardaryan concluded that the Middle Paleolithic of Armenia was more similar in its cultural attribution to the materials from sites of the Caucasus, Western Mediterranean basin and southwestern Asia, than to the Middle Paleolithic of Western Europe. Moreover, Panichkina proposed the first comparative chronology for the Paleolithic of Armenia, placing the finds from Arzni into the Early Middle Paleolithic (Early Mousterian by her definition) and the Ashirabat complex into the Developed Mousterian, noting that Late Middle Paleolithic or Late Mousterian sites were as yet unknown. Sardaryan, based on the western European chronology, meanwhile dated the Middle Paleolithic or Mousterian of Armenia between 100,000 – 40,000. Both scholars were deeply convinced that the future of Middle Paleolithic study of Armenia was related to the archaeological investigations of the volcanic caves, which are widely distributed along the slopes of Mt. Aragats and in the middle reaches of the Hrazdan River valley, or under the existing lava flows within the extent of the same region (Panichkina 1950, pp. 87-89, 100-101; 1951, pp. 76, 84-86; Sardaryan 1954, pp. 122-123, 169-171).

Between 1950-1969 a number of studies by different scholars (M. Hasratyan, A. Aslanyan, K. Karapetyan, V. Lyubin. S. Balyan, Yu. Sayadyan, B. Yeritysan and many others) recorded numerous Middle Paleolithic sites all over Armenia. These sites differed from the known ones in their exploitation and types of utilized raw materials, altitude, location and preservation. Among these the most important are: the find of a Mousterian point by M. Hasratyan during the excavations of a cave situated in the canyon of the Zorzor River, a tributary to the Vorotan (Syunik Region of southern Armenia) in 1950 (Hasratyan 1985, p. 168), the find of a Mousterian point made from green jasper by A. Aslanyan on the slope of Mt. Kaylik (Gilik) of the Papakar Range (Noyemberyan district of northeastern Armenia) in 1952 (Sardaryan 1954, pp. 109, 114, 119, Table XXX: 2a), Gilik open-air site discovered in 1967 by B.G. Yeritsyan at the same location (Yeritsyan 1970a), Verin Talin open-air site discovered by S. Balyan and V. Lyubin on the southern slopes of Mt. Arteni with surface collection of Acheulo-Mousterian obsidian and basalt implements in 1958 (Lyubin and Balyan 1961), Lusagyugh open-air site discovered by S. Barkhudaryan with surface collection of Acheulo-Mousterian obsidian implements in the Aparan Depression in 1969 (Petrosyants 1988, p. 37).

The most significant Middle Paleolithic localities, however, were discovered by the Expedition for the Study of Stone Age Sites in Armenia implemented by the Presidium of the Academy of Sciences of the Armenian SSR in 1967 and headed by Professor H.A. Martirosyan. During two years of intensive investigations (1967-1968) the expedition studied the canyons of the Hrazdan, Azat and Ughtakunk Rivers (all tributaries of the Araxes River), the southern, eastern and western slopes of Mt. Aragats, the eastern slopes and highlands of the Gegham Range, and the slopes of the Areguni and Vardenis Ranges overlooking Lake Sevan. While recording numerous Bronze and Iron Age fortress settlements and graveyards, as well as petroglyphs in the foothills and alpine zones, the expedition studied dozens of caves in Voghjaberd, Geghadir, Ayrivank, Garni, Ughtakunk and Daraband. Special efforts were spent on the study of the Hrazdan River gorge and the surroundings of Mt. Hatis, bringing to light many Stone Age open-air and cave sites from the different periods (Lower to Middle Paleolithic, Mesolithic, Neolithic) among which Jndrakhach, Nurnus I and II, Arzni, Abovyan, Getamej, Kaputan I, Hatis, Akunk, Aramus, Geghashen, Yerablur, Tacharabak, Kamaris, Nor-Nork open-air sites and clusters of caves in Karmir Blur, Shengavit, Kanaker and Zovuni are listed. The most important achievement of the expedition was the discovery of Yerevan and Lusakert caves containing well preserved Middle Paleolithic sequences (Azizyan 1982; Karapetyan 1983a; 1983b; Martirosyan 1968; 1969; 1970; 1974, pp. 25-28; Karapetyan and Yeritsyan 1969; Yeritsyan and Semyonov 1971, p. 32).

Beginning in 1967 and continuing intermittently until 1990, systematic excavations at the caves of Yerevan and Lusakert were conducted under the direction of B.G. Yeritsyan (Institute of Archaeology and Ethnography of NAS RA). These excavations yielded hundreds of thousands of lithic artifacts, faunal remains and geoarchaeological samples, not to mention the country's first radiometric Middle Paleolithic dates, all of which fundamentally changed our understanding of Armenia's Middle Paleolithic occupation (Ghazaryan 1979; 1983; Golovanova and Doronichev 2003; Karapetyan 1977; 1978; Lyubin 1984, pp. 65, 90-91, Fig. 33-34; 1989, pp. 64-67, Fig. 20; Pinhasi *et al*. 2008, p. 812, Table 3; Yeritsyan 1970b; 1970c; 1971; 1972; 1975; 1976a; 1976b; Yeritsyan and Semyonov 1971; Yeritsyan and Ghazaryan 1977; Yeritsyan and Korobkov 1979, Yeritsyan and Tadevosyan 1986, Yeritsyan and Gasparyan 1996). As a result the Hrazdan River canyon became the "center of gravity" for the Paleolithic study of Armenia, where, between 1970-1976, in parallel with Lusakert, small scale excavations were conducted in numerous caves – Karmir Blur, Kanaker, Hamo, Zovuni, Karashamb, some of which yielded Paleolithic finds, including Middle Paleolithic (Azizyan 1979; 1982; Azizyan *et al.* 1975; Chagharyan *et al*. 1972; Yeritsyan and Ghazaryan 1977). In addition many new open-air sites were discovered and studied in the middle reaches of the Hrazdan River starting from Arzakan to Arzni and along the boundaries of the Hrazdan-Kotayk Plateau. Especially starting from 1983 H.P. Ghazaryan (Institute of Archaeology and Ethnography of NAS RA) excavated a series of open-air sites situated between the villages of Akunk and Zar on the southern slopes of Mt.Hatis in direct proximity to obsidian raw material sources. As a result around ten open-air sites were discovered and studied – Late Acheulian (Hatis-1-4 and 6-9), Mousterian (Hatis 5) and Neolithic (Hatis-10). The special methodology, the spectrum of scientific questioning and the scale of the investigations of the Hatis open-air sites constituted a new step in the history of study of the Stone Age of Armenia (Ghazaryan 1986; 1991)[1].

During the last decade of the 20th century (1990-2000) consequent to the collapse of the Soviet Union and lack of funding, intensive study of the Middle Paleolithic sites of Armenia, and the Stone Age as a whole, all but ceased. The new strategy was of small-scale surveys and reconnaissance investigations, having an aim to re-examine the location, geomorphological and cultural distribution of previously known sites and to discover new and prospective landmarks for future investigations. These were implemented by B. Gasparyan in the Hrazdan River Gorge and its tributaries, the Hrazdan-Kotayk Plateau, Mt. Arteni and its environs, the Ararat, Shirak and Lori Depressions, the Tashir Plateau, the Kasakh River basin and the Aparan Depression (Gasparyan

1. Unfortunately, most of the research implemented by H. Gazaryan at Hatis remains unpublished.

1998; 2007a; 2007b; Gasparyan and Sargsyan 2003; Gasparyan *et al*. 2003; 2004; 2005). Most of the data collected during this work served as a base for future investigations involving international collaborative projects in commencing in the early 2000s (see Gasparyan and Arimura, this volume). Both new and previously known (e.g., Lusakert-1) Middle Paleolithic sites are currently being excavated and studied implementing modern archaeological and analytical methods, and we present the results of these studies here.

3. Lower to Middle Paleolithic transition in Armenia at Nor Geghi-1 open-air site

Our understanding of the timing and nature of the Lower to Middle Paleolithic transition in Armenia was aided by the discovery of the Nor Geghi-1 open-air site during a 2008 survey of the Hrazdan Gorge, with excavations conducted in 2008 and 2009. The site has a long exposed section following the construction of a narrow road in the late 1990s and is located at the uppermost deposits of the Hrazdan Gorge. The artifact-bearing deposits are sandwiched between two Middle Pleistocene basaltic lava flows from Gutanasar. Geoarchaeological research yielded considerable new data critical to our understanding of the Hrazdan Gorge's evolution, and new archaeological data are improving our understanding of the Middle Pleistocene landscapes and the environments and the hominins who inhabited them (Adler *et al*. 2012).

Preliminary analysis of the Nor Geghi-1 lithic assemblage indicates that the site dates to the Late Acheulian (late Middle Pleistocene), sometime between 400 and 200 ka. Geological samples from surrounding sediments (OSL, tephra) and basalts (Ar/Ar) are currently under analysis and will soon help verify the absolute age of the site, which is preliminary dated to >300 ka. All of the artifacts are produced on obsidian, several sources of which are found near the site (e.g., Hatis, Gutanasar) (Frahm *et al.* 2014a; 2014b). Hierarchical core techniques predominate, and débordants and overpass flakes document variable methods of core preparation and rejuvenation. The assemblage contains a high frequency of small debitage and shatter, and both flakes and blades, the platforms of which are typically plain or faceted and often large. Therefore it appears that all stages of manufacture are present at the site. Typologically the assemblage is dominated by denticulates, followed by notched pieces, scrapers (all varieties), bifaces (thin and ovate, thick and triangular, short and thick on Kombewa), burins, and thick end scrapers (Figure 1). Single and alternate notching is the primary form of retouch followed by truncated faceting, and scaled and stepped retouch (Adler *et al*. 2012). Continued analysis of these finds will allow us to delineate the role Nor Geghi-1 played in the mobility, settlement, and foraging behaviors of hominins within the Hrazdan Gorge prior to the Middle Paleolithic in comparison to other sites in the Caucasus and southwest Asia (e.g. Lyubin 1998; Barkai *et al*. 2005; Doronichev 2008; Slimak *et al*. 2008; Taskiran 2008; Kolpakov 2009; Doronichev and Golovanova 2010; Gasparian 2010; Gopher *et al*. 2010; Shimelmitz *et al.* 2011).

4. Bagratashen-1 open-air site

The group of Bagratashen open-air sites consists of five lithic scatters, all of which are associated with ancient terrace structures of the Debed at elevations between 435 and 549 m asl. A majority of the diagnostic surface material, the frequency of which ranges from a low of three at Bagratashen-5 to a high of 52 at Bagratashen-1, is Middle Paleolithic in character. The most noteworthy site, Bagratashen-1, was initially recognized when a well-made handaxe was recovered from the surface. Soon after, additional artifacts were observed eroding from a road cut dug only the year prior to the survey, in 2008 (Egeland *et al.* 2010; 2011; 2014)[2]. Excavations in 2010 and 2011 revealed a discrete, ca. 60 cm-thick archaeological horizon about 1.5 meters below the modern ground surface. As of 2011, a total of 6 m^2 of this horizon has been exposed and over 500 lithic artifacts were surveyed in and plotted. Small chipping debris (currently uncounted) was also common among the screened materials (Egeland *et al*. 2013).

Preliminary typological considerations suggest that Bagratashen-1 represents an early Middle Paleolithic occupation. Specifically, the retouched points recovered from the site (Figure 2) compare favorably to laminar technologies associated with late Middle Pleistocene or early Late Pleistocene chronometric dates from Armenia (Hovk-1: ~104 ka BP; Pinhasi *et al*. 2008), Georgia (Djruchula: ~230 ka BP and ~140 ka BP; Mercier *et al.* 2010), and the Levant (Hayonim: ~200 ka BP; Mercier *et al.* 2007). Whether the handaxe is associated with this laminar industry or from an as yet unidentified cultural component is not known. Preliminary examination indicates that a majority of the lithic material is flaked from (probably local) dacite and other fine-grained volcanogenic raw materials. Obsidian is represented by 12 pieces. The presence of flaking debris, cores (mostly cobbles), and finished tools indicates that all stages of reduction were carried out on-site. Unfortunately, the find horizon is devoid of faunal material.

2. This encounter underscores the serendipitous and sometimes paradoxical nature of archaeological discovery: the construction of the road, while destroying some of the original site, was likely the only reason the deeply buried finds were exposed in the first place.

While the archaeological deposit no doubt experienced some post-depositional disturbance, the presence of small chipping debris, the fact that the artifacts themselves show very little evidence of rounding or preferential orientation, and the identification of at least one refitting lithic set all suggest that the material is largely in situ. Further excavations and paleoenvironmental, geoarchaeological and dating work are currently ongoing at Bagratashen-1 and promise to reveal key aspects of early Middle Paleolithic adaptations in the area (Egeland *et al*. 2013).

5. Hovk-1 cave

Discovered in 2005, Hovk-1 cave is located in the northeasterly Tavush province of Armenia, 20 km east of Dilijan, the provincial capital, and 100 km northeast of Yerevan. The cave is at an elevation of 2040 m asl and exposed in an east-west orientated cliff which has developed as a result of faulting on the southern flank of the Ijevan Mountain Range. Hovk-1 cave developed in Jurassic dolomitic limestone as a result of karstic dissolution along a bounding plane between two limestone beds, and along a fault crack perpendicular to the cliff line. The net result is a hollow in the limestone measuring a maximum of 14 m in length, 2 m in width and 3 m height. The cave is divided into three zones: the main gallery which is exposed to light through the present cave entrance; a rear gallery that does not receive light from the cave mouth, but which is the location of a blocked karstic chimney; and a 1.5 m deep infilled karstic hollow (a “karren”) located immediately below the present cave entrance (Pinhasi *et al*. 2008; 2011; 2012).

The site was excavated during five fieldwork seasons between 2005 and 2009. The 0.80 and 4.40 m of infilling sediment that lie above the limestone platform forming the base of the cave have been divided into 13 sedimentary units. A combination of U-series, OSL and AMS 14C dating provides a chronology for the infilling events. Thus Unit 8 formed at and before 104 ± 9.8 ka BP (OxL-1001), flowstone formation of Unit 6a ceased soon after 94.2 ± 4.9 ka BP (BIG-UTh-A243) and was followed by a hiatus before Unit 6 accreted at 54.6 ± 5.7 ka BP (OxL-1000). Unit 5 was originally dated to 33.8 ± 0.5 14C ka BP (Poz-14674), but the *Capra aegagrus* (Bezoar goat) astragalus originally used for AMS 14C dating was reanalysed using the ultrafiltration technique and an age of >46 ka BP was obtained (Poz-23097). An *Ursus* bone from Unit 4 was AMS dated by ultrafiltration to 35.6 ± 0.7 14C ka BP (OxA-24504). Medieval ceramic fragments (1,000 – 500 BP), as well two Iron Age beads (one of carnelian and one of glass) dated by cultural attribution to ca. 500 BC – AD 0, were found in Units 1 and 3. This indicates that these units are of Holocene age and that an unconformity exists at the contact between Units 4 and 3 (Pinhasi *et al*. 2008; 2011; 2012).

The evidence for Middle Paeolithic human presence at Hovk-1 is based on a small number (n=50) of Mousterian stone tools, flakes and lithic debris (defined here as flakes <15 mm), some of which were made from local limestone, but some (n=26) were made on non-local obsidian and chert. In addition, several ash spreads were excavated in Pleistocene Units 12, 10, 9, 8, 6, 5 and 4, although no burnt bones or burnt lithic artifacts were recovered. The techno-typological analysis of the Hovk-1 Unit 8 artifacts (Figure 3) highlights some typological similarities with assemblages from the Kudaro-Djruchula group (Meignen and Tushabramishvili 2006), for example those from Djruchula Cave (Imereti, Republic of Georgia), Kudaro I and III, and Tsona (southern Osetia). However, the absolute age of these assemblages is not known due to a lack of reliable chronometric determinations for the relevant strata. The lithic assemblages from all these sites contain a high frequency of elongated Levallois points and blanks with low frequencies of debitage, cores and other tool forms. The elongated Levallois points and blades share techno-typological similarities with Levantine and other Near Eastern early Middle Paleolithic industries such as those from Tabun D, Hayonim E, Abu Sif, Rosh Ain Mor, Ain Difla, Doura and Hummal and are dated between 250 and 90 ka BP (Beliaeva and Lioubine 1998; Lyubin 1984; 1989; Rink *et al*. 2004).

The bone assemblage of Hovk-1 exhibits an exceptional preservation which does not vary considerably among the stratigraphic units or taxa. Evidence for low rates of *in situ* bone attrition includes the presence of porous and low-density skeletal parts of both immature and adult animals and the fresh appearance of most bone surfaces. The taxonomic composition of the Hovk-1 large faunal assemblages is rich and diverse. The bone assemblage includes a total of 1,090 complete and fragmentary bone specimens that were identified to taxon. The ungulate assemblages of Hovk-1 are dominated by Bezoar goat (*C. aegagrus*) which constitutes over 70% of total ungulates in each of the stratigraphic units. Red deer (*Cervus elaphus*) is the second most abundant ungulate taxa, their proportion ranging between 20% in Units 8, 6 and the karren and 10% or less in other units. Other ungulate species are represented by isolated bones and include wild boar (*Sus scrofa*), Caucasian bison (*Bison caucasicus*) and roe deer (*Capreolus capreolus*). The ratio of carnivores also varies according to stratigraphic unit. Cave bear (*U. spelaeus*) is the most abundant carnivore taxon in Units 7, 6, 2 and karren (>70%). In all other units the proportions of cave bears are <50% and the assemblages also include high proportions of small carnivores and wolves (*Canis lupus*). Among the small carnivores foxes (*Vulpes vulpes*) are the main taxon. Other small carnivores represented are common badger (*Meles meles*), pine marten (*Martes foina*), marbled polecat (*Vormela peregusna*) and lynx (*Felis lynx*). The remains of small carnivores also include deciduous teeth and unfused bones of neonatal specimens which could not be identified to species. However, their presence indicates that the cave was in use by small carnivores as a den during certain periods. In spite of the high quality of bone surface preservation there is no evidence for human modification by hammerstone percussion marks, butchery or consumption marks with the exception of two modified bear sacra with evidence of percussion marks and several modified bear canines. The completeness of bones also indicates little if any human breakage for marrow extraction, and there are also no signs of burning. The limited evidence for human modifications of bones together with the remarkable state of preservation is strong evidence that the assemblages represent natural accumulations with minimal anthropogenic influence (Pinhasi *et al*. 2008; 2011; Bar-Oz *et al*. 2012).

Both the pollen and the microfauna show some notable shifts which indicate significant paleoenvironmental variations. The large mammal fauna of Hovk reflects the high elevation environment of the cave and is indicative of general continuity in the composition of large-animal communities in this region throughout the Late Pleistocene. Wild goats, boars, bears and wolves are among the most common species in mountain environments above the tree line. Other species such as roe deer, red deer, bison, fox and marten typically inhabit forested areas of lower altitudes and occur in high-elevation environments on a more sporadic basis. The presence and dominance of the Bezoar goat throughout the stratigraphic sequence, however, shows a distinct difference from Late Pleistocene assemblages in northern areas of the Greater Caucasus, where the predominant ungulate is typically the Caucasian goat (*C. caucasica*). It appears that humans occupied Hovk-1 during periods of varied vegetation and fauna which correlated with warm episodes of the Late Pleistocene (MIS 5d-c and early MIS 3). If lithic density is taken as an indicator of the frequency and intensity of human occupation, then evidence for human use of the cave is more noticeable in Unit 8, i.e. during MIS 5d-c, than in any of the other units (Pinhasi *et al*. 2008; 2011; Bar-Oz *et al*. 2012).

It is possible to provide at least two explanations for human presence in Hovk-1 and its environs. Mountains provide a diversity of biotopes that change rapidly with elevation. Mountain plateaus and rugged terrain can be advantageous to capable hunters who rely on ambushing, trapping and hunting of game which is abundant in such regions, such as the Bezoar goat. Humans may have exploited this habitat during relatively regular short-term incursions (and during mild climatic periods), possibly for seasonal hunting of game at and below the plateau in the vicinity of the cave. The advantage of the Hovk mountainous habitats (and others) is that the steep terrain provided easy means to hunt mountain animals such as the mountain goat by ambushing and trapping. The plateau above Hovk-1 cave provides an ideal terrain for this activity. Another scenario is that the use of Hovk-1 by humans indicates rare and infrequent incursions by humans to high altitude regions, perhaps following their expansion into new habitats. The two scenarios are not mutually exclusive, and it is not at present possible to test which of these is most plausible. An intriguing aspect of Hovk-1 is the presence of elongated Levallois points in Unit 8 and the karren which are made from low quality local limestone. The lack of raw material sources in the Hovk region suggests that human occupation in Hovk-1 was not associated with the utilization of raw material sources. In fact, the production of highly standardized Levallois points from local coarse-grained raw material shows ingenuity and flexibility. The study of Hovk-1 can only provide a limited glimpse into the nature and timing of human occupation in this high-altitude region, but it clearly demonstrates the need to critically examine similar habitats in the context of understanding Neanderthal and modern human behaviour, subsistence and mobility (Pinhasi *et al*. 2008; 2011; 2012; Bar-Oz *et al*. 2012).

6. Cave sites of the Hrazdan River canyon (Yerevan-1 and Lusakert-1)

6.1. Yerevan-1 cave

Yerevan-1 cave is situated within the city limits of Yerevan on the right bank of the Hrazdan River at the beginning of the Yerevan reservoir. The cave is formed at the base of a Middle Pleistocene andesitic basalt flow with a total thickness of 20 m, and rests on doleritic basalt flows of Upper Pliocene age. The site, which is a small niche covering about 40 m^2 originated as a result of mechanical weathering of the basalts. The platform in front of the cave is the 15 m high erosional terrace of the Hrazdan and is covered by river cobbles (Karapetyan 1977). It was excavated between 1969-1975 by B.G. Yeritsyan of the Institute of Archaeology and Ethnography, Armenian National Academy of Sciences. Cultural remains in the front of the cave cover an area of 250 m^2. During nine seasons of excavation around 100 m^2 was uncovered, which represents about one third of the area occupied by the site (Yeritsyan 1970b; 1971; Yeritsyan and Semyonov 1971; Yeritsyan and Gasparyan 1996).

The excavations uncovered 11 lithostratigraphical units or horizons with a total thickness of three meters (from bottom to top: 7-6, 5A, II, Z, 5-1, A). Based on sedimentological and granulometrical, mineralogical and geochemical analyses, the Pleistocene stratigraphic sequence was divided into three cycles, described as follows: lower cycle (units 7, 6, 5A) consists of angular basaltic debris which was formed by mechanical weathering of the cave roof during very cold climatic conditions (end of Würm I); middle cycle (units 5-4) – alluvial silt formed during mild cold and wet climatic conditions (interstadial Würm I-II); upper cycle (units 3-1) – fine sands of aeolian origin formed during dry continental climatic conditions (Würm II). The palynological data also supports these observations, showing that the vegetation around the cave changed in three cycles. The palynological spectrum of the lower units contains tree pollens of cold tolerant taxa (*Pinus*, *Picea* and *Betula*) dominated by *Pinus.* The second cycle is characterized by a low percentage of trees with *Betula* dominant and an abundance of herbaceous plants dominated by *Sonchus.* Meanwhile, for the upper cycle an abundance of herbaceous plants (mainly *Chenopodiaceae*) and a low frequency of thermophilic tree taxa (*Quercus*, *Corylus*, *Juglans*, *Castanea*, *Elaeagnus*) is also recorded, indicating the existence of an open landscape. The composition of the Yerevan-1 large faunal assemblage consists of over 24 taxa of ungulates, carnivores, birds and reptiles. The osteological materials of the lower units (7-6, 5A) are represented by the following species – elk, Northern deer, gazelle, rhinoceros, wild horse and onager. The middle stratigraphic units (5-4) contain rhinoceros, wild horse, onager, elk, bison, wild sheep, Bezoar goat, cave bear, wolf, jackal, fox and hare. Finally, the upper units (3-1) yielded bison, wild sheep, wild horse, onager and turtle (Yeritsyan 1970b, pp. 7-14; Karapetyan 1977; 1978).

While excavating the front platform of the cave in 1973 at its southern side in unit 4 a molar and a skull fragment were recovered and identified by the Soviet anthropologists A.I. Zubov and V.P. Alekseev as the postcranial remains of an 8 year old Neanderthal. In addition, in 1974 one molar and one incisor were recovered from unit 2, belonging to an anatomically modern humans[3].

Units 7, 6, Z, 5, 4, 3 and 2 are rich in archaeological features[4] including small and large hearths, areas of knapping with noticeable concentrations of flaking products, hammerstones and basalt anvils, as well as lithic finds, with over 30,000 pieces produced overwhelmingly (98 %) from obsidian. Artifacts from other types of raw materials such as basalt, dacite, jasper and chert are limited. As an initial flaking material, including the rhyolithic hammerstones, the cobbles of the Hrazdan River were used. Those include Levallois and non Levallois cores, flaking products of different categories, angular debris, blanks (both flakes and blades) and tools modified on their bases. The main tool types (Figure 4) are different side scrapers, Levallois and Mousterian points, notched tools, backed knives, burins, pièces esquillées, and bifacial forms. Based on typological observations (typical Mousterian, Quina, Tayacian) the Middle Paleolithic industry of the cave is a representative for the Late Mousterian of Armenia and the Lesser Caucasus. Most significant are the materials from the upper units (3-1), which reflect the development of microlithic tendencies

3. These finds were never published. They were transported to Moscow, and their location remains unknown (B. Yeritsyan, personal communication).

4. In unit 4 traces of floor belonging to an artificial construction were recorded.

and specific features of tool preparation (Figure 5). These are reflected by the wide use of various methods of thinning for tool production, including the truncated-faceted technique. The most specific are so-called “Yerevan” or “Yerevan-type” points (retouched triangular points with truncated-faceted bases) and side scrapers with two or three truncated-faceted sides (“side scraper with thinned body”) (Figure 6). This tradition of tool manufacturing, noted at numerous sites, forms the Late Mousterian regional cultural group known as the “Yerevan-type industry”. Consequently, the invention of these new types of tools and the presence of new methods of fabrication enabled intensive use of the available raw materials (Beliaeva and Lioubine 1998; Fourloubey *et al*. 2003; Ghukasyan *et al*. 2011; Golovanova and Doronichev 2003; Liagre *et al*. 2006; Yeritsyan 1970b, pp. 14-30; 1971; 1972; Yeritsyan and Gasparyan 1996).

Functional and use-wear analyses by S.A. Semyonov, A.E. Shchelinskiy and H.P. Ghazaryan, suggest that the abrasion traces on the tools resulted from activities such as wood and bone processing (the most frequent type of abrasion), hide processing (traces of abrasion on scrapers) and the butchering (Ghazaryan 1993; Yeritsyan 1970b, p. 31; Yeritsyan and Semyonov 1971).

Radiocarbon dates obtained from Groningen (Netherlands) laboratory yielded dates ranging between >49,000 – 32,000 uncalibrated BP for units 4 and 3. Two dates from Unit 7 contradict these data with results of 28 – 27,000 uncalibrated BP, which indicates that the site is still in need of reliable chronometric dating (Cohen and Stepanchuk 1999, pp. 281-282; Pinhasi *et al.* 2008, p. 812, Table 3). While there can be no doubt that Yerevan-1 cave is among the most important late Middle Paleolithic sites in Armenia and, indeed, the entire region, our knowledge of its occupational history would benefit greatly from renewed excavations with modern analytical techniques as is currently being done at Lusakert-1.

6.2. Lusakert-1 cave

Excavations at Lusakert-1 cave were first conducted from 1971–1990 and headed by B. Yeritsyan. These efforts produced over 200,000 lithic artifacts (Figures 7-10) and a small assemblage of vertebrate fauna. An Armenian-French team conducted small-scale re-excavation of Lusakert-1 in the early 1990s (Fourloubey *et al*. 2003). In 2008 an Armenian-American team focused their efforts outside the cave where Yeritsyan, and later the Armenian-French team had worked and where collapsed sections were still visible and easily accessible. The Armenian-American team exposed new sections, clarified the original stratigraphy, collected a variety of chronometric and paleoenvironmental samples, recovered several thousand lithic artifacts, and began a geoarchaeological assessment of the site and the formation processes that influenced its development. Unfortunately, faunal preservation in this area of the site is extremely poor and very few identifiable specimens were recovered. In 2009 the team deepened the excavation outside the cave and began a test excavation in the interior of the cave where *in situ*, stratified archaeological horizons rich in well-preserved lithics, fauna, microfauna and combustion features were immediately encountered. Between 2010–2011 these interior excavations were deepened to bedrock and extended several meters to the north, thus producing a continuous section linked to the exterior deposits. Twelve new lithostratigraphic units containing well-preserved lithics, fauna, hearths and other features were documented inside the cave. Archaeological and faunal data from these new layers are still under study (Adler *et al*. 2012).

Initial observations indicate that the 2008–2009 lithic assemblage can be characterized as Levallois (flake and blade), with facetted and plain platforms, few cores, a moderate frequency of formal tools (denticulates, side scrapers, burins, end scrapers), and a very low frequency of cortex. However given the distinct taphonomic histories and site formation processes observed between the exterior and interior deposits, it is necessary to treat the assemblages from these two areas separately. Technological and typological analyses reveal that the studied sample from the exterior includes a high frequency of flakes with notches; a similarly high frequency of damage on the opposite or alternate surface to the “notches” suggests that this pattern is more likely due to edge damage rather than tool manufacture (Adler *et al*. 2012).

Within the interior assemblage the predominant flaking technique is Levallois and Kombewa (or Janus flakes). The high incidence of Kombewa flaking and its application to a wide variety of artifact sizes and forms is of note given that, when present in other assemblages, the technique is typically applied much less frequently, and then usually for the primary purpose of thinning bulbs or the application of truncated-faceting (Dibble and McPherron 2006; Inizan *et al*. 1995). Truncated-faceting and the removal of the exterior central ridge are very common. Both techniques are typically coupled with the thinning of the dorsal surface just beneath the platform regardless of platform type. Detailed analysis of the artifacts by stratigraphic level is ongoing and inclusion of the large sample of material from the 2010–2011 excavations will help further substantiate the patterns reported here (Adler *et al*. 2012).

The faunal assemblage (interior and exterior) is heavily fragmented. Bones identified to size class (small, medium, large ungulate) comprise about 2/3 of total NISP and include almost all of the postcranial elements. Taxonomically the assemblage is dominated by *Capra* sp. and *Equus* sp., however several bovine specimens, probably *Bison* sp., have also been identified.

Percussion marks, including pits, micro-striations and conchoidal notches, were documented on many specimens, and the high frequency of long bone epiphyses with green breaks attests to the routine exploitation of long bones for their marrow. Almost half of the shaft fragments from all size class categories display fresh fractures, and nearly all shafts retain less than half of their original circumference. While some specimens exhibit probable carnivore gnaw marks, evidence of butchering and processing by hominins (e.g., cut marks, impact fractures, green breaks) is much more common. Faunal analyses are ongoing and comparisons between the content and taphonomic history of the exterior versus interior assemblages are planned (Adler *et al.* 2012).

At present Lusakert-1 is the only Middle Paleolithic cave site in Armenia with stratified deposits of well preserved archaeological material currently under study. As such it provides the best opportunity to conduct a variety of technical and behavioral studies in the region. For example, the quality and quantity of the faunal assemblage is allowing us to conduct detailed zooarchaeological and taphonomic analyses and to assess regional Late Pleistocene hominin foraging behaviors in a manner similar to that already attempted in Georgia (Bar-Oz and Adler 2005; Adler *et al.* 2006; Bar-Oz *et al*. 2008; Adler and Bar-Oz 2009) and southern Russia (Cleghorn 2006; Golovanova *et al*. 2006). Lithic analyses are providing insights into technological and processing behaviors, and the sourcing of raw materials (obsidian) is allowing us to assess patterns of mobility and land use. Paleoenvironmental and geoarchaeological studies are providing data on the formation of the Lusakert-1 deposits and the site's proper geomorphological and ecological contexts. Chronometric estimates are allowing us to build an absolute chronology for the site based on three independent techniques (OSL, AMS, tephra). While OSL results for Unit D are pending, estimates for Unit C (OxL-1836: 36.6 ± 2.8 kya; OxL-1837: 35.3 ± 2.8 kya; OxL-1838: 23.9 ± 1.9 kya) suggest a preliminary age of ~36,000 BP OSL; the true age of each layer can only be assessed following completion of our dating program which remains ongoing. The AMS analysis from the French team excavations of a single equid tooth from Unit C (Mousterian) produced an age of 26,920 ± 220 14C BP ([GRA-14949/Lyon-1006], Fourloubey *et al*. 2003) and can be calibrated to 31,692 ± 190 Cal BPHulu (CalPal online calibration, 2011). The coordinated analysis of these data is allowing us to test a variety of behavioral hypotheses and compare results from Armenia with contemporaneous finds from the wider region (Adler *et al*. 2012).

6.3. Angeghakot-1 cave

In 2003, during a systematic campaign of surveys conducted by the Armenian-French team in the Vorotan River basin, a concentration of artifacts providing evidence for the presence of a

Mousterian site was discovered on the left bank of the Vorotan River at an altitude of 1800 m in the district of the village Angeghakot. Diagnostic pieces (cores, flakes, Levallois tools), as well as several Mousterian points allowed a typological attribution of the archaeological material to the late Mousterian industry of the so-called "Yerevan points". The artifacts were found in an area of about 100 m^2 on a steep slope. On the upper part of the slope were the remains of several eroded rock-shelters and caves whose entrances had collapsed. It is probable that erosion removed all the sedimentary facies corresponding to the occupation periods of the caves. The building of a chapel at the foot of the site during historical times and the digging of several tombs further down the slope are probably the cause of the unearthing of the artifacts, which are in a good state of preservation (Liagre *et al*. 2006).

The lithic assemblage collected from the surface of Angeghakot-1 consists of 84 artifacts, of which 68 are obsidian, nine basalt, two jasper and five limestone. This collection is not exhaustive, and because the artifacts were found a secondary position, their stratigraphic location remains unknown. During the fieldwork all diagnostic pieces were systematically selected. The nearest primary deposits for the supply of obsidian are located about 40 km to the northwest where the Vorotan volcanic group outcrops spread at an altitude of 2500-2800 m. However, the makers of these artifacts preferentially exploited raw material in secondary position in the form of small pebbles collected along the Vorotan valley below the shelters. The reduced dimensions of the lithic artifacts are in part related to the small size of these pebbles.

Typological study and technological observation show that the collection contains cores, tools on flakes, tools on pebbles, side scrapers and points. The points enabled attribution of the series to a late phase of the Middle Paleolithic. The assemblage of points consists of 21 pieces, of which ten are "Yerevan points" (Figure 11: 5, 7-8), five are points on Levallois flakes, and six are "classic Mousterian" points (Figure 11: 1-3). The "Yerevan points" have a symmetry, a continuous scalar retouch and highly retouched bases. Four of them are whole, with sizes varying between 2.5-3.6 cm in length and from 1.5-2.9 cm in width, with a thickness not greater than 1 cm. The other six are proximal fragments (Figure 11: 4, 6). The points made on Levallois flakes have scalar Quina retouch which is more or less steep and regular. These pieces are thick and small in size, never longer than 4 cm. The classic Mousterian points are retouched mainly on the distal end, and the retouch is scalar and often irregular. These points are all fractured, and their thickness varies between 1.3-2.2 cm.

The assemblage includes a large amount of point resharpening debris (19% of the objects), including seven pieces from thinning, all left lateral and corresponding to a detachment of the proximal part of the points (Figure 11: 9). Their width varies between 2.6-3.4 cm and their thickness between 0.7-1.1 cm, corresponding to the dimensions of retouched whole points found on the site. Six other pieces indicate the lateral maintenance of the points. The detachment of thinning flakes on the lower face of the points is also a feature characteristic of this industry. Finally, three tools made on fragments of reused points shed light on the method of exploitation of lithic resources, as well as the procurement strategy of raw material used by the hunters who frequented the site of Angeghakot-1. These proximal fragments of "Yerevan points" were transformed into a microlithic "beak" at the flake butt. These pieces are no larger than 2.3 cm by 3.6 cm wide (Liagre *et al*. 2006). The typological characteristics of the tools (particularly the points) are similar to those of pieces found in the upper layers of the cave of Yerevan-1, which relates them to the Late Mousterian culture of Armenia, characterised mainly by the presence of "Yerevan points" with thinned bases. The discovery of a Mousterian site in the Vorotan Basin is the first evidence for the presence of Middle Paleolithic human groups in the southern highland region of Armenia in a key area between the plains of Ararat, the mountains and steppe of Karabagh and northwest Iran. Angeghakot-1 confirms the occupation of the high plateaus and provides a link between the geography and archaeology of the region. The site belongs to the group of "Yerevan-type point" sites identified in the Caucasian Mousterian by various authors. Finally, the particularities of this "microlithic" industry, present at Angeghakot-1 and at other Middle Paleolithic sites of the Lesser Caucasus, raise new questions about the economic strategies of these hunter-gatherers and the variability of the facies of lithic industries present in this region at the end of the Middle Paleolithic (Liagre *et al*. 2006).

6.4. Kalavan-2 open-air site

A recent archaeological survey conducted by an Armenian-French team in 2005 in northeastern Armenia in the forested northern slopes of the Areguni Mountains, which dominate the northern shore of Lake Sevan, brought to light the open-air site of Kalavan-2. Two seasons of test excavation (2006 and 2007) have revealed a sequence of deposits belonging to the final phase of the Middle Paleolithic. Kalavan-2 open-air site is located at 1630 m asl on the left bank of the Barepat River valley. At least five Pleistocene terraces can be distinguished in this area, providing evidence of Quaternary landscape changes caused by climatic and/or geodynamic factors in northeastern Armenia. Kalavan-2 is situated on the third alluvial terrace, corresponding to the Late Pleistocene level at the confluence of the Barepat River and a small tributary. Today this terrace is evolving into a perched hydrographic system 30 m above the main river (Ghukasyan *et al*. 2011).

The main excavation area (trench 2) was established on the longitudinal axis of the spur near its northern extremity where the rocky substratum shows through due to regressive erosion. This sector was occupied in the Late Bronze Age and in the Iron Age, as indicated by the presence of a cemetery, of which several tombs have been robbed by clandestine excavations. The area of trench 2 was enlarged to 7 m^2. The whole area was excavated to a depth of 99–115 cm (layer 11) and a deep trench was dug in square L22 to a depth of 380 cm (layer 20). At the same time, two other trenches were made on both sides of the edge of the slope: trench 1 in the east and trench 3 in the west. Kalavan-2 yielded 20 principal stratigraphic layers which represent particular sedimentary units with both paleoclimatic and geomorphological information. Eight layers have produced variable quantities of archaeological remains comprising about 3/4 lithics and 1/4 fauna. The archaeological material from the modern soil horizon (layer 1) contained colluvial elements from higher up the slope, as well as artifacts from nearby Iron Age tombs (Ghukasyan *et al*. 2011).

The diversity of the lithic raw materials found at Kalavan-2 provides evidence of the geological complexity of this region of the Lesser Caucasus at the juncture of two geological complexes, volcanic and sedimentary. In fact, three different groups of raw material are found at the site. The first two groups represent local raw materials: sedimentary rocks (34 % of the artifacts, silicified limestone, chert, flint or jasper) of various colors, which are present in the alluvium of the rivers bordering the site, and volcanic rocks (basalt) that are rare (2 %) coming from ancient eruptive formations of the mountain chain which separates Lake Sevan from the basin of the Getik River, into which the Barepat flows. The third and largest group (64 %) consists of obsidian, volcanic glass usually black in color, sometimes brown, red or transparent. These rocks are not found in the Barepat basin. The closest sources of obsidian are located to the west and south of Lake Sevan, about 80 to 90 km as the crow flies (Ghukasyan *et al.* 2011).

The rare lithic artifacts from the lower levels 9-11 suggest the presence of the Mousterian. Layer 7 is the richest layer in the Kalavan-2 sequence. It contains 214 artifacts including 130 specimens made of obsidian. It is interesting to note the high proportion of small pieces (61.7 % less than 20 mm in length) which are mainly obsidian, unlike the pieces made on mauve or green local flint which are mostly longer than 20 mm. The production of the largest elements was carried out using the Levallois method and is exclusively recurrent convergent unidirectional. The main products are laminar flakes; less numerous are Levallois points (Figure 11: 13, 16) and oval pieces which are clearly laminar elements or points aborted by a shift in the wave of percussion due to poor convexity on the flaking surface. The tendencies that emerge from the layer 7 sample show the exclusive use of the recurrent convergent unidirectional Levallois method in the production process.

Half of the tool kit is composed of side scrapers and retouched Levallois points. However, layer 7 at Kalavan-2 seems devoid of “Yerevan points”.

The industry of layer 6 provides evidence for three methods of production. There is production of middle-sized flakes (30 to 50 mm), produced by the discoid method to obtain products having mainly convergent cutting edges; some of these products are typical pseudo-Levallois points. A very rare bladelet production is represented by a complete object and a fragment, while laminar flakes were obtained by a convergent unipolar method of Levallois type, very similar to those recorded in layer 7, but their badly preserved surfaces suggest secondary deposition. The tools are exclusively retouched and number only 12 pieces: four retouched points of obsidian of similar size (27 to 37 mm long, 17 to 23 mm wide, 6 to 9 mm thick), a flint point slightly larger than the latter (55 × 19 × 10 mm), two end scrapers and an atypical burin, a scraper with abrupt peripheral retouch, a *pièce esquillée*, and two miscellaneous retouched pieces. The predominance of the technology involving unidirectional preparation of the cores, laminar flaking, a high frequency of convergent pieces (retouched points, convergent side scrapers), and the presence of truncated-faceted pieces are characteristic of the Mousterian of the Zagros-Taurus (Figure 11: 10-12, 14-15, 17). This Mousterian assemblage group extends from western Iran (Kunji Cave, Warwasi) to Central Anatolia (Karain Complex I) where it is dated to OIS-3 (60,000 – 25,000 BP) (Ghukasyan *et al*. 2011).

From the entire excavated area of Kalavan-2, only 129 bones were found with a low rate of identification to species and/or skeletal element (14 %). Most of the elements belong to Mousterian layer 7. Some of the bones are poorly preserved, with a white porous or chalky appearance. The outer surface is usually missing, often rendering identification impossible and fragments of spongy bone are rare. All the faunal remains have suffered strong weathering, including the teeth, which are highly altered and split where the enamel has been unable to withstand various cycles of freezing and thawing. The identified faunal remains of Kalavan-2 include aurochs (*cf. Bos primigenius*), wild goat/ibex (*Capra* sp.), horse (*E. caballus*), and red deer (*C. elaphus*). The aurochs is an animal of open spaces. Wild goats live in rocky, open spaces and are resistant to cold climatic conditions. The wild horse is synonymous with open environments, and red deer inhabit open wooded zones and are resistant to cold conditions. Several types of modification have been identified on the surface of the bones which attests to the site’s complex taphonomic history. It should be noted that most bones have traces of root etching on their external surfaces. These traces indicate that the bones remained in the active zone of vegetation for a long period before being buried. The anthropogenic origin of the material is also indicated by the presence of a typical cutmark made by a stone tool on a small fragment of bone and by seven bones (e.g. the caudal diaphysis of the tibia of a large bovid) which show traces of burning. Finally, some fragments of large bovid bones have green breaks (Ghukasyan *et al*. 2011).

Four samples from trench 2 were radiocarbon dated. The sequence of dates obtained raises many questions. Sample UGAMS-2295 (layer 19) gives a date of 42,040 ± 400 BP (~43,500 ± 800 cal BC) which is at the limit of the method and thus should be taken as a minimum age. Sample Poz-22181 can be omitted due to its young age and layer 7 can be dated to 34,200 ± 360 BP (~37,700 ± 880 cal BC). The 14C dates for the horse tooth between layers 6 and 7 indicate the last glacial maximum between 20 and 16 ka (OIS-2), but this seems particularly late and raises issues concerning contamination as well as stratigraphy. Finally, these dates appear too young, given the techno-typological characteristics of the lithic artifacts (Cherkinsky and Chataigner 2010; Ghukasyan *et al*. 2011).

The issues explored above suggest the need for a new assessment of the Kalavan-2 deposits, making it a prospective site for understanding the early population history of Armenia and the Lesser Caucasus. Layer 7 represents the classic Mousterian of Armenia, with a reduction aimed at the production of Levallois laminar flakes and points. This industry is associated with fauna composed of aurochs, wild goat and red deer, with 14C dates falling in OIS-3 (34,200 ± 360 BP). The presence of some artifacts of Mousterian fabrication in the lower layers (9 and 11) seems promising. In addition, its proximity to a probable seasonal migration route for ungulates, moving upslope towards summer pastures in spring, and downslope in autumn for mating and feeding supports the same reasoning. Indeed, on the opposite bank of the Barepat River, the site of Kalavan-1 is located approximately several hundred meters from Kalavan-2 and dates to the end of the Upper Paleolithic. It is probable that the Kalavan territory occupied a strategic location from which Mousterian and Upper Paleolithic hunters could plan and launch hunting forays.

6.5. Barozh-12 open-air site

The newly discovered (2009) site of Barozh-12 promises to yield significant data on late Middle Paleolithic technology, land use, and lithic economy in a region that has heretofore been little explored. The lithic assemblage appears similar to those from other later Middle Paleolithic sites in the region, as described earlier. Based on the results of survey, test excavation and preliminary analysis of sample artifact assemblages, the locality presents exceptional opportunities for collecting data on long-term patterns of land use and technology. The results of future chronometric and geological sampling will yield important data that can serve as a basis for evaluating hypotheses and theories on regional Middle Paleolithic hominin behavior.

To collect data on Paleolithic occupation in western Armenia on the plateaus at the northern edge of the Ararat Depression, surface walkover survey, test excavation, and analysis of surface and excavated lithic assemblages were conducted, including obsidian sourcing with portable X-ray fluorescence (pXRF).

Barozh-12 is a large (ca. 100 × 200 m surface area), high density Middle Paleolithic site at 1,360 m asl. Artifacts are made predominantly on obsidian (Figure 12), but faunal material has not been recovered. A large sample of artifacts was randomly collected from the surface at the Barozh-12 locality. Due to the sheer amount of artifacts and time constraints, a small test trench was excavated. The trench measured 50 cm × 50 cm × 95 cm in depth, and was excavated down to the tuff bedrock. Profiles were cleaned and drawn, and their lithology was described. All artifacts were collected in roughly 10 cm levels. Samples of 102 artifacts from the surface and 340 from stratified sediments were analyzed according to ca. 30 metric and qualitative attributes. A total sample of 1,174 artifacts from both the surface and test trench were counted and categorized to class (cores, flakes, tools, bifaces).

The elemental composition of a sample of artifacts from the surface and individual excavation levels (n = 52) was analyzed using pXRF to characterize raw materials and determine source areas. Artifact geochemical signatures were statistically compared to those from reference collections from obsidian sources throughout Armenia.

Preliminary analysis of stratified deposits exposed in the test trench suggests that the artifacts were deposited on intermittently stable surfaces amid fluvial, followed by aeolian depositional processes. Based on preliminary analysis of artifacts from the surface and excavated contexts, both samples display techno-typological characteristics of the Middle Paleolithic in the region. Flake scar patterns on cores and flakes indicate triangular Levallois and discoidal core reduction. Numerous retouched pieces, mainly classified as elongated, Levallois and retouched Levallois points, blades and a variety of unifacial scrapers are observed in the tool assemblage. Surface and excavated artifacts are of all size classes and technological categories, including tool resharpening flakes and core trimming elements. Artifact class frequencies and cortex analysis also suggest that all stages of core reduction and tool use, maintenance and discard occurred on site. Preliminary results of pXRF on a sample of obsidian artifacts (mainly retouched pieces) indicate that most were manufactured from local (1-2 km) Mount Arteni material, while a smaller number of artifacts were manufactured on material originating from 80 km to more than 100 km away. Varying frequencies of local and "imported" raw materials observed in small samples from stratified archaeological levels suggests dynamic raw material transport patterns over time. The extent of a "raw material exploitation territory" is suggested by obsidian sourcing, though only to the east of the site. Further pXRF study of obsidian raw materials (following Frahm *et al*. 2014) in conjunction with further analysis of artifact manufacture and discard patterns will elucidate regional-scale technological organization and land use behavior. These first results of survey, lithic assemblage analysis, and test excavation indicate that Barozh-12 was frequently re-occupied over time for a variety of purposes, and is tentatively considered a "persistent place" (cf. Schlanger 1992) in the diachronic regional settlement and mobility system. Its geomorphic position on a plateau bounded by two stream valleys overlooking the Ararat Depression probably represents an optimal location for repeated occupation, at the boundary of upland and lowland biotopes, near abundant lithic raw material sources.

Ongoing research includes excavation with chronometric, geological and palaeoenvironmental sampling, and techno-typological and geochemical analysis of a large sample of surface and excavated artifacts. These efforts also include further survey in the area of Barozh-12, and in northeastern Turkey to document Paleolithic sites and assemblages and expand the view of raw material transport patterns to the west.

7. Concluding remarks

During the last century, in addition to the Yerevan and Lusakert caves, several well stratified Middle Paleolithic sites have been recorded allowing us to divide the Armenian Middle Paleolithic into three chronological sub-periods – early, middle, and late. Among the early Middle Paleolithic sites are Bagratashen-1 in the Debed River valley and Aghavnatun-1 in the Ararat Depression. Both sites are open-air and preliminary analyses suggest that they may represent multi-purpose camps with lithic industries based mainly on dacite raw materials. Such sites are very rare in the southern Caucasus and one can discern parallels with the elongated points of the "Djruchula-Kudaro" tradition of the Caucasian Middle Paleolithic sites. If typological similarities are any indication, the Bagratashen-1 occupation may fall within the penultimate glacial cycle (MIS 7-6). This assessment, however, must be tested further with chronometric age determinations. Traces of slightly later Middle Paleolithic settlement has been recorded at the high altitude cave site of Hovk-1, where a sparse lithic assemblage indicates a short-term human visit during the early glacial period (MIS 5). Hovk-1 cave is the only middle Middle Paleolithic site currently known in Armenia, and it is likely that humans exploited such high altitude ecological niches for seasonal hunting. The late Middle

Paleolithic sites discovered or re-excavated during the last decade, Lusakert-1 cave, Angeghakot-1 cave, Kalavan-2 and Barozh-12 open-air sites have a wider geographic and functional distribution. Coinciding with the beginning of MIS 4 and the early part of MIS 3, they vary by means of environmental diversity, raw material source exploitation strategies and socio-economic behaviors and permit us to reconstruct the lifeways of late Middle Paleolithic hominins within the territory of Armenia.

References

Adler, D.S. and Bar-Oz, G. (2009) Seasonal Patterns of Prey Acquisition during the Middle and Upper Palaeolithic of the Southern Caucasus. In: Hublin, J.-J. and Richards, M. (eds.), *The Evolution of Hominid Diets: Integrating approaches to the study of Palaeolithic subsistence*. Leipzig: Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, pp. 127–140.

Adler, D.S. Bar-Oz, G., Belfer-Cohen, A. and Bar-Yosef, O. (2006) Ahead of the Game: Middle and Upper Palaeolithic Hunting Practices in the Southern Caucasus. *Current Anthropology* 47 (1), pp. 89–118.

Adler, D.S., Yeritsyan, B., Wilkinson, K., Pinhasi, R., Bar-Oz, G., Nahapetyan, S., Mallol, C., Berna, F., Bailey, R., Schmidt, B.A., Glauberman, P., Wales, N. and Gasparyan, B. (2012) The Hrazdan Gorge Palaeolithic project, 2008-2009. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15−17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 21−37.

Azizyan, H.A. (1979) Paleontologicheskie nakhodki iz peshcheri-obitalishcha v kan’one reki Razdan (Paleontological finds from a cave site in the Hrazdan River canyon). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (85), pp. 277−283 (in Russian).

Azizyan, H.A. (1982) Bratso mardy ev nra ekologian Hrazdani kirchi karayr-katsarannerum (Early Man and its ecology in the caves of the Hrazdan canyon). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (97), pp. 162–172 (in Armenian).

Azizyan, H.A., Chagharyan, A.D., Simonyan, E.E. and Shaverdyan, S.V. (1975) Raskopki v okrestnostyakh Yerevana (Excavations in surroundings of Yerevan). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1974 goda* (Archaeological Discoveries for year 1974). Moscow: “Nauka” Publishing House, p. 477 (in Russian).

Barkai, R., Gopher, A. and Shimelmitz, R. (2005) Middle Pleistocene blade production in the Levant: an Amudian assemblage from Qesem cave, Israel. *Eurasian Prehistory* 3 (2), pp. 39–74.

Bar-Oz, G. and Adler, D.S. (2005) The Taphonomic History of the Middle and Upper Palaeolithic Faunal Assemblages from Ortvale Klde, Georgian Republic. *Journal of Taphonomy* 3 (4), pp. 185–211.

Bar-Oz, G., Belfer-Cohen, A., Meshveliani, T., Djakeli, N., and Bar-Yosef, O. (2008) Taphonomy and Zooarchaeology of the Upper Palaeolithic Cave of Dzudzuana, Republic of Georgia. *International Journal of Osteoarchaeology* 18, pp. 131–151.

Bar-Oz, G., Weissbrod, L., Gasparyan, B., Nahapetyan, S., Wilkinson, K. and Pinhasi, R. (2012) Taphonomy and zooarchaeology of a high-altitude Upper Pleistocene faunal sequence from Hovk-1 Cave, Armenia. *Journal of Archaeological Science* 39, pp. 2452–2463.

Bayburtyan, Ye.A. (1937) Noviye nakhodki kamennogo veka v Amenii (New Stone Age finds in Armenia). *Sovetskaya Arkheologiya* (Soviet Archaeology) 3, pp. 206−208 (in Russian).

Bayburtyan, Ye.A. (1938) Ashkhatanki gortsiknery Hin Hayastanum (Yst Haykakan KSH Petakan Patmakan Tangarani nyuteri) (Tools in Ancient Armenia [Based on the materials of Armenian SSR State Historical Museum]). *HKSH Patmutyan ev Grakanutyn Iinstituti Teghekagir, Girk I* (Bulletin of the Institute of History and Literature of the Armenian SSR, Book I), pp. 193−231 (in Armenian).

Beliaeva, E.V. and Lioubine, V.P. (1998) The Caucasus-Levant-Zagros: possible relations in the Middle Paleolithic, In: Otte, M. (ed.), *Préhistoire d'Anatolie. Genese de deux mondes*. Actes du colloque international, Liege, 28 avril – 3 mai, 1997. ERAUL 85, Vol. I. Liège: Université de Liège, pp. 39−55.

Chagharyan, A.D., Yeritsyan, B.G. and Karapetyan, K.I. (1972) Ob issledovanii peshcheri Zovuni (About investigation of Zovuni cave). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1971 goda* (Archaeological Discoveries for year 1971). Moscow: "Nauka" Publishing House, p. 492 (in Russian).

Cherkinsky, A. and Chataigner, C. (2010) 14C Ages of bone fractions from Armenian Prehistoric sites. *Radiocarbon* 52, Nr. 2-3, pp. 569–577.

Cleghorn, N.E. (2006) *A Zooarchaeological Perspective On The Middle To Upper Paleolithic Transition At Mezmaiskaya Cave, The Northwestern Caucasus, Russia.* Ph.D. Dissertation, Stony Brook University.

Cohen, V.Yu. and Stepanchuk, V.N. (1999) Late Middle and Early Upper Paleolithic evidence from the East European Plain and Caucasus: A new look at variability, interactions, and transitions. J*ournal of World Prehistory* 13 (3), pp. 265−319.

de Morgan, J. (1909) Les Stations Prehitoriques De L'Alagheuz (Arménie Russe). *Revue de l'Ecole d'Anthropologie de Paris*, pp. 189-204.

Dibble, H.L. and McPherron, S.J.P. (2006) The Missing Mousterian. *Current Anthropology* 47 (5), pp. 777–803.

Doronichev, V.B. (2008) The Lower Paleolithic in Eastern Europe and the Caucasus: A Reappraisal of the Data and New Approaches. *PaleoAnthropology*, pp. 107−157.

Doronichev, V. and Golovanova, L. (2010) Beyond the Acheulean: A view on the Lower Paleolithic occupation of Western Eurasia. *Quaternary International* 223-224, pp. 327−344.

Egeland, C.P., Gasparian, B., Arakelyan, D., Byerly, R.M., Nicholson, C.M. and Zardaryan, D. (2011) Multiperiod archaeological reconnaissance in the Debed River valley, north-eastern Armenia. *Antiquity* 85 (229) (http://antiquity.ac.uk/projgall/egeland329/).

Egeland, C.P., Gasparian, B., Arakelyan, D., Nicholson, C.M., Petrosyan, A., Ghukasyan, R., Byerly, R.M. (2014) Reconnaissance survey for Palaeolithic sites in the Debed River Valley, northern Armenia. *Journal of Field Archaeology* 39/4, pp. 370-386.

Egeland, C.P., Gasparian, B., Fadem, C., Arakelyan, D., Miller, C., Nahapetyan, S., Armitage, S. and Nicholson, C.M. (2013) Middle Paleolithic Occupations in the Debed River Valley (Lori Depression, Northeastern Armenia). In: Abstracts of Oral Contributions, *The Role of the Southern Caucasus on Early Human Evolution and Expansion – Refuge, Hub or Source Area?* Workshop organized by Bruch, A.A. and Lordkipanidze, D. October 15-20, 2013, Tbilisi, Georgia, p. 24.

Egeland, C.P., Nicholson, C.M. and Gasparian, B. (2010) Using GIS and ecological variables to identify high potential areas for paleanthropological survey: an example from Northern Armenia. *Journal of Ecological Anthropology* 14 (1), pp. 89−98.

Fourloubey, C., Beauval, C., Colonge, D., Liagre, J., Ollivier, V. and Chataigner, C. (2003) Le Paléolithique en Arménie: Etat de connaissances acquises et données récentes. *Paléorient* 29/1, pp. 5−18.

Frahm, E., Schmidt, B.A., Gasparyan, B., Yeritsyan, B., Karapetyan, S., Meliksetyan, Kh. and Adler, D.S. (2014a) Ten seconds in the field: rapid Armenian obsidian sourcing with portable XRF to inform excavations and surveys. *Journal of Archaeological Science* 41, pp. 333−348.

Frahm, E., Feinberg, J.M., Schmidt-Magee, B.A., Wilkinson, K., Gasparyan, B., Yeritsyan, B., Karapetian, S., Meliksetian, Kh., Muth, M.J. and Adler, D.S. (2014b) Sourcing geochemically identical obsidian: multiscalar magnetic variations in the Gutansar volcanic complex and implications for Palaeolithic research in Armenia. *Journal of Archaeological Science* 47, pp. 164−278.

Gasparian, B. (2010) Landscape organization and resource management in the Lower Paleolithic of Armenia. *TÜBA-AR* 13, pp.159−183.

Gasparyan, B. (1998) Tsitsernakaberd-2 paleolityan norahayt karayr katsarany (Newly discovered Paleolithic cave site of Tsitsernakaberd-2). In: Kalantaryan, A.A. and Harutyunyan, S.B. (eds.), *Hin Hayastani mshakuyty XI* (Culture of Ancient Armenia XI). Abstracts of Scientific Conference dedicated to the memory of professor K. Ghafadaryan. Yerevan: Republic of Armenia Academy of Sciences Institute of Archaeology and Ethnography Press, pp. 15−16 (in Armenian).

Gasparyan, B. (2007a) In: de Clairfontaine, F.F. (ed.), *Dans les montagnes d' Arménie, 500 000 ans d'histoire avant notre ére*. Rouen, Saint Raphaël, pp. 47−51, 130−133.

Gasparyan, B. (2007b) Le peuplement de L'Armenie au Paleolithique. *Les dossiers d'archéologie* 321, pp. 24−29.

Gasparyan, B., Nahapetyan, S., Arakelyan, D., Colonge, D. and Chataigner, C. (2004) Mestonakhozhdeniya kamennogo veka Aparanskoy kotlovini (Respublika Armeniya) (Stone Age sites of the Aparan Depression [Republic of Armenia]). In: Gambashidze, G. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). International Scientific Conference dedicated to 90th anniversary of the academician A.M. Apakidze, Collection of abstracts of the reports. Tbilisi: "Nekeri" Publishing House, pp. 49−50 (in Russian).

Gasparyan, B., Nahapetyan, S., Jaubert, J., Chataigner, C. and Ollivier, V. (2003) Novoe Paleoliticheskoe mestonakhozhdenie Mulki-4 (Newly discovered Paleolithic open-air site of Mulki-4). In: Kalantaryan, A. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus).

Materials of International Conference, Yerevan, 17−18 November, 2003. Yerevan: Mother See of Holy Echmiadzin Press, pp. 30–37 (in Russian).

Gasparyan, B., Nahapetyan, S., Sargsyan, G. and Gabrielyan, I. (2005) Kamenniy vek Tashirskogo plato (Stone Age of the Tashir Plateau). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: "Mughni" Publishing House, pp. 17−27 (in Russian).

Gasparyan, B. and Sargsyan, G. (2003) Kasakhi kirchi hnagitakan hushardzanneri usumnasirutyan nakhnakan ardyunknery (Preliminary results of investigation of the archaeological monuments in the Kasakh River Canyon). *The Jubilee Conference "Aragatsotn. Spiritual and Cultural Heritage", dedicated to the 1700th anniversary of the unction of the Mother Temple of Holy Ejmiatsin*. Theses of the Conference. Oshakan, pp. 58−59 (in Armenian).

Ghazaryan, H.P. (1979) Ob etnospetsifichnosti funktsiy must'erskikh orudiy (po materialam Kavkaza) (On the ethno-specific character of the functions of the Mousterian tools [on the materials of the Caucasus]). *Lraber Hasarakakan gitutyunneri* (Herald of Social Sciences) 9 (441), pp. 98−110 (in Russian).

Ghazaryan, H.P. (1986) Verkhneashel'skoe mestonakhozhdenie Atis I (Upper Acheulian open-air site Hatis I). In: Shilov, V.P. (ed.), *Arkheologicheskiye otkritiya 1984 goda* (Archaeological Discoveries of the year 1984). Moscow: "Nauka" Publishing House, pp. 433–434 (in Russian).

Ghazaryan, H.P. (1991) Hatis V paleolityan arhestanotsy (Paleolithic workshop Hatis V). In: Tiratsyan, G.A. (ed.), *Hayastani Hanrapetutyunum 1989−1990 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to Archaeological Fieldwork Results in the Republic of Armenia in 1989−1990). Yerevan: Armenian Academy of Sciences Press, pp. 3−4 (in Armenian).

Ghazaryan H.P. (1993) Butchery knives in the Mousterian sites of Armenia. In: Anderson, P., Beyries, S., Otte, M. and Plisson, H. (eds.), *Traces et function: les gests retrouvés*. Collogue International de Liège. Editions ERAUL vol. 50. Liège: Université Liège, pp. 79−85.

Ghukasyan, R., Colonge, D., Nahapetyan, S., Ollivier, V., Gasparyan, B., Monchot, H. and Chataigner, C. (2011) Kalavan-2 (North of Lake Sevan, Armenia): A New Late Middle Paleolithic Site in the Lesser Caucasus. *Archaeology, Ethnology and Anthropology of Eurasia* 38/4, pp. 39−51.

Golovanova, L.V., Cleghorn, N., Doronichev, V.B., Hoffecker, J.F., Burr, G.S. and Sulergizkiy, L.D. (2006) The Early Upper Paleolithic in the Northern Caucasus (New Data from Mezmaiskaya Cave, 1997 Excavation). *Eurasian Prehistory* 4 (1–2), pp. 43–78.

Golovanova, L.V. and Doronichev, V.B. (2003) The Middle Paleolithic of the Caucasus. *Journal of World Prehistory* 17/1, pp. 71−140.

Gopher, A., Ayalon, A., Bar-Matthews, M., Barkai, R., Frumkin, A., Karkanas, P. and Shahack-Gross, R. (2010) The Chronology of the Late Lower Paleolithic in the Levant Based on U/Th Ages of Speleothems from Qesem Cave, Israel. *Quaternary Geochronology* 5, pp. 644–656.

Hasratyan, M.S. (1985) Hnagitakan hetazotutyunner Sisianum (Archaeological investigations in Sisian), In: Arakelyan, B.N., Barkhudaryan, V.B., Zaryan, R.V. and Gharibjanyan, G.B. (eds.), *Patma-Hnagitakan Hetazotutyunner* (Historical-Archaeological Investigations). Yerevan: Armenian SSR Academy of Sciences Press, pp. 166−201 (in Armenian).

Inizan, M.-L., Reduron, M., Roche, H. and Tixier, J. (1995) *Technologie de la pierre taillée. Préhistoire de la Pierre Taillée, Tome 4*. Meudon: CREP.

Karapetyan, K.I. (1977) Usloviya obrazovaniya paleoliticheskikh peshcher ushchel'ya reki Razdan (Armyanskaya SSR) (The conditions of formation of the Paleolithic caves in the canyon of the Hrazdan River [Armenian SSR]). In: Aslanyan (ed.), *Geologia chetvertichnogo perioda (Pleystotsen), K X kongressu INQUA, Birmingem 1977* (Geology of the Quaternary Period [Pleistocene], for the X Congress of INQUA, Birmingham 1977). Yerevan: Armenian SSR Academy of Sciences Press, pp. 110−117 (in Russian).

Karapetyan, K.I. (1978) Usloviya formirovaniya peshchernikh otlozheniy nizhnepaleoliticheskoy stoyanki Yerevan 1 (The conditions of formation of the cave sediments in Lower Paleolithic site Yerevan 1). *Izvestiya Akademii Nauk Armyanskoy SSR, Nauki o Zemle* (Bulletin of the Academy of Sciences of the Armenian SSR, Earth Sciences) Volume XXXI, Issue 4, pp. 52−60 (in Russian).

Karapetyan, K.I. (1983a) O zarozhdenii znaniy geologicheskogo kharaktera (na primere kamennogo veka territorii Armyanskoy SSR) (On the origins of geological knowledge [on the example of the Stone Age of the territory of the Armenian SSR]), In: Aslanyan, A.T. and Sayadyan, YU.V. (eds.), *Voprosi geologii chetvertichnogo perioda Armenii, K XI kongressu INQUA, Moskva 1982* (Questions of Geology of the Quaternary Period of Armenia, for the XI Congress of INQUA, Moscow 1982). Yerevan: Armenian SSR Academy of Sciences Press, pp. 75−84 (in Russian).

Karapetyan, K.I. (1983b) Ob ispol'zovanii dannikh arkheologii pri stratigraficheskom raschlenenii chetvertichnikh vulkanitov Armyanskoy SSR (About using of the archaeological data during stratigraphic division of the Quaternary vulcanite of the Armenian SSR). In: Aslanyan, A.T. and Sayadyan, YU.V. (eds.), *Voprosi geologii chetvertichnogo perioda Armenii, K XI kongressu INQUA, Moskva 1982* (Questions of Geology of the Quaternary Period of Armenia, for the XI Congress of INQUA, Moscow 1982). Yerevan: Armenian SSR Academy of Sciences Press, pp. 85−94 (in Russian).

Karapetyan, K.I. and Yeritsyan, B.G. (1969) Novoe Yerablurskoe must'erskoe mestonakhozhdenie v Armenii (New Mousterian open-air site of Yerablur in Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 2 (45), pp. 171−176 (in Russian).

Kolpakov, E. (2009) The Late Acheulian Site of Dashtadem-3 in Armenia. *PaleoAnthropology* 2009, pp. 3–31.

Liagre, J., Gasparyan, B., Ollivier, V. and Nahapetyan, S. (2006) Angeghakot 1 (Armenia) and the identification of the Mousterian cultural facies of "Yerevan points" type in the Southern Caucasus. *Paléorient* 32/1, pp. 5−18.

Lyubin, V.P. (1984) Ranniy Paleolit Kavkaza (Early Paleolithic of the Caucasus). In: Boriskovskiy, P.I. (ed.), *Paleolit SSSR* (Paleolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 45−93 (in Russian).

Lyubin, V.P. (1989) Paleolit Kavkaza (Paleolithic of Caucasus). In: Boriskovskiy, P.I. (ed.), *"Paleolit Kavkaza i Severnoy Azii"*, iz serii "Paleolit Mira, Issledovaniya po Arkheologii Drevnego Kamennogo Veka" ("The Paleolithic of Caucasus and Northern Asia", from Series of "The Old Stone Age of the World, Studies in the Paleolithic Cultures"). Leningrad: "Nauka" Publishing House, Leningrad Branch, pp. 7−142 (in Russian).

Lyubin, V.P. (1998) *Ashel'skaya epokha na Kavkaze* (The Acheulian Epoch in the Caucasus). Rossiyska Akademia Nauk, Institut Istorii Material'noy Kul'turi, Arkheologicheskie iziskaniya, 47, Paleolit Kavkaza, kn. 1 (Russian Academy of Sciences, Institute for the Material Culture History, Archaeological Studies, 47, Paleolithic of Caucasus, book1). St. Petersburg: "Peterburgskoe Vostokovedenie" Publishing House (in Russian).

Lyubin, V.P. and Balyan, S.P. (1961) Noviye nakhodki kul'turi paleolita na vulkanicheskom nagorii Armyanskoy SSR (New findings of Paleolithic culture on the volcanic highlands of the Armenian SSR). *Dokladi Akademii Nauk Armyanskoy SSR* (Report of the Armenian SSR Academy of Sciences) Volume XXXIII, N2, pp. 67−72 (in Russian).

Martirosyan, H.A. (1968) Arkheologicheskie otkritiya v Armenii (Archaeological discoveries in Armenia). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1967 goda* (Archaeological Discoveries for year 1967), Moscow: "Nauka" Publishing House, pp. 308−313 (in Russian).

Martirosyan, H.A. (1969) Hayastani nakhnadaryan mshakuyti nor hushardzanner (New sites of the Prehistoric Culture of Armenia). *Patma-Banasirakan Handes* (Historical-Philological Journal) 3 (46), pp. 191−208 (in Armenian).

Martirosyan, H.A. (1970) Issledovanie peshcher v kan'one reki Razdan i naskal'nikh izobrazheniy v Gegamskikh gorakh i Shamirame (Investigations of caves in the Hradan River canyon and petroglyphs in Gagham Range and Shamiram). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1969 goda* (Archaeological Discoveries for year 1969). Moscow: "Nauka" Publishing House, p. 384 (in Russian).

Martirosyan, H.A. (1974) Hayastani hnaguyn mshakuyti usumnasirutyuny ev nra zargatsman herankarnery (Investigations of the ancient culture of Armenia and the perspectives of its development). *Lraber Hasarakakan gitutyunneri* (Herald of Social Sciences) 7 (379), pp. 25−39 (in Armenian).

Meignen, L. and Tushabramishvili N. (2006) Paléolithique moyen laminaire sur les flancs sud du Caucasus: productions lithiques et fonctionnement du site de Djruchula (Georgie). *Paléorient* 32/2, pp. 81−104.

Mercier, N., Valladas, H., Froget, L., Joron, J.L., Reyss, J.L., Weiner, S., Goldberg, P., Meignen, L., Bar-Yosef, O., Belfer-Cohen, A., Chech, A., Kuhn, S.L., Stiner, M.C., Tillier, A.M., Arensburg, B. and Vandermeersch, B. (2007). Hayonim Cave: a TL-based chronology for this Levantine Mousterian sequence. *Journal of Archaeological Science* 34, pp. 1064−1077.

Mercier, N., Valladas, H., Meignen, L., Joron, J.-L., Tushabramishvili, N., Adler, D.S. and Bar-Yosef, O. (2010) Dating the early Middle Palaeolithic laminar industry from Djruchula Cave, Republic of Georgia. *Paléorient* 36/2, pp. 163−173.

Panichkina, M.Z. (1950) *Paleolit Armenii* (Paleolithic of Armenia). Leningrad: State Hermitage Press (in Russian).

Panichkina, M.Z. (1951) Ashirabadskoe must'yerskoe mestonakhozhdenie v Armenii (Ashirabad Mousterian open-air site in Armenia). In: Udal'tsov, A.D. (ed.), *Kratkiye soobshcheniya o dokladakh i polevikh issledovaniyakh Instituta Istorii Material'noy Kul'turi* (Abstracts of Reports and Field Investigations of the Institute of History of Material Culture) XXXVI. Moscow-Leningrad: USSR Academy of Sciences Press, pp. 76−86 (in Russian).

Petrosyants, V.M. (1988) *Nig-Aparani patma-chartarpetakan hushardzannery* (Historical-cultural monuments of Nig-Aparan). Yerevan: "Hayastan" Publishing House (in Armenian).

Pinhasi, R., Gasparian, B., Nahapetyan, S., Bar-Oz, G., Weissbrod, L., Bruch, A.A., Hovsepyan, R. and Wilkinson, K. (2011) Middle Paleolithic human occupation of the high altitude region of Hovk-1, Armenia. *Quaternary Science Reviews* 30, pp. 3846−3857.

Pinhasi, R., Gasparyan, B., Nahapetyan, S., Bar-Oz, G., Weissbrod, L., Bruch, A., Hovsepyan, R. and Wilkinson, K. (2012) Middle Palaeolithic occupation at Hovk-1, Armenia. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15−17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 38−51.

Pinhasi, R., Gasparyan, B., Wilkinson, K., Bailey, R., Bar-Oz, G., Bruch, A., Chataigner, C., Hoffmann, D., Hovsepyan, R., Nahapetyan, S., Pike, A.W.G., Schreve, D. and Stepehens, M. (2008) Hovk-1 and the Middle and Upper Paleolithic of Armenia: a preliminary framework. *Journal of Human Evolution* 55 (5), pp. 803−816.

Rink, W.J., Schwarcz, H.P., Weiner, S., Goldberg, P., Meignen, L. and Bar-Yosef, O. (2004) Age of the Mousterian industry at Hayonim Cave, Northern Israel, using electron spin resonance and 230Th/234U methods. *Journal of Archaeological Science* 31, pp. 953−964.

Sardaryan, S.H. (1954) *Paleolit v Armenii* (Paleolithic in Armenia). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Sardaryan, S.H. (1967) *Nakhnadaryan hasarakutyuny Hayastanum* (Primitive Society in Armenia). Yerevan: "Mitk" Publishing House (in Armenian, with Russian and English Resume).

Schlanger, S.H. (1992) Recognizing persistent places in Anasazi settlement systems. In: Rossignol, J. and Wandsnider, L. (eds.), *Space, time, and archaeological landscapes*. New York: Springer, pp. 91−112.

Shimelmitz, R., Barkai, R. and Gopher, A. (2011) Systematic blade production at late Lower Paleolithic (400−200 kyr) Qesem Cave, Israel. *Journal of Human Evolution* 61, pp. 458–479.

Slimak, L., Kuhn, S.L., Roche, H., Mouralis, D., Buitenhuis, H., Balkan-Atlı, N., Binder, D., Kuzucuoglu, C. and Guillou, H. (2008) Kaletepe Deresi 3 (Turkey): Archaeological evidence for early human settlement in Central Anatolia. *Journal of Human Evolution* 54, pp. 99–111.

Taskıran, H. (2008) Thoughts about the Acheulean in Anatolia. *L'Anthropologie* 112, pp. 140–152.

Yeritsyan, B.G. (1970a) Karedaryan kayanner Noyemberyani shrjanum (Stone Age sites in Noyemberyan district). *Lraber Hasarakakan Gitutyunneri* (Herald of Social Sciences) 5 (234), pp. 84−90 (in Armenian).

Yeritsyan, B.G. (1970b) *Yerevanskaya peshchernaya stoyanka i ee mesto sredi dreneyshix pamyatnikov Kavkaza* (Yerevan cave site and its place among the ancient monuments of the Caucasus). Avtoreferat dissertatsii na soiskanie uchenoy stepeni kandidata istoricheskix nauk (Synopsis of Candidate Dissertation). Moscow (in Russian).

Yeritsyan, B.G. (1970c) Novaya Paleoliticheskaya peshchernaya stoyanka Yerevan II (New Paleolithic cave site Yerevan II). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1969 goda* (Archaeological Discoveries for year 1969). Moscow: "Nauka" Publishing House, p. 385 (in Russian).

Yeritsyan, B.G. (1971) La station de Paléolithique inférieur dans la caverne "Erevan I" et sa culture. In: *VIII Congres international des sciences préhistoriques et protohistoriques (Belgrade, 1971), Les rapports et les communications délégation des archéologiques de l'URSS*. Moscou, pp. 1–10.

Yeritsyan, B.G. (1972) Nekotoriye ossobennosti namerennogo rassecheniya orudiy must'erskoy epokhi (po materialam Yerevanskoy peshchernoy stoyanki) (Some features of intentional truncation of Mousterian tools [based on the materials of Yerevan cave site]). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N131*, *Kamenniy vek* (Stone Age). Moscow: "Nauka" Publishing House, pp. 53–60 (in Russian).

Yeritsyan, B.G. (1975) Novaya nizhnepaleoliticheskaya peshchernaya stoyanka Lusakert 1 (New Lower Paleolithic cave site of Lusakert 1). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N141, Kamenniy vek* (Stone Age). Moscow: "Nauka" Publishing House, pp. 42–50 (in Russian).

Yeritsyan, B.G. (1976a) Issledovanie peshcheri Lusakert (Investigations at the Lusakert cave), In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1975 goda* (Archaeological Discoveries for year 1975). Moscow: "Nauka" Publishing House, p. 509 (in Russian).

Yeritsyan, B.G. (1976b) The life style and habitat of Middle Paleolithic man in Transcaucasia. In: *IX International Congress of Prehistoric and Protohistoric Sciences, Reports and communications by archaeologists of the USSR*. Moscow, pp. 14–17.

Yeritsian, B. and Gasparian, B. (1996) La Grotte Erevan-1, Arménie. In: Santrot, J. (ed.), *Trésors de l'Arménie ancienne, des origines au IVe siècle*. Paris: Somogy Editions d'Art, p. 33.

Yeritsyan, B.G. and Ghazaryan, H.P. (1977) Raboti Lusakertskoy ekspeditsii (The works of Lusakert expedition). In: Ribakov, B.A. (ed.), *Arkheologicheskiye otkritiya 1976 goda* (Archaeological Discoveries of the year 1976). Moscow: "Nauka" Publishing House, pp. 498–499 (in Russian).

Yeritsyan, B.G. and Korobkov, I.I. (1979) Issledovanie paleoliticheskikh pamyatnikov v srednem techenii reki Razdan (Study of Paleolithic sites in the middle stream of the Hrazdan River). In: Ribakov, B.A. (ed.), *Arkheologicheskiye otkritiya 1978 goda* (Archaeological Discoveries of the year 1978). Moscow: "Nauka" Publishing House, pp. 519–520 (in Russian).

Yeritsyan, B.G. and Semyonov, S.A. (1971) Novaya nizhnepaleoliticheskaya peshchera Yerevan (New Lower Paleolithic cave of Yerevan). In: Kruglikova, I.T. (ed.), *Kratkiye soobshcheniya Instituta Arkheologii* (Briefs of the Institute of Archaeology), *N126, Paleolit i Neolit* (Paleolithic and Neolithic). Moscow: "Nauka" Publishing House, pp. 32–36 (in Russian).

Yeritsyan, B.G. and Tadevosyan, S.V. (1986) Paleoliticheskaya peshchernaya stoyanka Lusakert 1 (Paleolithic cave site Lusakert 1). In: Shilov, V.P. (ed.), *Arkheologicheskiye otkritiya 1984 goda* (Archaeological Discoveries of the year 1984), Moscow: "Nauka" Publishing House, p. 432 (in Russian).

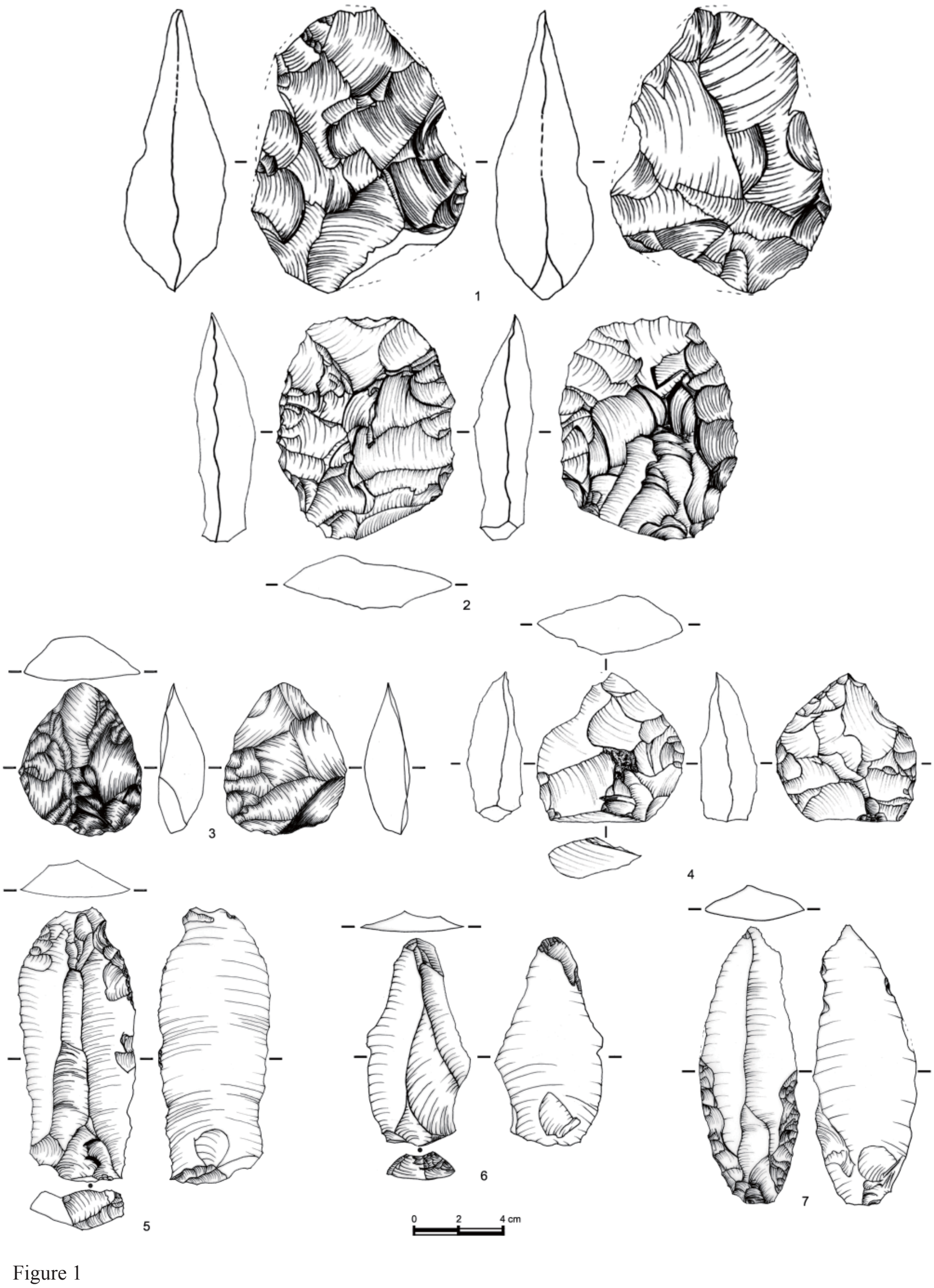

Figure 1
Nor Geghi-1 open-air site. 1-4. Bifaces (obsidian); 5. Blade with retouch (obsidian); 6. Blade (obsidian); 7. Point with retouched base (obsidian).

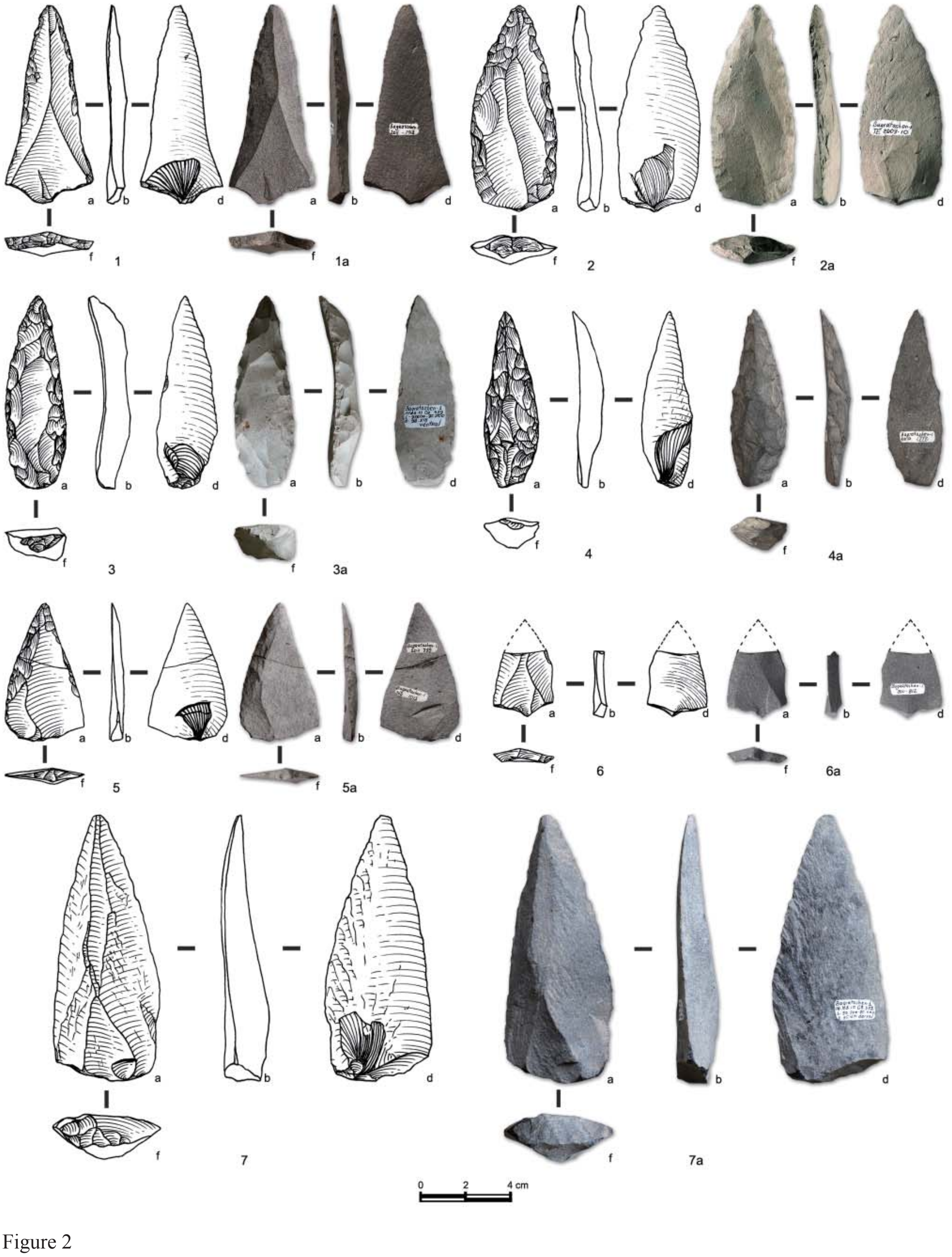

Figure 2

Bagratashen-1 open-air site. 1-1a, 6-6a. Levallois points with faceted bases (dacite); 2-2a, 5-5a. Levallois points (limestone, dacite); 3-3a – 4-4a. Mousterian points (flint, dacite); 7-7a. Levallois point with truncated and faceted base (dacite).

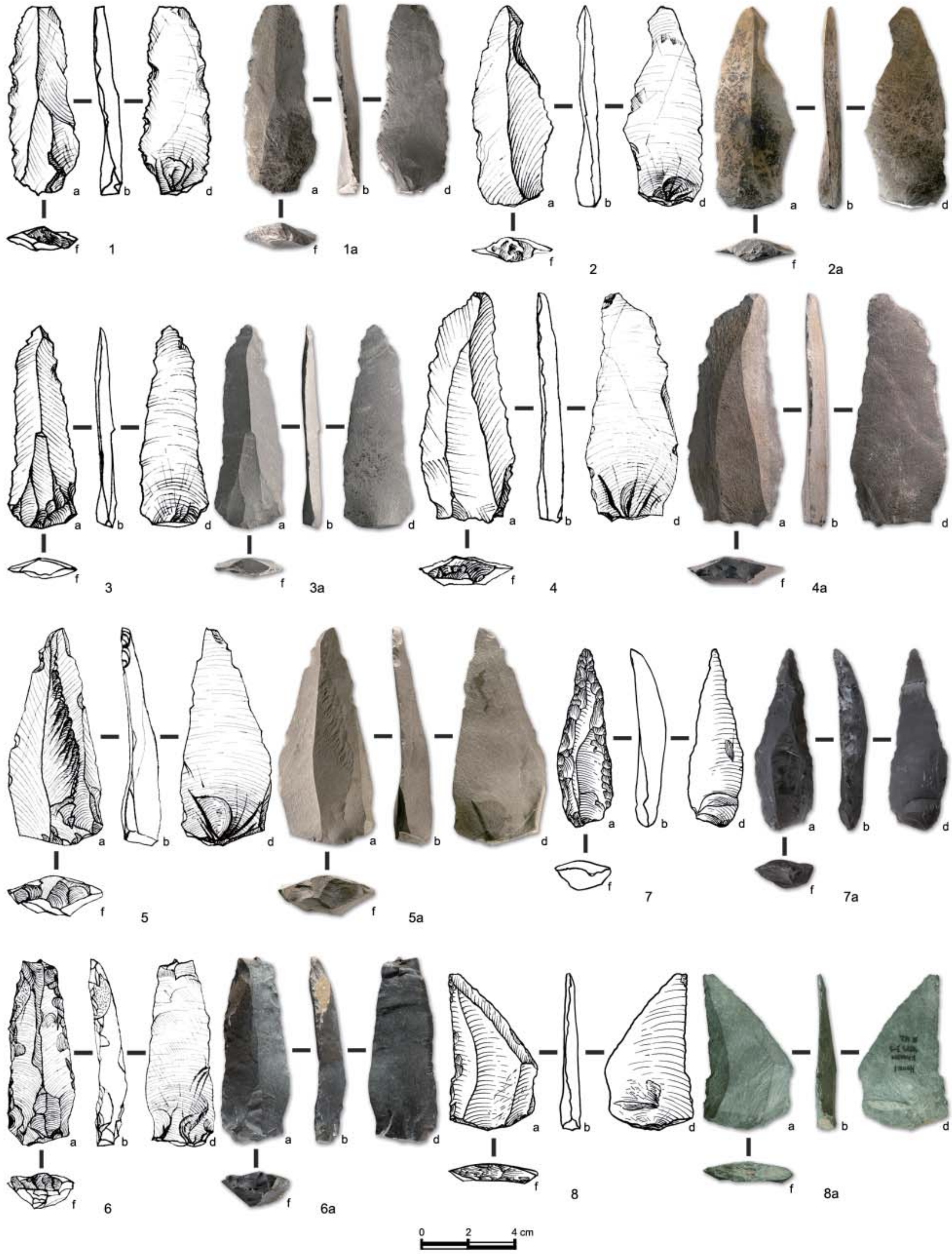

Figure 3
Hovk-1 cave. Levallois and Mousterian points from Unit 8 and "karren". 1-1a – 5-5a. Levallois points (limestone), 7-7a. Mousterian point (obsidian); 6-6a – 8-8a. Levallois points (flint).

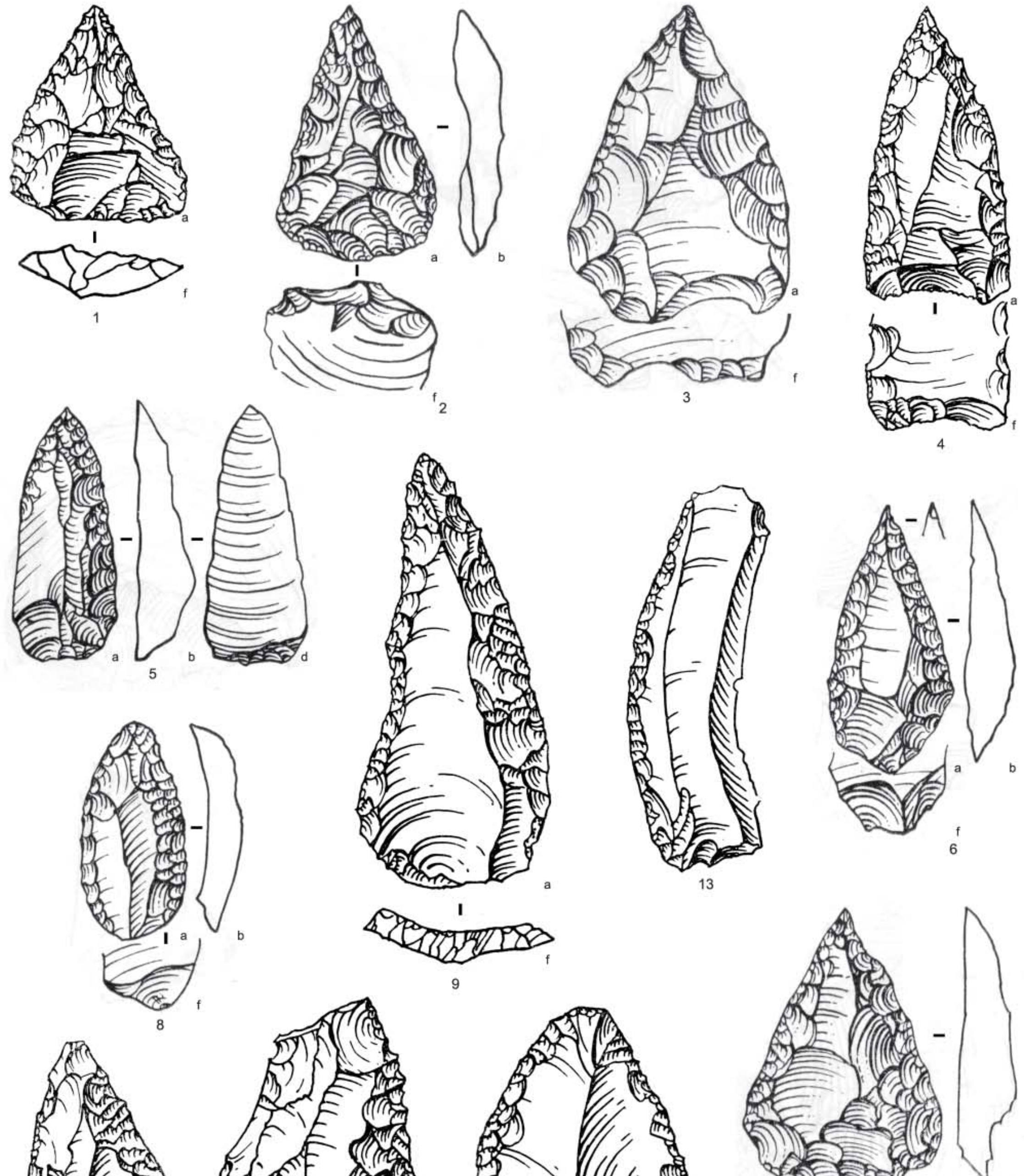

Figure 4

Yerevan-1 cave. Drawings of obsidian lithic artifacts from B.G. Yeritsyan's excavtions (after Yeritsyan, in: Lyubin 1984; 1989). 1-8. "Yerevan points"; 9. Levallois point; 10-13. Side scrapers.

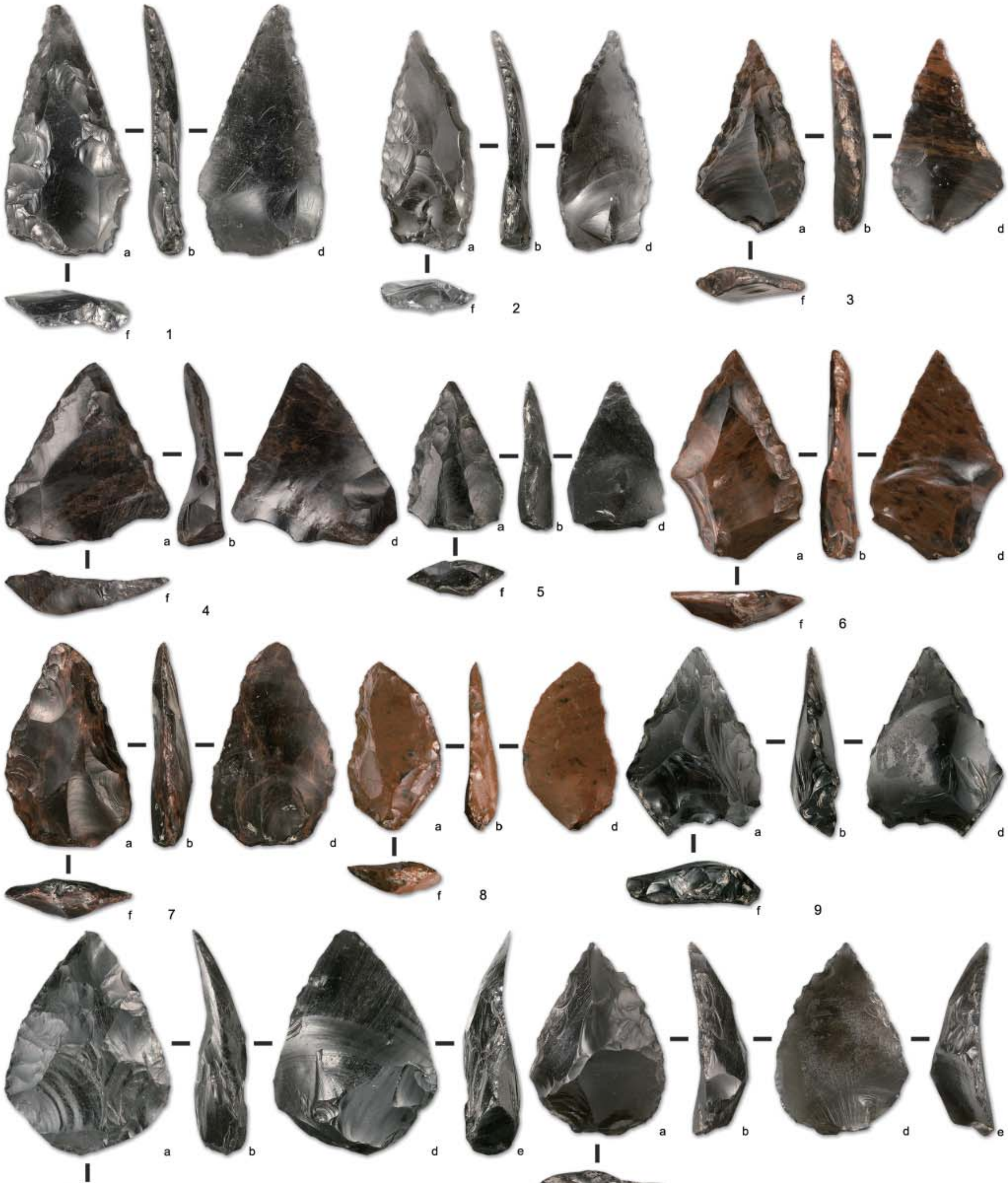

Figure 5
Yerevan-1 cave. 1-11. Small Levallois and Mousterian points (obsidian). B.G. Yeritsyan's excavtions (Units 3-1).

Figure 6

Yerevan-1 cave. 1-3. Proximal fragments of truncated Mousterian points (obsidian); 4-9. “Yerevan points” (obsidian); 10, 12-13. Truncated and recycled “Yerevan Points” (obsidian); 11, 14. “Yerevan points” with truncation and resharpening removals (obsidian). B.G. Yeritsyan’s excavations (Units 3-1).

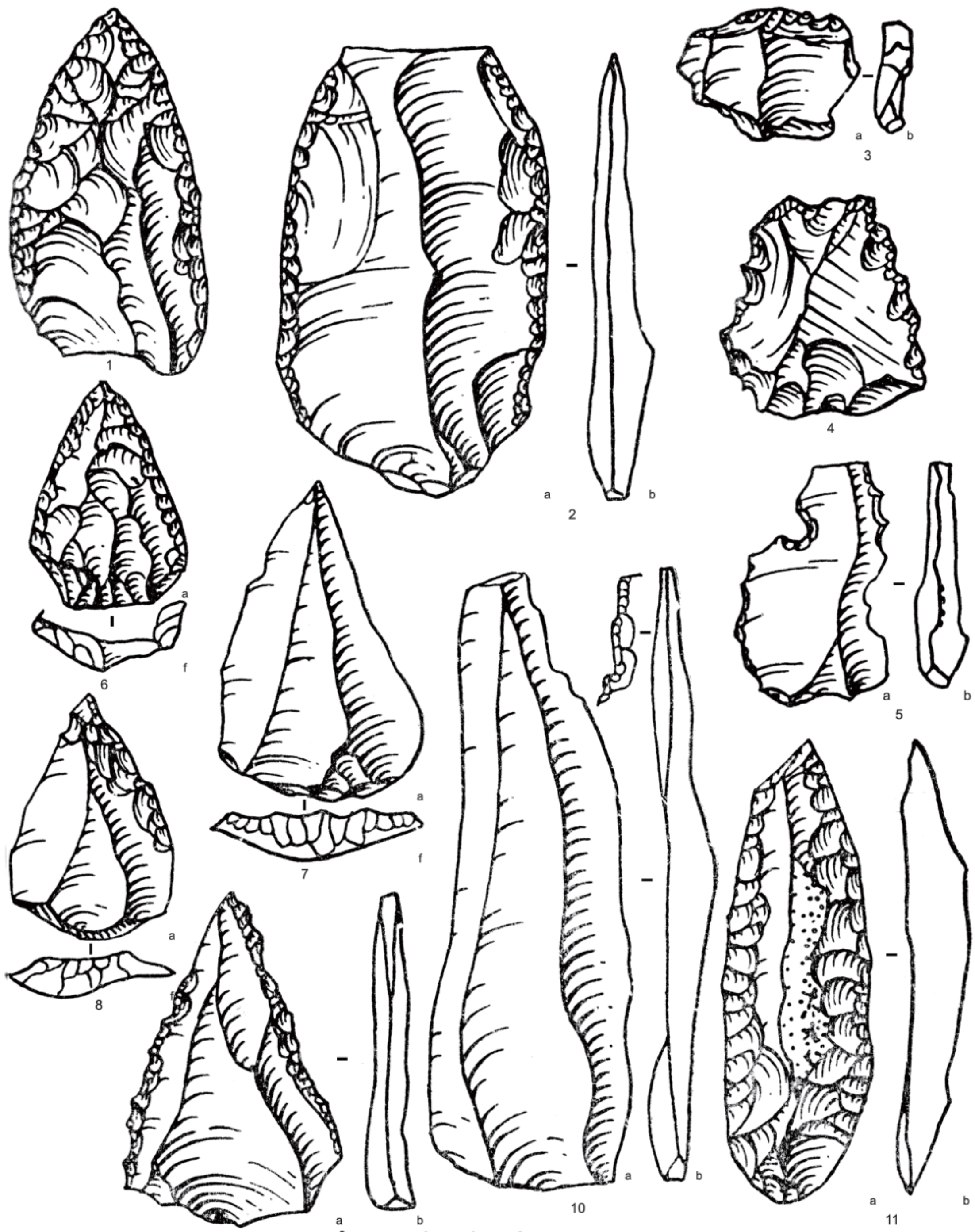

Figure 7

Lusakert-1 cave. Drawings of obsidian lithic artifacts from B.G. Yeritsyan's excavtions (Yeritsyan 1975).

1. Mousterian point; 2, 11. Side scrapers; 3-4. Denticulated tools; 5. Notched tool; 6. "Yerevan point"; 7-10. Levallois points (1-5: Unit B; 6-11: Unit CI).

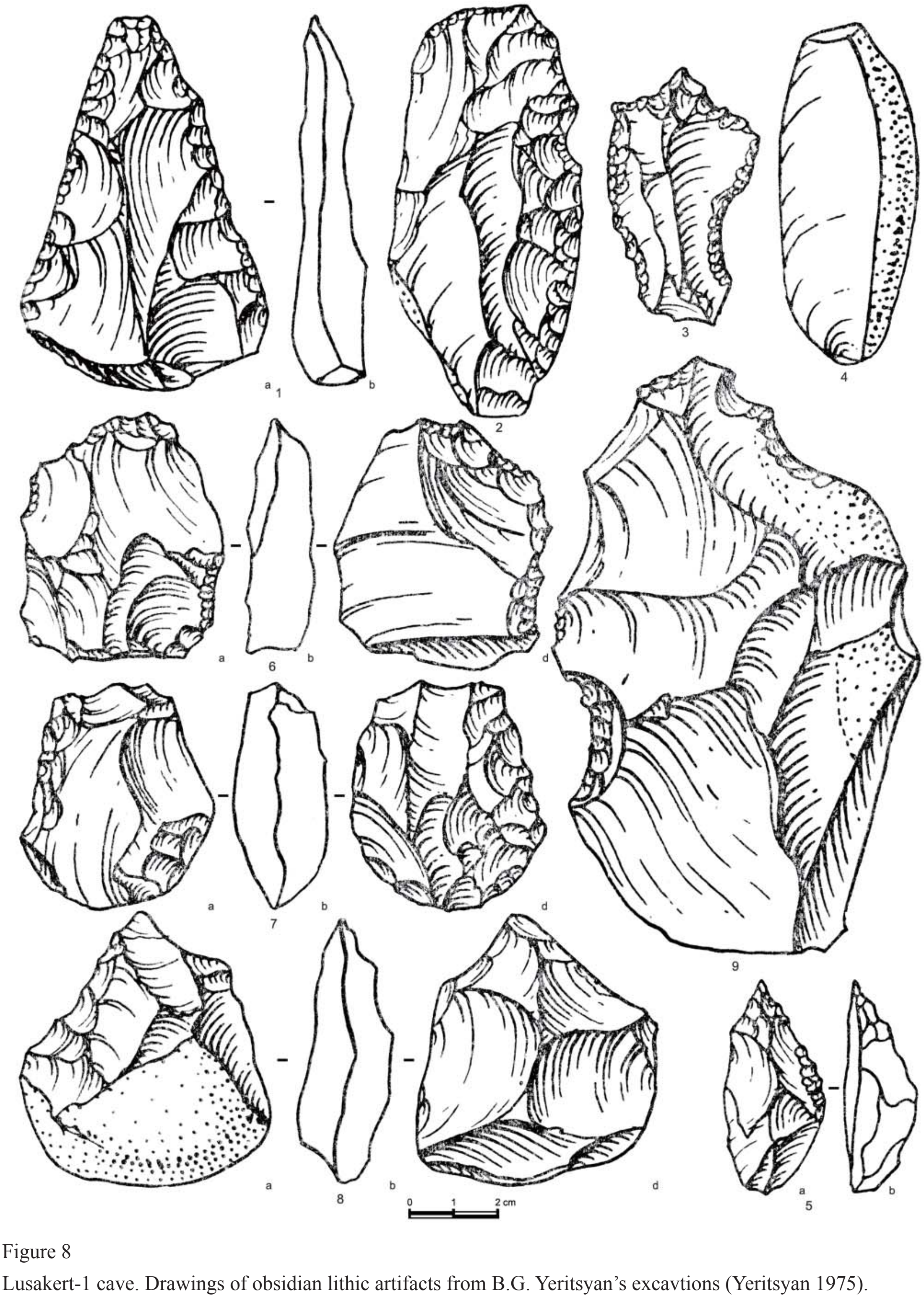

Figure 8

Lusakert-1 cave. Drawings of obsidian lithic artifacts from B.G. Yeritsyan's excavtions (Yeritsyan 1975).
1-2. Side scrapers; 3. Point; 4. Backed knife; 5. Limas; 6-8. Bifacial tools; 9. Notched tool prepared on massive flake (1-5: Unit CII; 6-9: Unit D).

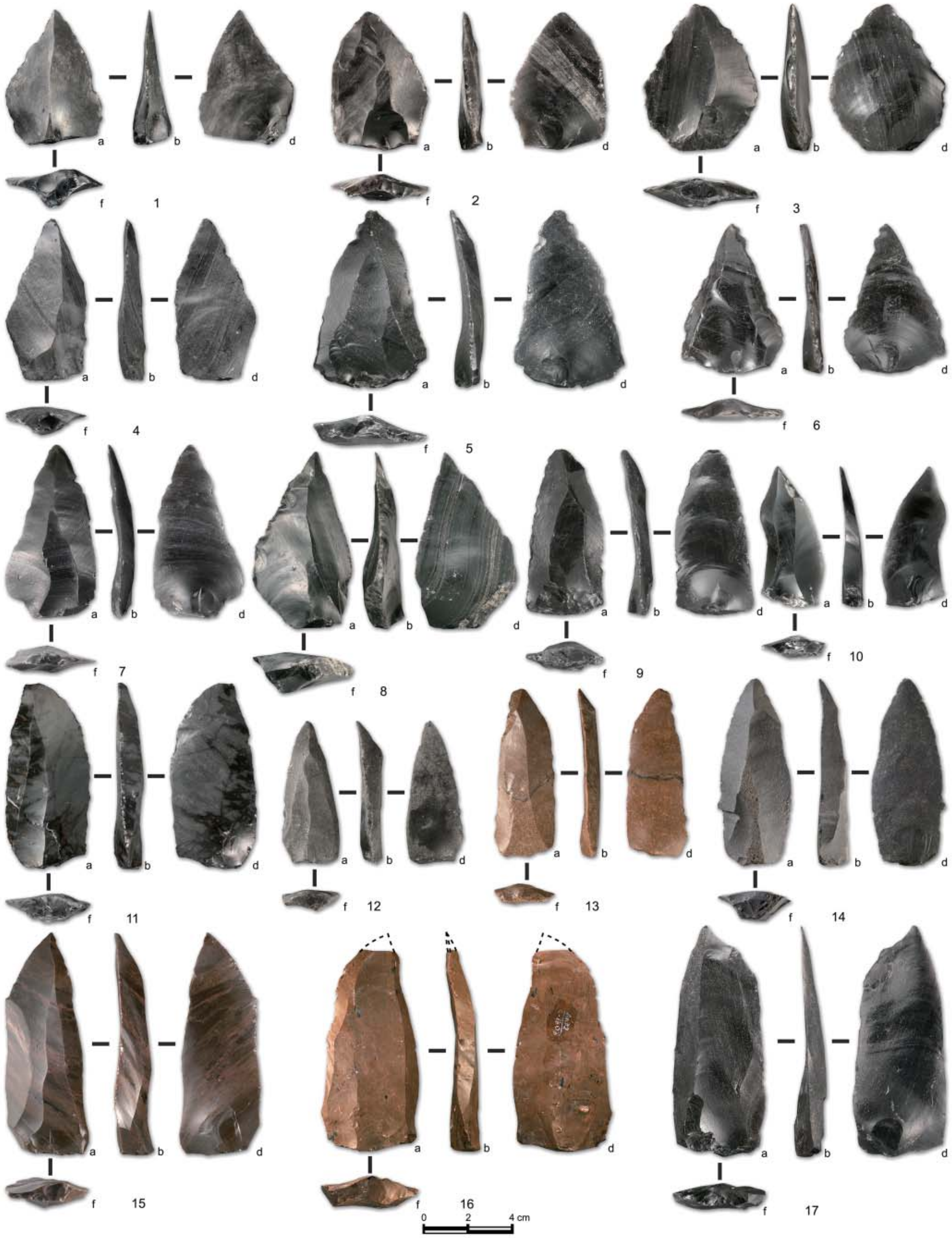

Figure 9
Lusakert-1 cave. 1-17. Levallois points and blanks (obsidian). B.G. Yeritsyan's excavtions (Units B and CI).

Figure 10
Lusakert-1 cave. 1. Massive Levallois flake with thinned base (obsidian); 2-4. Elongated Levallois points (dacite and obsidian); 5-6, 8. Levallois blades (obsidian); 7-9. Side scrapers (obsidian). B.G. Yeritsyan's excavtions (Units B and CI).

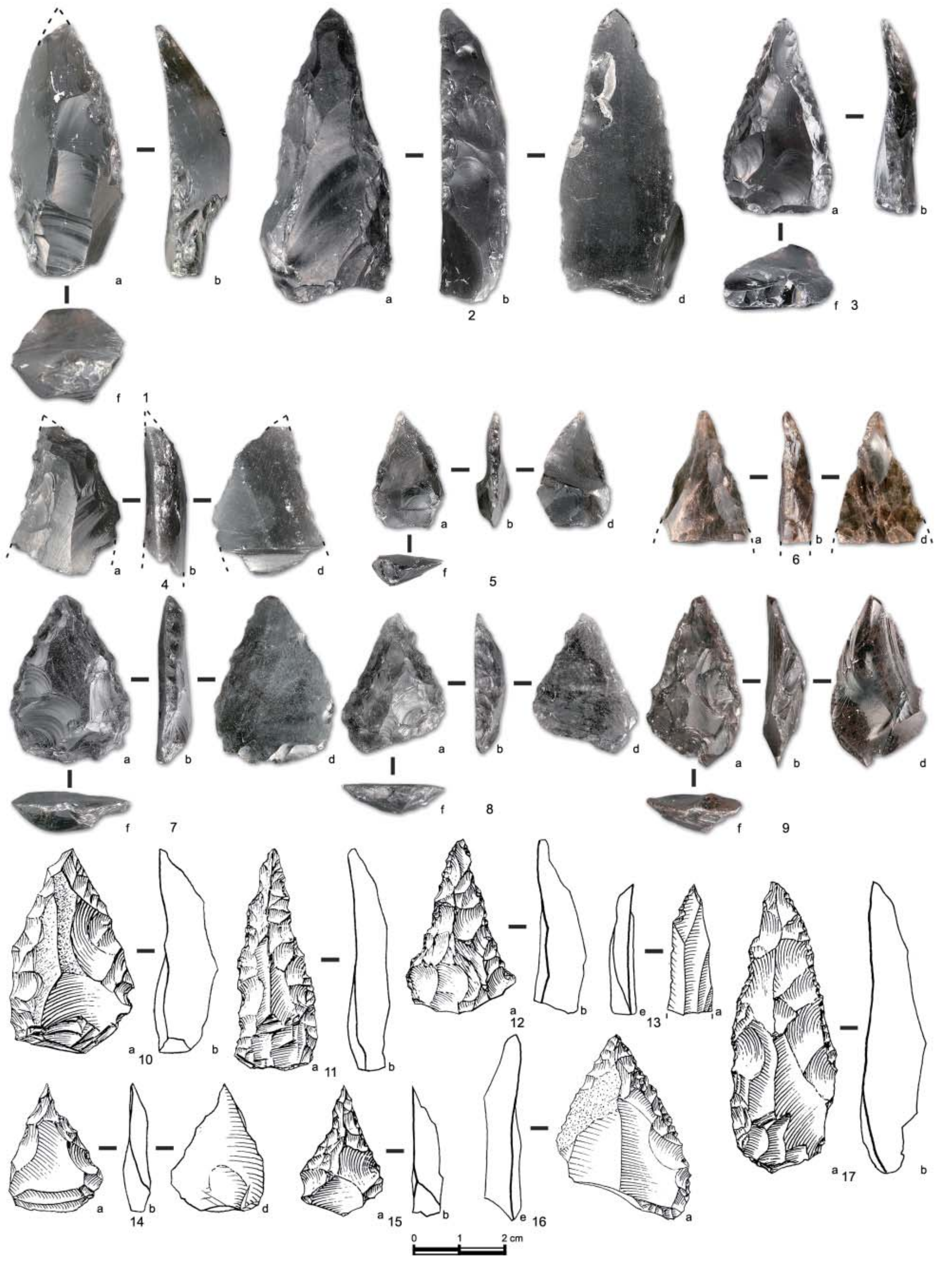

Figure 11

Angeghakot-1 cave. 1-3. Mousterian points (obsidian); 4, 6. Proximal fragments of truncated Mousterian points (obsidian); 5, 7-8. “Yerevan points” (obsidian); 9. Refreshing or resharpening flake (obsidian).

Kalavan-2 open-air site. 10-12, 14-15, 17. Small Mousterian points from layer 6 (obsidian and silicified limestone); 13, 16. Levallois points from layer 7 (silicified limestone).

Figure 12
Barozh-12 open-air site. 1. Side scraper (obsidian); 2. Levallois point (obsidian); 3. Mousterian point (obsidian); 4-7. Levallois and Mousterian points with truncated and faceted bases (obsidian); 8-9. Points with notches at the bases (obsidian).

Living the High Life: The Upper Paleolithic Settlement of the Armenian Highlands

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1. Introduction

While the Armenian Highlands have benefited from a longer history of research into the Early and Middle Paleolithic occupations of this region, its Upper Paleolithic settlement has only recently begun to come into focus. With this brief contribution we summarize new archaeological data from two high elevation sites that together span the majority of the Upper Paleolithic. These well stratified sites in the Armenian Highlands benefited from the use of modern excavation methods. The first evidence for modern human behavior is seen at Aghitu-3 Cave in Syunik Province of southern Armenia, while cultural remains from the late Upper Paleolithic are documented in the north at the site of Kalavan-1, located in the wooded montane landscape north of Lake Sevan. We hypothesize that any hominin who entered the Armenian Highlands had to solve the problem of how to survive in this high altitude environment. Under modern conditions, which we view as analogous to an interglacial, the climate is continental, exhibiting a large fluctuation between summer and winter temperatures. This high altitude region, much of it above 2000 m, is blanketed by snow during the winter and well into spring. During glacial periods, alpine ice sheets would have covered a considerable portion of the region, providing a significant impediment for human habitation. Such environmental hurdles would surely have imprinted on the early inhabitants of the region and facilitated the solutions that led to their survival at these high altitudes.

2. Background on Upper Paleolithic research in Armenia

The first lithic artifacts from the Upper Paleolithic of Armenia were published by M.Z. Panichkina. She reported findings from two open-air localities (Chatkeran and Nurnus) during her 1946-1947 survey of the middle reaches of the Hrazdan River canyon, identifying surface collections of obsidian tools as characteristic of that time period. The small assemblages of lithic artifacts (150 implements from Chatkeran and 130 from Nurnus), prepared from obsidian pebbles washed by the Hrazdan, included prismatic cores, massive retouched blades of regular shape, notches, end scrapers, carinated scrapers, burins, points and borers, chisels (*pièces esquillées*) and sickle elements, with end scrapers and burins predominating. Based on her detailed typological description of the finds and a comparison with similar ones from Georgia, the Caucasus, Iran and the Near East, Panichkina concluded that the open-air sites of Hrazdan, which are not rich with archaeological materials, but nonetheless contain very characteristic types, could be attributed to the second half of the Upper Paleolithic. This period was presumed to be coeval with the cave sites of Georgia. This assumption placed these finds at the end of the second chronological group of the Upper Paleolithic scheme proposed by S.N. Zamyatnin for Transcaucasia, approximately equivalent to the Magdalenian, based on Western European classification. The Upper Paleolithic culture of Armenia differs from that of Eastern Europe. It is associated with sites of the same age in Georgia, Crimea and the Eastern Mediterranean, and linked through their shared mild climate and suitable geographical conditions for habitation (Panichkina 1948; 1950, pp. 13, 90-98, 101).

A more substantial collection of implements attributed to the Upper Paleolithic was published by S.H. Sardaryan. From 1945-1949 he collected artifacts from the open-air sites of the Hrazdan River valley (Arzni, Nurnus) and Mt. Arteni (Satani-dar, Areguni blur, Yerkaruk blur) in central and west-central Armenia, which were located in close proximity to obsidian raw material sources. Based on the same methodology as Panichkina, Sardaryan came to similar conclusions and, using the Western European chronological scheme, divided his collection of over 1,700 implements into the three conventional typo-chronological groups dated between 40,000 and 12,000 – the Aurignacian, Solutrean and Magdalenian (Sardaryan 1954, pp. 127-168, 170-171; 1967, pp. 76-93).

In 1967 B.G. Yeritsyan recorded Upper Paleolithic finds in northern Armenia (Noyemberyan district) on the northwestern slopes of the Gugarats Range. Stone artifacts from the Hatsut-1 open-air site were collected from about 100-150 m^2 on a dry river terrace. Test trenches yielded *in situ* lithic finds and small unidentifiable faunal remains. He collected a total of 170 artifacts made mainly on local flint, in addition to limited obsidian and quartz implements. The cores were represented by small and highly reduced unidirectional examples, mainly oriented toward bladelet production. Small sized flakes, blades and bladelets dominate the finds, and often bear traces of retouch. The toolkit includes borers and points, as well as scrapers and denticulates, but lacks burins. Based on his short description Yeritsyan attributes the site to the developed Upper Paleolithic culture, which would be contemporaneous with the materials from Chatkeran (Yeritsyan 1970a, pp. 88-90).

Further publications report the discovery of several other sites with Upper Paleolithic material collected from the Hrazdan River gorge and the Hrazdan-Kotayk Plateau (e.g. Argel, Jraber, Nurnus 1-4, Hatis, Yerablur, Aramus). However, these generally lack site descriptions, as well as the corresponding lithic materials (Tadevosyan 1986; Yeritsyan *et al*. 1996; 1998). Compared to the rich Upper Paleolithic occupations documented in the caves of Georgia ("Imeretian" culture) and the northern Caucasus ("Gubs culture"), the Upper Paleolithic discoveries of Armenia did not receive much attention, nor were they discussed in detail in the summary publications of the Soviet era. Some scholars hypothesized that the Armenian Highlands were not inhabited during the Last Glacial Maximum due to its high altitude environment and cold climate (Bader 1984; Lyubin 1989). Others researchers shared a different opinion, and suggested that the Upper Paleolithic of Armenia derives from the Middle Paleolithic, resulting from the further evolution, innovation and transformation of the Middle Paleolithic into the typological and morphological variants of the Upper Paleolithic (e.g. end scrapers, points, and burins). Based on research at the caves of Yerevan-1 (Units 1-2) and Lusakert-1 (Units A-B), the final stages of development showed tool forms more characteristic of the Upper Paleolithic starting to predominate (>47% at Lusakert-1, excluding microliths). Meanwhile those tools were shaped by the technological traditions characteristic of the Middle Paleolithic (Yeritsyan 1970b, pp. 25-26; Yeritsyan and Tadevosyan 1986; Tadevosyan 1985; 1986; 1991; 1998; 2008; Fourloubey 2003, pp. 16-17; Adler *et al*. 2012, p. 26).

However, further investigations and multiple visits to the areas of these collections have demonstrated that the open-air sites described by Panichkina, Sardaryan and the others are probably Neolithic-Chalcolithic workshops located near obsidian raw material sources. In the case of Yerevan and Lusakert caves, it is not certain whether Upper Paleolithic occupation occurred during the formation of the upper parts of the strata, despite the nature of some of the finds, because the sediments have a colluvial origin, comprising sediments originating from above the cliff and from cliff collapse. This means that Units A and B of Lusakert-1 are not *in situ*, and there is little potential for obtaining reliable absolute dates on the archaeological material from these strata (Adler *et al*. 2012, p. 27).

In summary, the only site that can be securely attributed to the Upper Paleolithic is Hatsut-1, which despite limited publication of the finds (Yeritsyan 1970a, pp. 88-90), looks similar to the materials from Kalavan-1 (see below). Within this in mind, we present here the first “true” Upper Paleolithic sites of Armenia, which have only been recently uncovered and evaluated.

3. Aghitu-3 cave

The Tübingen-Armenian Paleolithic Project (TAPP) conducted its first field reconnaissance of southern Armenia in the Vorotan River valley in June, 2008. During its visit to the village of Aghitu, the TAPP team identified a series of caves along the base of a flat-topped basalt massif. Often referred to as the fortress of Aghitu (Achaemenid-Hellenistic Period, Aghitu Fortress, Sisian, 1640 m, N39 30’49.7” E46 4’51.2”), the basalt plateau shows ample evidence of occupation from the Bronze Age through the Middle Ages (Cherry *et al*. 2007; Kroll 2006). In addition to the outlines of stone structures visible atop the massif, finds of pottery and the bones of domesticated animals are common. As our team conducted survey around the base of the hill, we also recognized stone artifacts typical of the Paleolithic and fossilized bones on the floor of a cave named Aghitu-3. Measuring 18 m wide, 11 m deep and 6 m high, this cave seemed to have the potential to yield older sediments (Figures 1 and 2).

Therefore, between 2009 and 2013 the TAPP team conducted archaeological excavations at Aghitu-3 (Kandel *et al*. 2012; 2014). The cave is situated at 1601 m above sea level at the base of the basalt formation. The basalt flow that formed the cave was deposited during a series of volcanic eruptions that issued from nearby Mt. Bugdatapa between 126,000–111,000 (Ollivier *et al*. 2010). Further evidence of continuing volcanic eruptions is demonstrated by at least two tephra layers contained in the site. In addition to experiencing active volcanism, the region shows geomorphological evidence of glaciation, such as ground and end moraines, U-shaped trog valleys, glacials striations on bedrock, glacial erratics atop sedimentary deposits, and poorly sorted glacial tills (Ollivier *et al.* 2010, Samvel Nahapetyan pers. comm.).

Based on five years of careful excavation, profile drawing and sediment sampling, the stratigraphy of the cave was divided into 12 geological horizons (GH) containing seven archaeological horizons (AH) (Figure 3). The Holocene deposits of layers GH 1 and 2 (AH I and II) contained stone artifacts, bones and ceramics. While layer 1 was loose and strewn with modern rubbish consisting of metal, glass and plastic, layer 2 was more compact and free of modern debris. Both layers 1 and 2 contained stratified dung layers that were often burned. These layers were also disturbed by numerous features including basalt walls, a pit lined with basalt slabs, a clay oven-tonir for baking bread (Figure 4: 1), a pit with the remains of several cattle, and most notably, an undisturbed tomb containing seven individuals and grave goods dating to the Parthian era of the 1st century BC (Figure 4: 2).

Beginning with layer GH 3 (AH III), about 40 cm below the original surface, we observed a remarkable change. The sediment became more compact and finely stratified with many shattered basalt plates. Modern debris and ceramic were absent and artifacts typical of the Upper Paleolithic became common. In fact GH 3 contained at least four, spatially continuous, archaeological layers (AH IIIa-d), each about 2-3 cm thick, documenting intensive use of the site between about 28,000–24,000 Cal BP (Figures 3, 5: 1, 7). While analytical studies of all find classes are presently underway, based on the team's field and laboratory observations, we report here on a few notable trends.

Layer AH III was the most intensively occupied layer at Aghitu-3. Stone artifacts are numerous, with almost 10,000 pieces recorded. The most common raw material is obsidian that comes in a wide variety of types, including glassy translucent, gray matte, and red-black striped "tiger". The volcanic mountains of Syunik offer primary sources obsidian 30-40 km to the northeaswest, and we collected secondary obsidian pebbles and cobbles along the Vorotan River and its tributaries. Handheld X-ray diffraction studies of the obsidian is presently underway and suggests mostly local sources, although about 10% of the obsidian assemblage comes from sources in northern Armenia up to 250 km away (Ellery Frahm pers. comm.). Chert is the next most common lithic raw material and comes in a multitude of colors including white, gray, green, yellow, red, and brown. Geological maps and field survey indicate that primary sources of chert are available about 5 km to the west near Brnakot and 40 km to the east near Goris. Other raw materials are extremely rare and include chipped basalt and dacite.

The stone tools are distinct in their technology and typology. The lithic industry is based almost entirely on the production of laminar blanks, predominantly bladelets, from small highly reduced unidirectional cores. When a second platform was initiated, reduction continued in one direction. The vast majority of tools are fashioned from laminar blanks and consist of bladelets finely retouched on one or both lateral edges. Other tool forms are less frequent and include a variety of backed forms, burins and carinated scrapers. Regardless of the raw material chosen, the method of reduction produced standardized blanks and tools, suggesting that people had a fixed concept of the implements they required (Figure 6).

Many of the faunal remains consist of shaft fragments and suggest that hunting focused on the acquisition and processing of wild sheep, wild goat, and equids. Other faunal remains include wolf, fox, hare, micromammals, birds and fish. Isotopic and genetic studies are underway to examine questions of subsistence, as well as whether the canids showed signs of incipient domestication. Not only have three bone tools (one eyed bone needle, one bone point and one bone awl) been identified among the remains of layer 3, but six perforated shells, are also present. These remains hint at the manufacture of clothing and personal ornamentation. Based on micromammals, pollen and sedimentology, the first results from environmental studies tell us of a cold and dry period. Thus, we conclude that the manufacture of clothing was an important element in the life cycle of these Upper Paleolithic people.

Layers GH 4-8 (AH IV-V) yielded few archaeological remains. Nonetheless, these layers date between 31,000–28,000 Cal BP and indicate a continued cold and dry climate. Layer GH 8 documents two phases of volcanic ash deposition (Victoria Cullen pers. comm.). Micromammal diversity is very high, indicating that a raptor such as the eagle owl (*Bubo bubo*) accumulated the assemblage. Micromammal density is also very high (Lior Weissbrod pers. comm.), telling us that humans were not using the site that often. Whether caused by an earthquake or the very cold conditions, a very large rockfall (GH 9) suggests that humans would have found it difficult to use the cave during this period (Figures 3 and 5: 1).

Layer GH 10 (AH VI) denotes a significant change in sedimentation at the site. In stark contrast to the overlying strata, GH 10 consists mainly of fine-grained sediments with very little basalt debris. This layer dates between 35,000–31,000 Cal BP. Human occupation can be seen through distinct, spatially isolated occupation events. These horizons document small combustion features associated with low densities of lithic artifacts numbering about 350 pieces. The raw material spectrum, technology and typology of AH VI are remarkably similar to AH III. However, many of the faunal remains may not have been accumulated by humans. At least the predominance of wild sheep and wild goat, combined with an unusual body part representation and evidence of gastric etching indicate that carnivores contributed significantly to this accumulation of fauna (Hans-Peter Uerpmann pers. comm.). Micromammals indicate a warmer climate (Lior Weissbrod pers. comm.), as do pollen spectra (Angela Bruch pers. comm.) and sedimentological observations (Samvel Nahapetyan pers. comm.).

In Layer GH 11 (AH VII) we observe another significant sedimentological change. The sediment matrix is a mélange of all size classes strewn between basalt boulders. Nonetheless, a small collection of about 50 lithic artifacts was recovered, as well as some faunal remains. Based on its stratigraphic position, this layer pre-dates 35,000 Cal BP, with further radiocarbon dating currently in progress. Initial observations suggest that this layer was lain down under a higher energy regimen than the overlying fine-grained deposits of GH 10.

The deepest strata we encountered at Aghitu-3 was GH 12 at a depth of almost 6 m below surface. This layer contained neither lithics nor faunal remains and resembled the sterile layers we observed at the base of other test trenches excavated along the basalt massif. If our interpretation is correct, this layer represents the bedrock onto which the basalt flowed and thus predates it.

In summary, the thick, well stratified Paleolithic sequence excavated at Aghitu-3 cave offers us the chance to decipher the climatic and behavioral record of the first half of the Upper Paleolithic in the Armenian Highlands. This remarkable sequence is presently under study and will allow us to better understand how the first modern humans of Armenia survived in this high altitude region. To understand the second half of the Upper Paleolithic sequence we move north to study the deposits at the open air locality of Kalavan-1.

4. Kalavan-1 open-air site

The open-air site of Kalavan-1 is located to the north of Lake Sevan at an altitude of 1640 m in the Barepat valley, in the heart of the Aregunyats Mountain Range. Discovered in 2004, it was excavated in the framework of the Armenian-French joint team of the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia and "Mission Caucase" (co-directed by B. Gasparyan and C. Chataigner; Chataigner *et al*. 2012, pp. 52-54, 59-61; Montoya *et al*. 2013). The excavation revealed the great potential of the Kalavan sites, documenting an Early Bronze Age (Kura-Araxes culture) necropolis and Upper Paleolithic layers (Liagre *et al*. 2009). A few hundred meters downstream, a survey shed light on an important Middle Paleolithic sequence (Kalavan-2; Ghukasyan *et al*. 2011).

Kalavan-1 is positioned in a bottleneck, at the interface between the narrowing of the Barepat valley and the opening of the alpine meadows situated above 2000 m. It is a strategic position for hunting because it provides an overview of the seasonal migrations of mammals ascending and descending the valley.

This late Upper Paleolithic settlement was situated on an old alluvial terrace of the Barepat (Figure 8). The analysis of the stratigraphic sequence highlights a sedimentary dynamic in two phases: alluvial at the base, then colluvial above. The Upper Paleolithic occupation was recognized within sedimentary unit 7 (7d1 and 7d3) positioned at the beginning of the colluvial sedimentary cycle, probably allowing for the quick burial of the artifacts and the optimal preservation of the site (Figure 9). The analysis of the taphonomic processes highlighted classical phenomena of disturbances on the principal archaeological level 7d3 (e.g. bioturbation, vertical dispersion by freezing and thawing) without disturbing the archaeological structures or modifying the general spatial organization of the artifacts.

Kalavan-1 can be interpreted as a high mountain seasonal kill site of Caprinae. Archaeozoological studies have demonstrated a restricted faunal spectrum, composed mainly of wild Caucasian caprinae (*Ovis* sp./*Capra* sp. = *Ovis orientalis gmelini*?). The hunting strategy for Caprinae appears to be focused on adult animals between one and six years old. The presence of most anatomical parts of the animals at the site supports a kill site close to Kalavan-1 (Montoya *et al*. 2013).

From a spatial point of view, the activities are marked by a knapping area and also a hearth (G28) comprising backed bladelets and two bladelet cores whose function appears related to the preparation of hunting weapons. The excavation also revealed a space structured by two other hearths, as well as lithic and/or fauna concentrations. The densest concentration (GF 23-24), probably a debris mound, is composed of nearly 1200 remains of fauna with nearly twenty caprinae mandibles (Figure 10; Montoya *et al*. 2013).

The examination of lithic raw material evokes a nomadic logistic with planned management of allochthonous material: nearly 60% of the lithic raw material is composed of obsidian. Using LA-ICP-MS analysis we identified the Armenian Volcanic Highlands (1500–3000 m) as the source of the obsidian to the west and south of Lake Sevan (Geghasar, Gutanasar, Hatis, Syunik Highlands), approximately three to four days' walk from Kalavan-1 (Barge and Chataigner 2004; Chataigner and Gratuze 2013). It is probably near these obsidian sources that the blades imported to Kalavan-1 were produced. Indeed, there is no evidence of a laminar *chaine opératoire* discovered on the site. The cutting-edge quality of these blades and their robustness suggest their potential for use in butchery activities. Conversely, the *chaine opératoire* of bladelets was mainly dedicated to the fabrication of microgravettes and backed bladelets for hunting weaponry (Figures 11-14). The techno-typological characteristics and, in particular, the presence of many microgravette points, argue for a cultural attribution to the Epigravettian tradition (Figures 13: 5-10, 14), well represented since the Last Glacial Maximum in the Caucasus (Nioradze and Otte 2000).

Seven AMS dates between 18,000–16,000 Cal BP (Figure 15) provide chronological information for the occupation during a cold period with a dry environment, composed of a steppic herb vegetation around the site and the presence of some trees in the valley bottoms (Montoya *et al*. 2013). Kalavan-1 is the first site in the Lesser Caucasus to document, on the one hand, the process of (re)colonization by human groups at this high altitude during the Late Glacial, and on the other, the mobility strategies and subsistence patterns developed by the local populations in this area.

5. Concluding remarks

Recent investigations of the Upper Paleolithic of Armenia revealed at least two new stratified sites: Aghitu-3 cave and Kalavan-1 open-air. These sites provide us with a well-preserved environmental and cultural stratigraphic record, respectively dated between 40,000 and 24,000 Cal BP (early to middle Upper Paleolithic) and 18,000–16,000 Cal BP (late Upper Paleolithic). For now, the timeframe between 24,000 and 18,000 Cal BP remains unknown. Furthermore, the as yet undocumented Middle to Upper Paleolithic transition in Armenia counts among the most important research questions. We are sure that these ongoing projects will help fill the existing gaps and place new Upper Paleolithic sites on the map of Armenia. These sites, together with the ones in Georgia and the northern Caucasus, are helping to paint an overall picture of the cultural development of the regional Upper Paleolithic populations. The Armenian sites are also important from the perspective of their geographic distribution. The Soviet era researchers of the regional Upper Paleolithic postulated that the late Upper Paleolithic cultures of Georgia (“Imeretian”) and the Near East (“Zarzian”) were linked with the sites of Armenia. Now it is clear that the Armenian sites will play an important role in providing concrete evidence about whether such connections existed (Bader 1966, pp. 143-144; 1984, pp. 287-288; Lyubin 1989, pp. 138-142).

References

Adler, D.S., Yeritsyan, B., Wilkinson, K., Pinhasi, R., Bar-Oz, G., Nahapetyan, S., Mallol, C., Berna, F., Bailey, R., Schmidt, B.A., Glauberman, P., Wales, N. and Gasparyan, B. (2012) The Hrazdan Gorge Palaeolithic project, 2008-2009. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan.* Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 21–37.

Bader, N.O. (1966) Razlichiya mezhdu verkhnepaleoliticheskimi kul’turami Zakavkazya i Blizhnego Vostoka (Differences between the Upper Paleolithic Cultures of the Transcaucasus and the Near East). In: Merpert, N.Ya. and Kozhin, P.M. (eds.), *Arkheologiya Starogo i Novogo Sveta* (The Archaeology of the Old and New World). Moscow: “Nauka” Publishing House, pp. 135–143 (in Russian).

Bader, N.O. (1984) Pozdniy Paleolit Kavkaza (Late Paleolithic of the Caucasus), In: Boriskovskiy, P.I. (ed.), *Paleolit SSR iz serii Arkheologiya SSSR* (The Paleolithic of USSR, Series of Archaeology of the USSR). Moscow: “Nauka” Publishing House, pp. 272–301 (in Russian).

Barge, O. and Chataigner, C. (2004) Un SIG pour l’analyse des approvisionnements: l’exemple de l’obsidienne de l’Arménie. *Revue d’Archéométrie* 28, pp. 25–33.

Bronk Ramsey, C. (2013) Recent and planned developments of the program OXCAL. *Radiocarbon* 55, pp. 720–730.

Chataigner, C., Gasparyan, B., Montoya, C., Arimura, M., Melikyan, V., Liagre, J., Petrosyan, A., Ghukasyan, R., Colonge, D., Fourloubey, K., Arakelyan, D., Astruc, L., Nahapetyan, S., Hovsepyan, R., Balasescu, A., Tome, K. and Radu, V. (2012) From the Late Upper Palaeolithic to Neolithic in North-Western Armenia: Preliminary results. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 52–63.

Chataigner, C. and Gratuze, B. (2013) New data on the exploitation of obsidian in the Southern Caucasus (Armenia, Georgia) and eastern Turkey. Part1: Source characterization. New data on the exploitation of obsidian in the Southern Caucasus (Armenia, Georgia) and eastern Turkey. Part2: Obsidian procurement from the Upper Palaeolithic to the Late Bronze Age. *Archaeometry* (doi: 10.1111/arcm.12007).

Cherry, J.F., Manning, S.W., Alcock, S.E., Tonikyan, A.V. and Zardaryan, M.H. (2007) Radiocarbon dates for the second and first millennia B.C. from southern Armenia: Preliminary results from the Vorotan Project 2005-2006. *Aramazd* 2, pp. 52–71, 228.

Fourloubey, C., Beauval, C., Colonge, D., Liagre, J., Ollivier, V. and Chataigner, C. (2003) Le Paléolithique en Arménie: Etat de connaissances acquises et données récentes. *Paléorient* 29/1, pp. 5–18.

Ghukasyan, R., Colonge, D., Nahapetyan, S., Ollivier, V., Gasparyan, B., Monchot, H. and Chataigner, Ch. (2011) Kalavan-2 (North of Lake Sevan, Armenia): A New Late Middle Paleolithic Site in the Lesser Caucasus. *Archaeology, Ethnology and Anthropology of Eurasia* 38/4, pp. 39–51.

Kandel, A.W., Gasparyan, B., Bruch, A.A., Weissbrod, L. and Zardaryan, D. (2012) Introducing Aghitu-3, the First Upper Paleolithic Cave Site in Armenia. *Aramazd* 6/2, pp. 7–23, 220–221, 235–247.

Kandel, A.W., Gasparyan, B., Nahepetyan, S., Taller, A. and Weissbrod, L. (2014) The Upper Paleolithic Settlement of the Armenian Highlands. In: Otte, M. (ed.), *Modes of contacts and displacements during the Eurasian Paleolithic, Conference Proceedings, Liège, 29-31 May 2012*. ERAUL 140. Luxembourg, pp. 39–60.

Kroll, S. (2006) Southern Armenia Survey (Syunik), 2000-2003. *Aramazd* 1, pp. 19–49, 265–266.

Liagre, J., Arakelyan, D., Gasparyan, B., Nahapetyan, S. and Chataigner, C. (2009) Mobilité des groupes préhistoriques et approvisionnement des matières premières à la fin du Paléolithique supérieur dans le Petit Caucase: données récentes sur le site de plein air de Kalavan 1 (nord du lac Sevan, Arménie). In: Djindjian, F., Kozlowski, J. and Bicho, N. (eds.), *Le concept de territoires dans le Paléolithique supérieur européen - UISPP, Proceedings of the XV World Congres (Lisbon, 4-9 September 2006)*. BAR International Series 1938. Oxford: ArchaeoPress, pp. 75–84.

Lyubin, V.P. (1989) Paleolit Kavkaza, Glava 2, Verkhniy Paleolit (Paleolithic of Caucasus, Chapter 2, Upper Paleolithic). In: Boriskovskiy (ed.), "*Paleolit Kavkaza i Severnoy Azii*", iz serii "Paleolit Mira, Issledovaniya po Arkheologii Drevnego Kamennogo Veka" ("The Paleolithic of Caucasus and Northern Asia", from Series of

"The Old Stone Age of the World, Studies in the Paleolithic Cultures"). Leningrad: "Nauka" Publishing House, Leningrad Branch, pp. 93–142 (in Russian).

Montoya, C., Balasescu, A, Joannin, S., Ollivier, V., Liagre, J., Nahapetyan, S., Ghukasyan, R., Colonge, D., Gasparyan, B. and Chataigner, C. (2013) The Upper Palaeolithic site of Kalavan 1 (Armenia): An Epigravettian settlement in the Lesser Caucasus. *Journal of Human Evolution* 65 (5), pp. 621–640.

Nioradze, M.G. and Otte, M. (2000) Paléolithique supérieur de Géorgie. *L'Anthropologie* 104, pp. 265–300.

Ollivier, V., Nahapetyan, S., Roiron, P., Gabrielyan, I., Gasparyan, B., Chataigner, C., Joannin, S., Cornée, J.-J., Guillou, H., Scaillet, S., Munch, P. and Krijgsman, W. (2010) Quaternary volcano-lacustrine patterns and palaeobotanical data in southern Armenia. *Quaternary Research* 223–224, pp. 312–326.

Panichkina, M.Z. (1948) K voprosu o verxnem paleolite v Armenii (To the question of the Upper Paleolithic in Armenia). *Izvestiya Akademii Nauk Armyanskoy SSR, Obshchestvenniye nauki* (Bulletin of the Academy of Sciences of the Armenian SSR, Social Sciences) 7, pp. 67–80.

Panichkina, M.Z. (1950) *Paleolit Armenii* (Paleolithic of Armenia). Leningrad: State Hermitage Press (in Russian).

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Bronk Ramsey, C., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M. and van der Plicht, J. (2013) IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years Cal BP. *Radiocarbon* 55, pp. 1869–1887.

Sardaryan, S.H. (1954) *Paleolit v Armenii* (Paleolithic in Armenia). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Sardaryan, S.H. (1967) *Nakhnadaryan hasarakutyuny Hayastanum* (Primitive Society in Armenia).Yerevan: "Mitk" Publishing House (in Armenian, with Russian and English Resume).

Tadevosyan, S.V. (1985) Lusakert arajin karayri verin paleolityan mshakuyty (Upper Paleolithic culture of the Lusakert one cave). In: Arakelyan, B.N. (ed.), *Haykakan SSH-um 1983-1984 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, april 1985 t., Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to the Archaeological Fieldwork Results in 1983-1984 in the Armenian SSR, april 1985). Yerevan: Armenian SSR Academy of Sciences Press, pp. 5–6 (in Armenian).

Tadevosyan, S.V. (1986) Hayastani verin paleolityan kayannery ev drants mshakuyty (Upper Paleolithic sites of Armenia and their culture). In: Kharatyan, Z.V. and Petrosyan, H.L. (eds.), *"Hay zhoghovrdakan mshakuyti hetazotman hartser", Yeritasard gitnakanneri VIII konferans nvirvats SMKK XXVII hamagumarin (19-21 mart 1986 t.), Zekutsumneri himnadruytner* [Abstracts of reports of "Questions of Investigation of Armenian Folk Culture", VIII Conference of young scientists dedicated to the XXVII Congress of the SUCP (19-21 March 1986)]. Yerevan: Institute of Archaeology and Ethnography Press, pp. 3–4 (in Armenian).

Tadevosyan, S.V. (1991) Verin paleoliti drsevorumnery Hayastanum (Distributions of the Upper Paleolithic in Armenia), In: Tiratsyan, G.A. (ed.), *Hayastsni Hanrapetutyunum 1989-1990 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, mayis 1991 t., Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to the Archaeological Fieldwork Results in 1989-1990 in the Republic of Armenia, may 1991). Yerevan: Republic of Armenia Academy of Sciences Press, Yerevan, pp. 7–8 (in Armenian).

Tadevosyan, S.V. (1998) Verin paleoliti teghy Hayastani kari dari parberatsman hamakargum (Place of the Upper Paleolithic in the Stone Age Periodization System of Armenia). In: Kalantaryan, A.A. and Harutyunyan, S.B. (eds.), *Hin Hayastani mshakuyty XI, Hanrapetakan gitakan nstashrjan nvirvats prof. K. Ghafadaryani hishatakin, Zekutsumneri himnadruytner* (Culture of Ancient Armenia, XI, Abstracts of Reports of the Republican Conference dedicated to the memory of prof. K. Ghafadaryan). Yerevan: Institute of Archaeology and Ethnography Press, pp. 24–25 (in Armenian).

Tadevosyan, S.V. (2008) Tekhnologicheskie sposobi vtorichnoy obrabotki verxnepaleoliticheskix orudiy peshcheri Yerevan-1 (Technology of the secondary processing of the Upper Paleolithic tools from the Yerevan-1 cave). In: Avetisyan, P.S., Kalantaryan, A.A. and Badalyan, R.S. (eds.), *Hin Hayastani mshakuyty XIV, Nyuter Hanrapetakan gitakan nstashrjani nvirvats akademikos B.B. Piotrovsku ev H.M. Janpoladyani hishatakin* (Culture of Ancient Armenia, XIV, Materials of the Republican Conference dedicated to the memory of academician B.B. Piotrovskiy and H.M. Janpoladyan). Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 11–16 (in Russian).

Yeritsyan, B.G. (1970a) Karedaryan kayanner Noyemberyani shrjanum (Stone Age sites in Noyemberyan district). *Lraber Hasarakakan Gitutyunneri* (Herald of Social Sciences) 5 (234), pp. 84–90 (in Armenian).

Yeritsyan, B.G. (1970b) *Yerevanskaya peshchernaya stoyanka i ee mesto sredi dreneyshix pamyatnikov Kavkaza* (Yerevan cave site and its place among the ancient monuments of the Caucasus). Avtoreferat dissertatsii na soiskanie uchenoy stepeni kandidata istoricheskix nauk (Synopsis of Candidate Dissertation). Moscow (in Russian).

Yeritsyan, B.G. and Tadevosyan, S.V. (1986) Paleoliticheskaya peshchernaya stoyanka Lusakert 1 (Paleolithic cave site Lusakert 1). In: Shilov, V.P. (ed.), *Arkheologicheskiye otkritiya 1984 goda* (Archaeological Discoveries of the year 1984). Moscow: “Nauka” Publishing House, p. 432 (in Russian).

Yeritsyan, B.G., Tadevosyan, S.V. and Gasparyan, B.Z. (1996) Kul’turniye osobennosti materialov mestonakhozhdeniya kamennogo veka Jraber (Cultural features of the materials of the Stone Age Site of Jraber). *Banber Yerevani Hamalsarani, Hasarakakan gitutyunner* (Bulletin of the Yerevan University, Social Sciences) 3 (90), pp. 125–131 (in Russian).

Yeritsyan, B.G., Tadevosyan, S.V. and Gasparyan, B.Z. (1998) Rezul’tati issledovaniya mestonakhozhdeniya kamennogo veka Nurnus (The results of investigation of the Stone Age Site of Nurnus). *Lraber Hasarakakan Gitutyunneri* (Herald of Social Sciences) 1 (597), pp. 164–169 (in Russian).

Figure 1
Aghitu-3 cave. 1: View of the Aghitu basalt massif looking west into the valley of the Vorotan River and showing the Zangezur mountain range in the background; 2: View looking west into the cave.

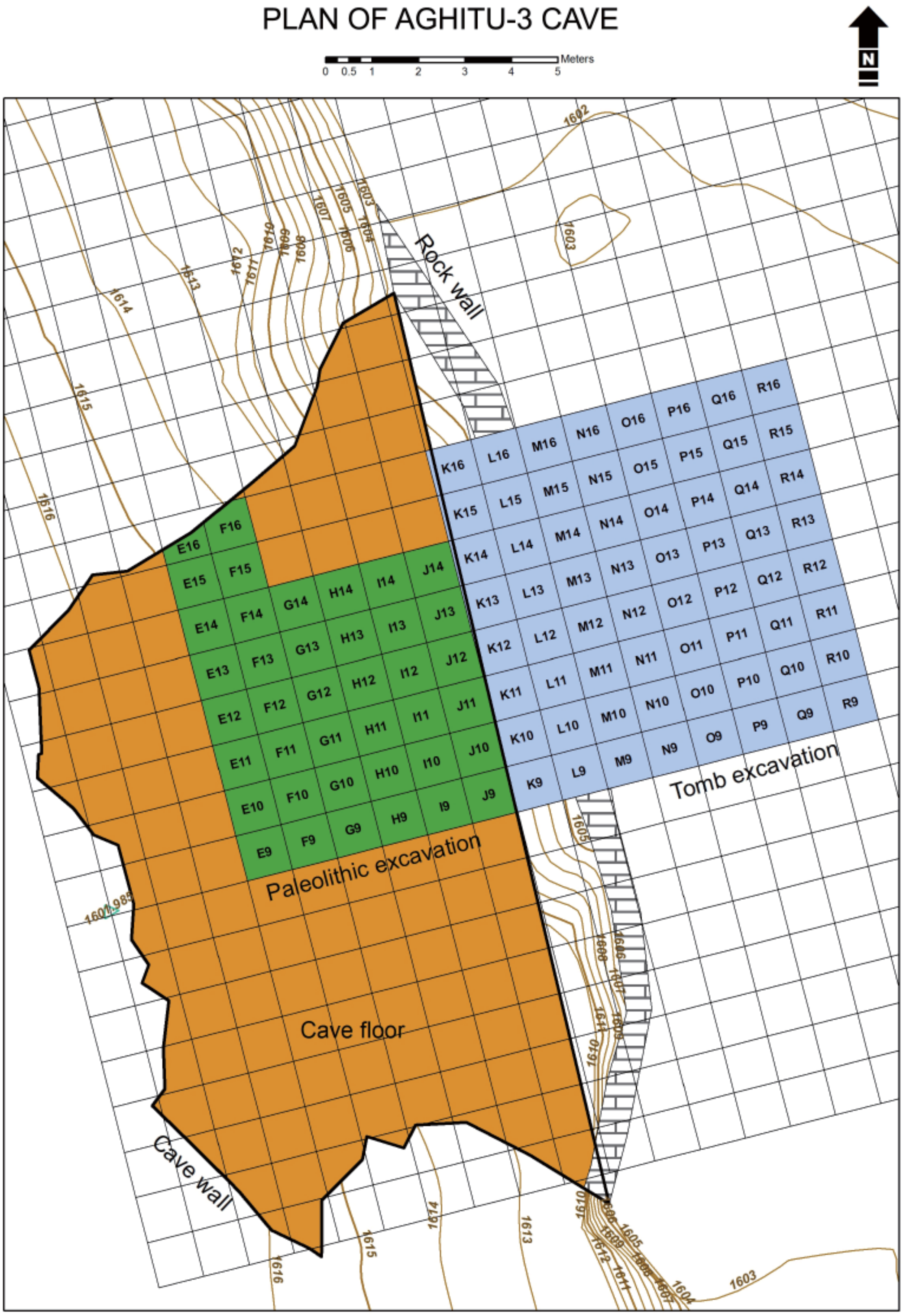
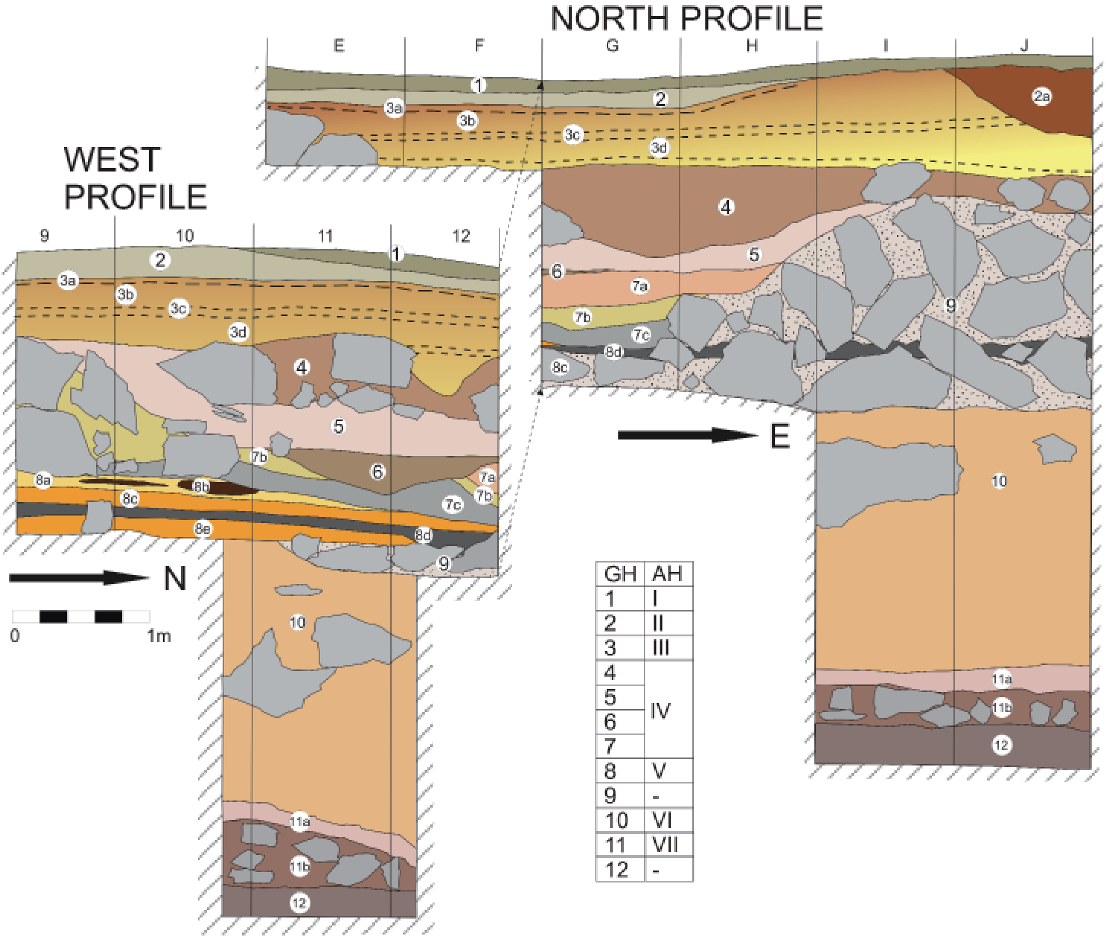


Figure 2
Aghitu-3 cave. Plan of the cave showing the areas of Paleolithic (green) and tomb (blue) excavations.



GH	AH
1	I
2	II
3	III
4	IV
5	
6	
7	
8	V
9	-
10	VI
11	VII
12	-

1. 10YR 4/2 Dark grayish brown sandy humus with some angular debris (modern human activity)
2. 10YR 5/2 Grayish brown humus with silt, angular debris and sand (colluvial and eolian formation)
2a. 10YR 4/2 Dark grayish brown humic silt with angular debris (mix by human activity)
3a, 3c, 3e. 10YR 6/4 Light yellowish brown angular debris with silt, includes fine carbonate sand (colluvial and eolian formation)
3b, 3d. 10YR 6/4 Light yellowish brown angular debris with silt, angular cobbles and fine sand (colluvial and eolian formation)
4. 10YR 6/4 Light yellowish brown angular debris with eolian silt and angular boulders (colluvial and eolian formation)
5. 10YR 6/4 Light yellowish brown eolian silt with angular debris and fine sand, some boulders (colluvial and eolian formation)
6. 10YR 6/4 Light yellowish brown fine sand including angular debris, facies changes every 1-2 cm (fluvial and colluvial formation)
7a, 7c. 2.5YR 5/3 Light olive brown silt including angular debris and angular boulders (colluvial and eolian formation)
7b. 2.5YR 5/3 Light olive brown angular debris including silt and angular boulders (colluvial and eolian formation)
8a. 2.5YR 5/3 Light olive brown fine sand, small sized pebbles of basalt and pumice (fluvial formation)
8b. 10YR 2/2 Very dark brown fine sand, small sized pebbles of basalt and pumice including charcoal (fluvial formation)
8c. 2.5YR 4/4 Olive brown loam (fluvial formation)
8d. 2.5YR 3/1 Very dark gray fine sand, small sized pebbles of basalt and pumice (fluvial formation)
8e. 2.5YR 4/4 Olive brown loam and fine sand, facies changes every 1-2 cm (fluvial formation)
9. Rockfall - Angular boulders including silt and angular debris (rock fall, cliff debris and eolian formation)
10. 2.5YR 4/4 Olive brown loam including some sub-angular debris and angular boulders, lens of peat and charcoal (fluvial formation)
11a, 11b. 2.5YR 4/4 Olive brown loam and angular debris, including some angular and sub-angular medium-size boulders (rock fall, cliff debris and eolian formation)
12. 10YR 4/4 Dark yellowish brown angular and sub-angular boulders including loam and lens of sand (colluvial, fluvial and elluvial formation)

Figure 3
Aghitu-3 cave. Profile drawings of the north and west walls of the Paleolithic excavation, including a general soil description of each layer and a chart correlating the geological horizons (GH) with the archaeological horizons (AH).

1

2

Figure 4
Aghitu-3 cave. 1: Remains of a clay oven-tonir located in square G14 whose base was originally dug about 30 cm into GH 3; 2: View looking southwest into the Parthian era (1st century BC) tomb constructed of basalt blocks and containing seven individuals.

Figure 5
Aghitu-3 cave. 1: Upper portion of the west profile wall depicting GH 1-10; 2: Lower portion of the west profile wall showing GH 10-12.

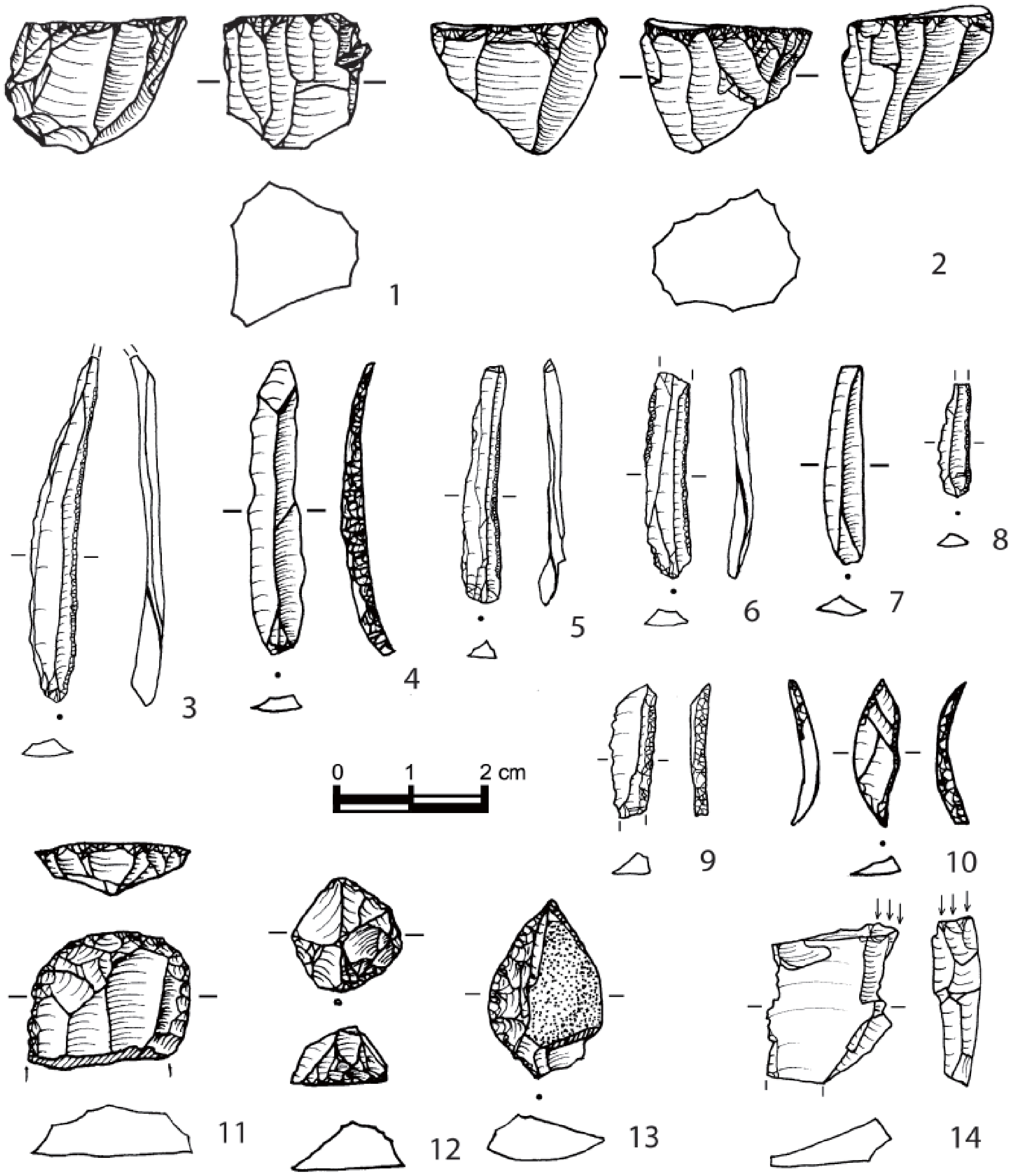


Figure 6

Aghitu-3 cave. Obsidian (1-6, 8-9, 12-14) and chert (7, 11) artifacts from GH 3. 1-2: Single platform cores; 3, 5-6, 8: Retouched bladelets; 4, 9-10: Backed pieces; 11-13: Scrapers; 14: Burin.

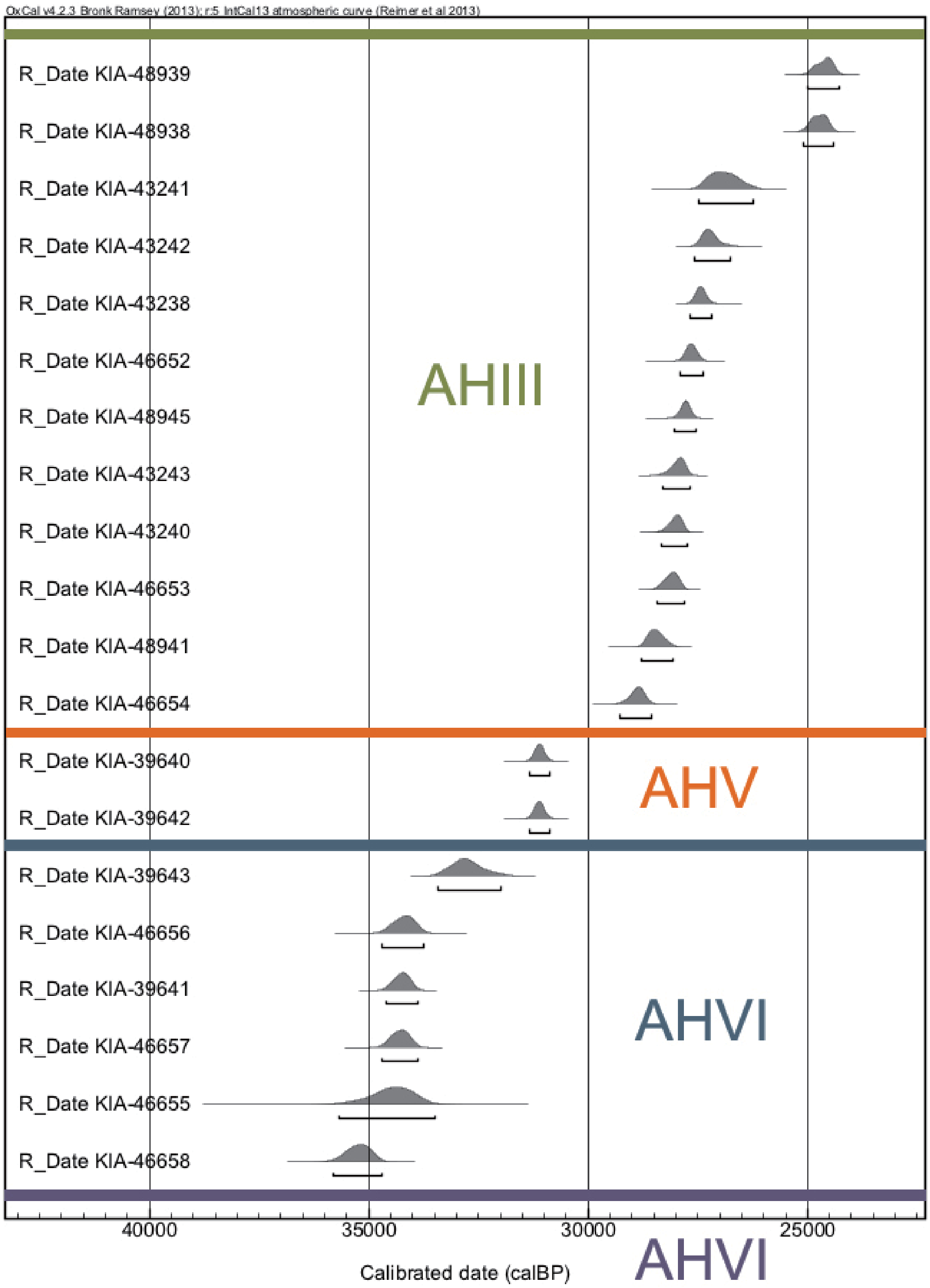


Figure 7
Aghitu-3 cave. Summary of radiocarbon dating results calibrated using OxCal v. 4.2.3 (Bronk Ramsey 2013) and IntCal 09 (Riemer *et al*. 2013).

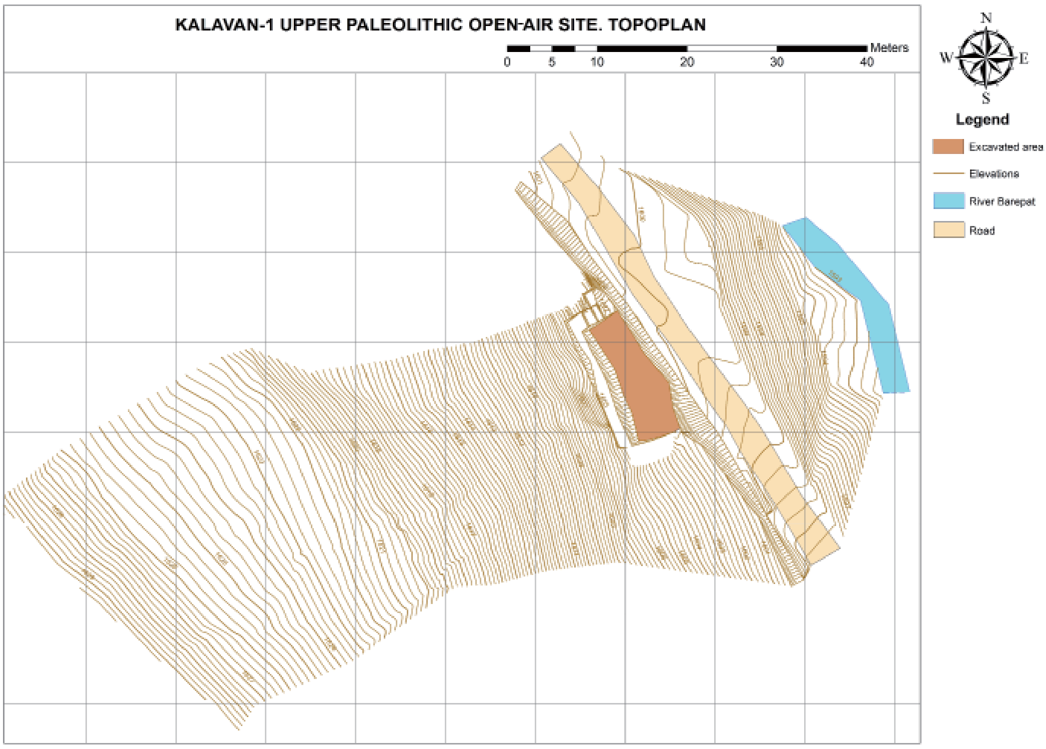


Figure 8

Kalavan-1 open-air site. Plan of site showing local topography, area of excavation and position of Barepat River.

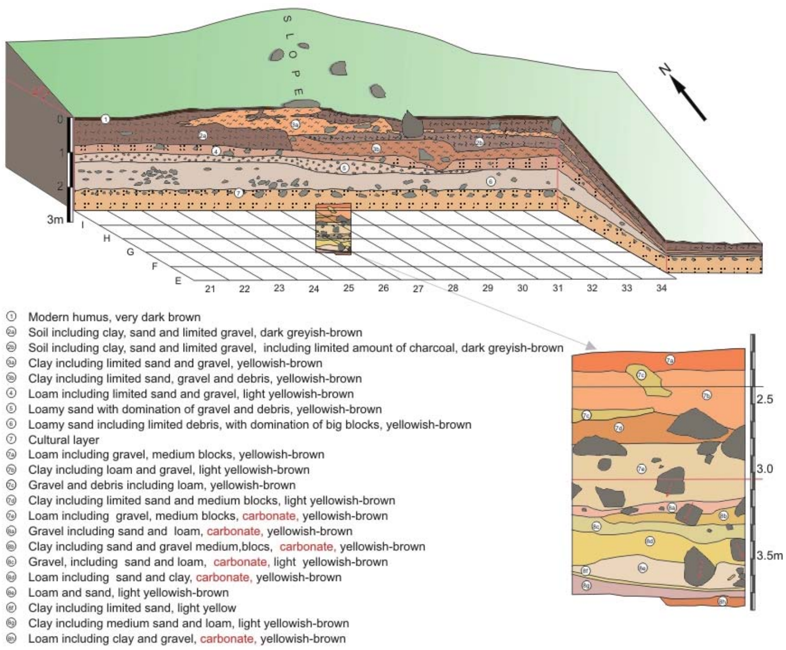


Figure 9

Kalavan-1 open-air site. 3D block diagram depicting profiles of the north and east walls of the excavation.

1

2

Figure 10

Kalavan-1 open-air site. 1: Squares GF 23-24, debris mound; 2: Concentration of lithic artifacts and faunal remains in Square F24.

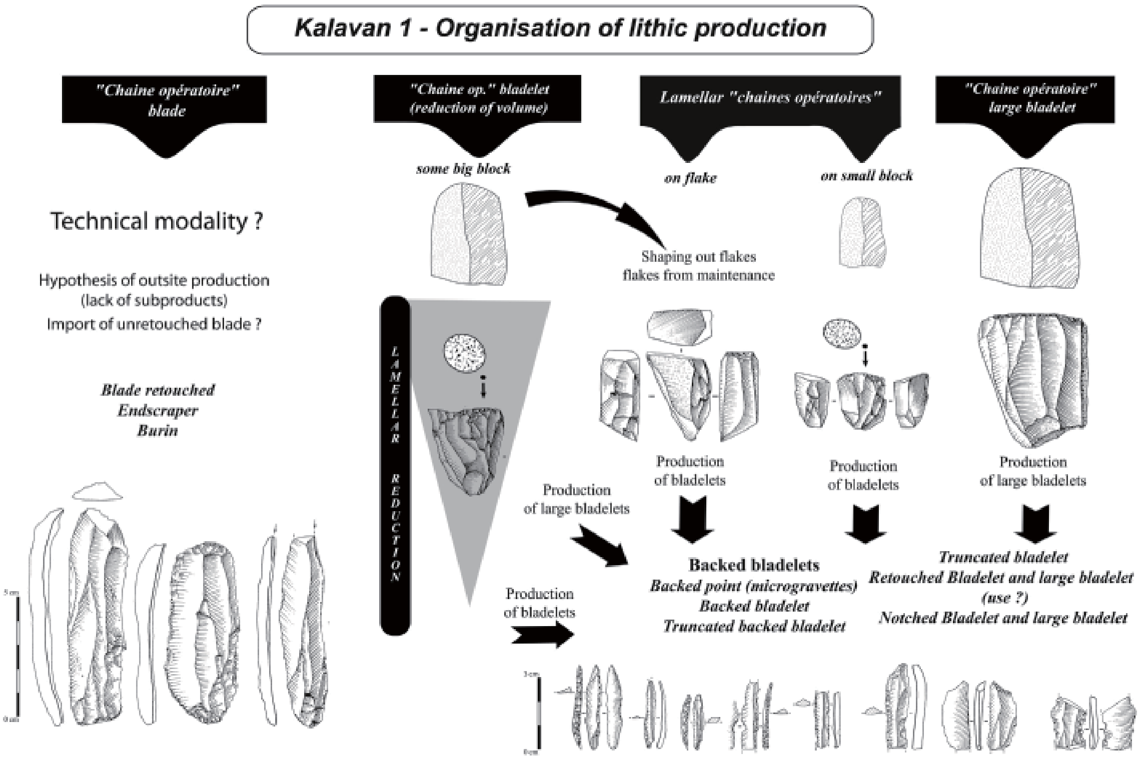


Figure 11

Kalavan-1 open-air site. Organization of lithic production.

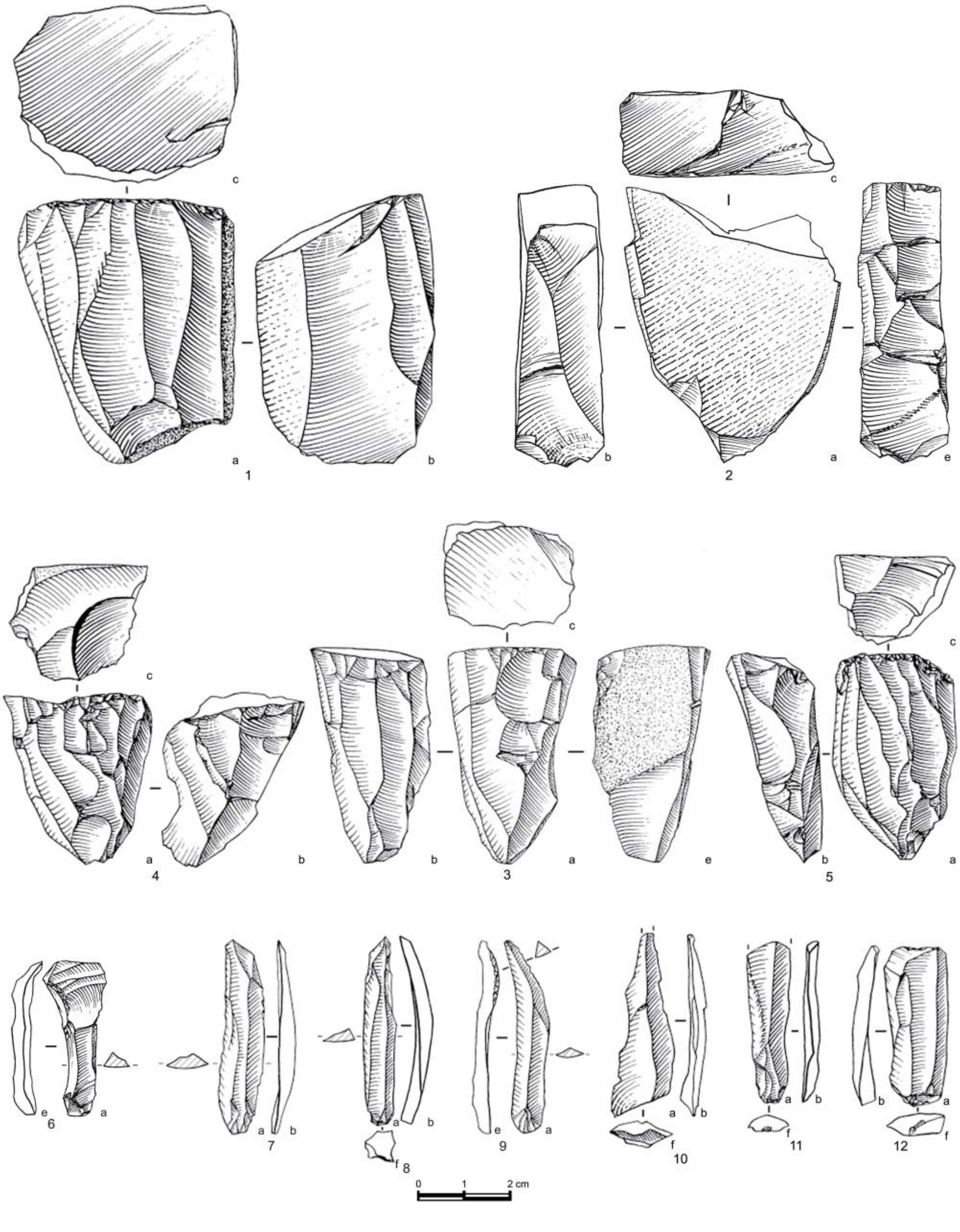


Figure 12
Kalavan-1 open-air site. 1-5: Single and double platform cores; 6-12: Bladelets.

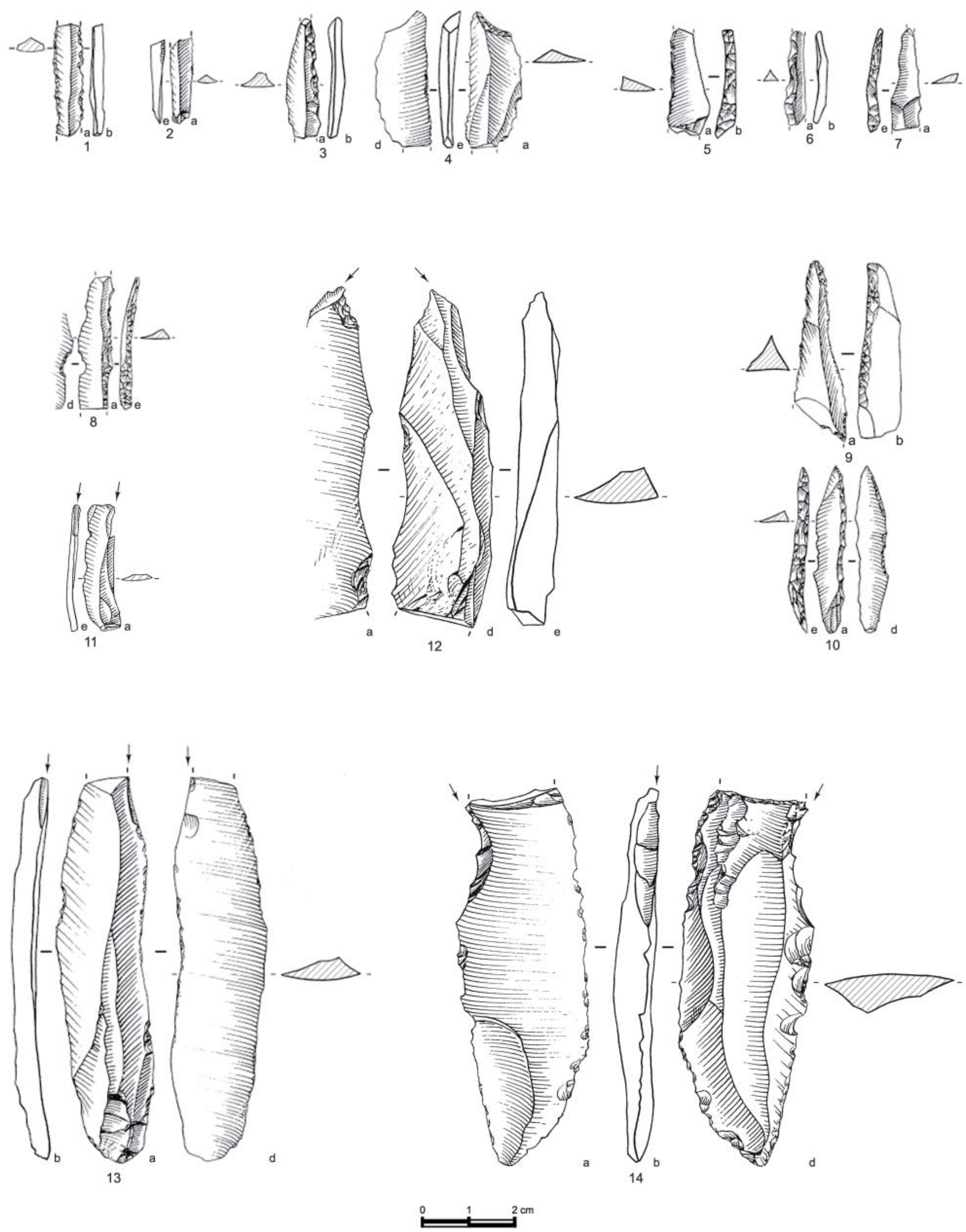


Figure 13
Kalavan-1 open-air site. 1-4: Retouched blades and bladelets; 5-10: Backed bladelet points (“microgravettes”); 11-14: Burins.

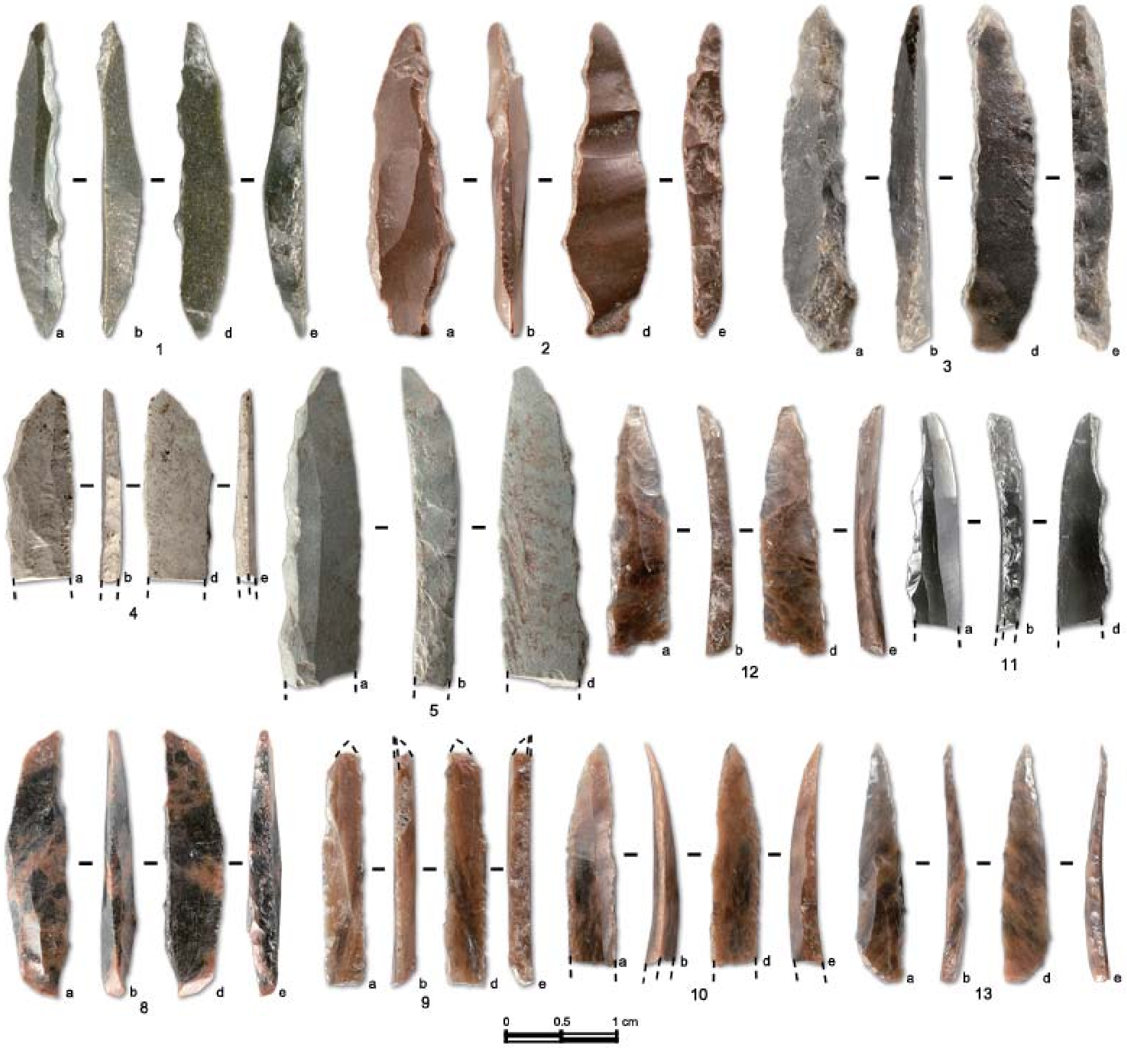


Figure 14
Kalavan-1 open-air site. 1-13: Backed bladelet points (“microgravettes”) made from flint, limestone and obsidian for hunting weaponry.

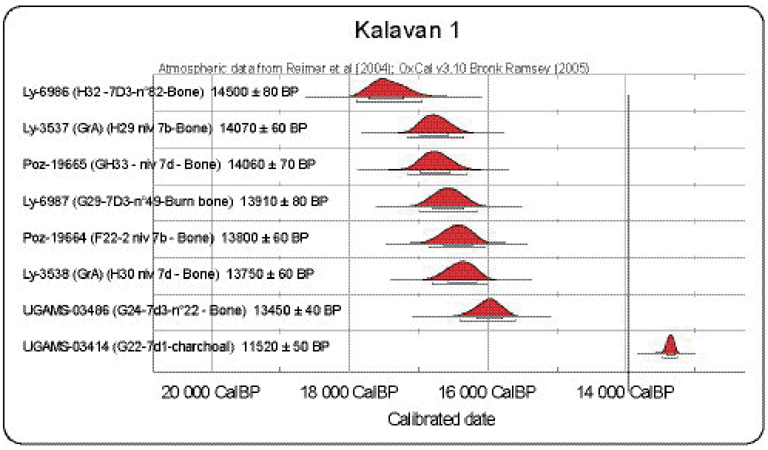


Figure 15
Kalavan-1 open-air site. Summary of radiocarbon dating results calibrated using OxCal v.3.10 (Bronk Ramsey 2005) and IntCal 09 (Riemer *et al*. 2004).

Early Holocene/Neolithic

Early Holocene Sites of the Republic of Armenia: Questions of Cultural Distribution and Chronology

Arthur Petrosyan, Makoto Arimura, Boris Gasparyan, Samvel Nahapetyan and Christine Chataigner

1. Introduction

Until recently, the earliest farming communities in Armenia were dated from the early 6th millennium BC. However, these sites are attributed to the Late Neolithic and display well established food-producing economies (Badalyan *el al*. 2007; Arimura *et al.* 2010). Thus, one of the main archaeological problems for the territory of Armenia and the whole southern Caucasian region is the reconstruction of the process of Neolithization. Unfortunately however, the archaeological sites dating to the terminal Pleistocene/Early Holocene required to establish such a reconstruction were very poorly represented. Happily, investigations within the last decade have revealed the very first terminal Pleistocene and Early Holocene sites in the country. These new findings, which build upon developments of the late 19th century, are opening new perspectives on the Neolithic Period. In general, the history of research into the Neolithic of Armenia can be divided into three stages:

The **First stage (from the beginning of the 20th century**–**1960)** is characterized by a period of surface collection, artifact definition, and chronological placement based on European Global Stone Age periodization schemes (J. de Morgan, A. Potapov, Y. Bayburtyan, S. Zamyatnin, M. Panichkina, S. Sardaryan).

The **Second stage (1960–2000)** is based on the discovery and research of certain Neolithic period archaeological sites such as the Aknashen-Khatunarkh (R.Torosyan) and Masis Blur (G.E. Areshian) settlements in the Ararat valley and the Hatis-10 open-air site, which is a large workshop near the outcrops of obsidian in the Kotayk Plateau (H. Ghazaryan). This research stage involved the study of stratified Neolithic materials and the definition of their local characteristics and chronological position in comparison with the synchronous sites of the southern Caucasus and Near East.

The **Third stage (2000–2014)** is significant for the targeted systematic research of Neolithic sites through an established network of local and foreign specialists and, importantly, with usage of modern excavation and analytical techniques. It is during this stage that several Early Holocene sites were discovered across Armenia (B. Gasparyan). New and significant results were achieved in parallel while re-excavating three Late Neolithic settlements in the Ararat Valley – Aratashen, Aknashen-Khatunarkh (R. Badalyan), and Masis Blur (P. Avetisyan and G.E. Areshian).

Early Holocene sites were first detected in the Aparan Depression as a result of investigations by the Armenian-French joint expedition (directors: B. Gasparyan, Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia and C. Chataigner, Maison de l'Orient et de la Méditerranée, Lyon), which, because of the general lack of such materials from previous work, provided a wealth of information about this period. While recent years have seen discovery of other Early Holocene sites in other regions of Armenia (Ararat, Shirak and Lori Depressions, Aghstev River Valley, etc.), it is those located in the limits of the Aparan Depression that display what appears to be a consistent cultural phenomenon within one geomorphologic unit. It is therefore these sites that form the framework of our discussion.

2. Apnagyugh-8/Kmlo-2 cave

Apnagyugh-8/Kmlo-2 is situated on the eastern side of the Aragats massif, in the middle stream of the Kasakh River valley at its junction with a small tributary. The absolute elevation of the cave, opened in a basaltic lava flow, is about 1700 m asl. Internal erosion caused most of the cave's degradation, although earthquakes were probably responsible for the ultimate collapse of the entrance (Figure 1). The site was discovered in 2002 by an Armenian-French joint expedition during a systematic survey in the Kasakh River valley. A test trench revealed the presence in the cave of obsidian artifacts and faunal remains. The excavations started in 2003 and, over the next four field seasons, about 10 m^2 were excavated (Figure 2).

Wind-blown sediments were initially deposited on a mass of fallen rocks from the collapsed vault. The upper layer 1 lies sub-horizontally and corresponds to a Medieval occupation, which, unfortunately, has heavily disturbed the upper part of the archaeologically rich underlying prehistoric layers 2-5 (Figure 2). In these layers there are lumps of hardened floor full of obsidian artifacts and faunal remains, which is probably the only evidence of *in situ* prehistoric occupation in the cave.

With the exception of domestic sheep, the floral and faunal remains belong exclusively to wild species. It is important to note, however, that the stratigraphic position of the few sheep bones is tenuous since the earthquake-induced porch collapse may have caused some material to percolate down between the blocks of stone and ultimately come to rest more than 1 m deeper. The objects of the prehistoric layers are thus possibly mixed together and displaced.

C14 dates taken from different layers could be grouped into four occupational phases (Table 1). The first group points toward the 12th–10th millennia Cal BC, the second to the 10th–8th millennia Cal BC, the third to the 6th–5th millennia Cal BC and, finally, the last to the Medieval period.

Table 1
C14 dates from Apnagyugh-8/Kmlo-2 cave.

Phase	Code	Material	Date BP uncalibrated	Date AD/BC calibrated (2 sigmas)
I	LTL-5736A	charcoal	679 ± 50	1250 – 1400 AD
I	Ly-13663	charcoal	975 ± 30	1014 – 1155 AD
I	Ly-12512	charcoal	1095 ± 35	887 – 1017 AD
II	Ly-2761 (OxA)	burnt bone	5515 ± 30	4450 – 4328 BC
II	Ly-2817 (SacA)	charcoal	5555 ± 60	4520 – 4269 BC
II	UGAMS-4077	burnt bone	5610 ± 30	4499 – 4360 BC
II	Ly-2762 (OxA)	tooth	6640 ± 40	5631 – 5491 BC
III	UGAMS-6457	bone	8480 ± 40	7587 – 7498 BC
III	Poz-19666	bone	8500 ± 50	7596 – 7492 BC
III	UGAMS-6456	charcoal	8830 ± 30	8201 – 7759 BC
III	UGAMS-6455	bone	8980 ± 40	8286 – 7976 BC
III	UGAMS-6458	bone	9050 ± 40	8304 – 8226 BC
III	LTL-5735A	bone	9311 ± 50	8720 – 8420 BC
III	UGAMS-6459	charcoal	*10020 ± 40*	*9794 – 9366 BC*
IV	UGAMS-5797	bone	8790 ± 30	8165 – 7728 BC
IV	UGAMS-5798	charcoal	9420 ± 30	8778 – 8626 BC
IV	LTL-5737A	charcoal	9507± 60	9140 – 8640 BC
IV	UGAMS-4076	bone	9840 ± 30	9354 – 9252 BC
IV	AA-68562	bone	10024 ± 91	10012 – 9300 BC
IV	AA-68563	bone	10184 ± 93	10425 – 9446 BC
V	Poz-20231	bone	10900 ± 50	10976 – 10680 BC
V	Ly-6990 (SacA)	bone	10990 ± 60	11131 – 10732 BC
V	UGAMS-5799	bone	11310 ± 30	11344 – 11165 BC
V	UGAMS-5800	charcoal	11600 ± 30	11645 – 11363 BC

The lithic industry tends to confirm this partition into three early phases of occupation:

- The most frequent types of microliths are the backed bladelets and scalene (straight-backed and obliquely truncated) bladelets that recall those of the Late Upper Paleolithic tradition of Kalavan-1 and the Mesolithic sites of the 10th to 9th millennia BC in Georgia, for example at Kotias Klde (Meshveliani *et al*. 2007; Montoya *et al*. 2013);
- So-called "Kmlo tools", which are defined as having lamellar parallel retouch, created by pressure flaking that forms a steeply-angled edge with a dentate outline. The position of retouche occurs on both the dorsal and ventral faces. The retouch often terminates before the proximal end, which has the form of a hook or two accentuated ridges (Figure 3). Similar tools are known from sites the Pre-pottery Neolithic (8th to 7th millennia BC) of both the Near East and north-western Caucasia. These tools are also present from at least the first half of the 9th millennium BC at Apnagyugh-8/Kmlo-2 cave (Figure 3);
- Transverse arrowheads are characteristic of the Late Neolithic and the Chalcolithic of a very large region, as they appear in the Near East at the end of the 7th millennium BC (Sabi Abyad in Syria) and spread then over the northern part of the Near East and into southern Europe (Copeland and Akkermans 1994; Wechler 2001). In Armenia, a large number of transverse arrowheads have been found at a late 5th millennium BC site (Tsaghkahovit-1 rock-shelter) located not far from Apnagyugh-8/Kmlo-2 on the northern flank of Mt. Aragats (Arimura *et al*. 2012).

Regardless of the cultural phase, all of the lithic artifacts of Apnagyugh-8/Kmlo-2 share some common features:

a) Obsidian is almost exclusively the raw material used: more than 6,000 pieces are in obsidian, other raw materials such as flint and dacite are quite few;

b) Cores are generally small; the main core reduction strategy was based on unidirectional knapping with direct percussion;

c) The microlithic component is predominant; some larges blades, more than 2 cm wide and 10 cm long, are present but very rare.

The site of Apnagyugh-8/Kmlo-2 demonstrates the presence of human groups at the beginning of the Holocene in the region of the Aragats massif. With a cave occupation and a tool kit of microlithic tradition, the culture represented at Apnagyugh-8/Kmlo-2 could be related to the Mesolithic. But a particular category of artifacts (the "Kmlo tools"), with abrupt and regular pressure retouch, is reminiscent of both the "Çayönü tools", present in northern Mesopotamia between the 8th and the 7th millennia BC and the "hook-like tools" of the "Paluri-Nagutny" culture which developed on the south-west flank of the Greater Caucasus and then on the high plateaus of southern Georgia in later periods (Grigolia 1977; Caneva *et al*. 1998). The relations between Kmlo-2 and these cultures will be the subject of a further study.

Further research should be especially focused on Early Holocene sites, which will enable a better understanding of the human occupation of Armenia in this period as well as the process of floral and faunal domestication in the southern Caucasus (Chataigner *et al*. 2012, p. 57).

3. Kuchak-1 rock-shelter

Kuchak-1 rock-shelter is located north-east of the village for which it is named at the northern bank of the Aparan Reservoir at an elevation about 1855 m asl. It is a small natural cavity (12 × 6 × 2 m) that was formed on the western edge of the Aragats Mountain. It lies at the junction of the Kasakh River and one and its tributaries on a weathered Upper Pleistocene andesitodacite flow. It is possible that a cave existed prior to the collapse of the entrance (Figure 4).

The site was discovered and studied in 2004 by an Armenian-French joint expedition. Systematic excavations at the site began in 2007. During the 2007-2010 seasons the expedition of the Institute of Archaeology and Ethnography (directed by B. Gasparyan) excavated an area around 60 m^2 under the shelter and on the slope in front of the rock-shelter. Test trenches were also set up on the opposite side of the modern road passing directly across the site to define the limits of the occupation (Figure 5).

The following statigraphy of the geological horizons or layers were identified (from the top to the bottom, Figure 6):

Layer 1. Modern soil, overall thickness averages 0.35 m , which is subdivided into three horizons;

1a: Grayish brown (10YR 5/2) humus with limited sub-angular debris (first horizon of modern soil 0.20 m)

1b: Very dark brown (10YR 3/2) humus with sub-angular debris (second horizon of modern soil, 0.10 m)

1c: Dark grayish brown (10YR 4/2) humus with sub-angular debris and ash and charcoal (third horizon of modern soil, 0.06 m).

Layer 2. Second layer of humus, overall thickness averages 0.20 m, which is subdivided into:

2a: Grayish brown (10YR 5/2) humus including sub-angular debris and big blocks (pedogenesis), 0.08 m;

2b: Grayish brown (10YR 5/2) humus with sub-angular debris and big blocks, including limited alluvial pebbles and small sand (pit), 0.07 m;

2c: Grayish brown (10YR 5/2) humus with sub-angular debris, including limited alluvial pebbles and small sand (bioturbation pit), 0.05 m;

Layer 3. Brown (10YR 4/3) loam, including sub-angular debris, alluvial pebbles, and small sand (fluvial and aeolian sediments, 0.25 m);

Layer 4. Brown (10YR 4/3) humus and loam, including limited sub-angular debris (paleosol, 0.20 m);

Layer 5. Andesitedacite bedrock.

The total thickness of sediments in the excavated areas is between 0.20–1.01 m. The full sequence of deposition exists in only a few of the excavation squares (Figures 6 and 7: 2), as bedrock lies close to the surface along most of the excavated areas. The formation of Layer 1 probably occurred in the Late Holocene while Layer 2 was likely formed during the Early Holocene. Layer 3 most probably belongs to the Younger Dryas and marks a boundary between Pleistocene and Holocene of the Aparan Depression. The layer was formed in conditions of noticeable climatic displacements (from dry and cold to warm and humid) and rapid change of local paleoenvironment. The timing of formation of Layer 4 is Late Pleistocene, which is confirmed by the existence of late Middle Paleolithic artifacts. The excavations here recorded noticeable density of cultural remains from different periods.

Most of Early Holocene cultural remains originate from Layers 2 and 3. Layer 1 contains many pottery fragments from the Medieval Period (4th–13th centuries AD) and Late Bronze Age (15th/14th–13th centuries BC) in addition to trash and other indicators of recent activity. Unfortunately, the recent, Medieval, and Bronze Age activities disturbed most of the *in situ* deposition of the cultural remains of the Early Holocene. Early Holocene populations were also responsible for disturbing earlier occupations, as pits and other constructions passed into the Middle Paleolithic cultural remains in Layer 4. The stone construction discovered in front of the shelter is very poorly preserved and heavily damaged by recent activities. However, this is the earliest such phenomenon yet recorded in Armenia, which shows that artificial structures in front of caves date to at least the Early Holocene (Figure 7: 1). In sum, the stratigraphic position of the cultural remains is relatively clear and their distribution is in agreement with the geological stratigraphy of the site.

The lithic industry, represented by over 3,000 stone implements, originates mainly from layers 2a to 4 and is a result of activity of Early Holocene and Middle Paleolithic populations. The artifacts are prepared mainly from obsidian. Implements from other types of raw materials (basalt, andesite, dacite, limestone, etc.) are rare and are represented by natural pebbles and cobbles, which served mainly as hammer-stones and retouchers. Two examples of serdolite beads and a fragment of "shaft-straightener" from andesitic basalt are also present among the materials. The obsidian implements of the Early Holocene period represent a single industry. Cores are knapped from obsidian pebbles of various sizes that were washed by the Kasakh River from the Tsaghkunyats sources. The class of cores are single-platform unifacial, double-platform unifacial, and discoidal as well, proto-prismatic and prismatic, which corresponds to the products of knapping (large and massive flakes and blades, small and thin bladelets of different shapes) and the tools based on them.

Among the tool assemblage retouched flakes and blades, scrapers, naturally backed knives, burins, notched and denticulated tools, harpoons, asymmetric and simple points, arrowheads, geometric microliths, and backed bladelets are all present. The most significant are the aforementioned "Kmlo tools". They are manufactured on thick, elongated flakes with an application of steep lamellar retouch on the ventral side of the artifact with pressure technology (Figure 8). Other examples are well known from the synchronous sites of the Aparan Depression and other areas of Armenia (Chataigner *et al.* 2007, pp. 31-32; Arimura *et al*. 2009; 2010, pp. 77-80). It is interesting to note that in the Kuchak collection there are other categories of tools, mainly arrowheads, that are also formed with steep lamellar pressure retouch, which suggests that this technique was used for purposes other than the shaping of these "Kmlo tools" (Figure 8). It is important to mention that a limited number of poorly preserved faunal remains, among which wild sheep, goat, and roe dear were identified, were also found *in situ* (some inside of the construction)[1].

4. Gegharot-1 open-air site

Gegharot-1 is an open-air site on the eastern suburbs of the eponymous village, on the southern slope of the Pambak Range at the elevation about 2127 m asl. The site was discovered in 2002 by an Armenian-French joint expedition during a systematic survey in the Kasakh River valley (Arimura *et al*. 2009, p. 19). It is located on the slope of small hill, which is a heavily weathered intrusive granite massif of Paleocene ege. In small ravines, spread on the right and left sides of the hill, peat-bog formations can be observed, some of which are covered with alluvial sediments composed of

1. We gratefully acknowledge Prof.-Dr. H.-P. Uerpmann (University of Tübingen, Germany) and Dr. Guy Bar-Oz (Laboratory of Archaeozoology, Zinman Institute of Archaeology, University of Haifa), who identified the faunal remains.

weathered granite sand. The site itself probably occupied the top of the hill during the early stages of Holocene pedogenesis. Afterwards, as a result of slope activitation, the occurrence of cultural remains were disturbed, and later buried at different levels of soil or on the eroded surface.

More than 100 lithic artifacts in total were collected from the surface and the eroded parts of the soil cover.

The lithic industry is based mainly on obsidian (around 90%) and the tools made of other raw materials (quartzite, basalt, dacite, flint) are unique. In the small collection of Gegharot-1 there are pieces quite similar to the ones from the Apnagyugh-8/Kmlo-2 industry – "Kmlo tools" (the most characteristic artifact of the collection, around 17 pieces), pressure detached bladelets, geometric microliths, end scrapers, and burins. The "Kmlo tools" (Figures 9-12) from Gegharot-1 are characterized as follows:

- Blanks: all pieces are made on simple large blades, around 20 mm wide and 8 mm thick.
- Abrasion trace: This is a common character among "Kmlo tools" from Gegharot-1. Abrasions typically occur opposite the retouched faced. In general, abrasion traces are well developed in a band but, in some cases, very slight abrasion traces also exist on the ventral face. The abrasion traces were created prior to the pressure retouche, as they are cut through by the latter.
- Edge modification: This is also a common character in Gegharot-1. The lateral edge is often modified by burin blow, and a spall removed from a "Kmlo tool" is present in the collection. Truncation of the end(s) is also often observed.

As mentioned above, the function of "Kmlo tool" is yet uncertain, but some were probably used for hard mineral working. In the collection there is a flake tool with traces of abrasion, which indicates that some mineral working was an important activity in Gegharot-1 (Figure 12: 2). Among the most interesting finds from Gegharot-1 is a small "shaft-straightener" made from serpentine, which, together with a similar find from Kuchak-1 rock-shelter, are the oldest examples of such artifacts from all of Armenia (Figure 12: 3).

There are limited finds of faunal remains from Gegharot-1 in the context of the lithic implements, represented by teeth of kulan or *Equus hemionus* (identifications of H.-P. Uerpmann).

Based on the techno-typological characteristics of the "Kmlo tools", the Gegharot-1 collection can be attributed to the Early Holocene, possibly contemporary with the sites mentioned above in the Aparan Depression (Apnagyugh-8/Kmlo-2 cave, Kuchak-1 rock-shelter and the others).

5. Concluding remarks

The investigations of the last decade have brought to light the first known Mesolithic and/ or Proto-Neolithic sites dating to the Early Holocene in Armenia. These sites are concentrated within the limits of the Aparan Depression and the Kasakh River valley (Apnagyugh-8/Kmlo-2 cave, Kuchak-1 rock-shelter, Gegharot-1, Ria-Taza-2, Aragats-1 and 2 open-air sites). Other such sites have been discovered on the southern slopes of Mt. Aragats in the Ararat Depression (Aruch-1, Vahagni-1, Satani-Dar, Ashnak-1 and Katnaghbyur-1 open-airs), the Shirak Depression (Shirakavan-1, Aghvorik-1 open-airs), the Lori Depression (Kruglaya-Shishka-1 cave, Paghaghbyur-1 open-air site), the Aghstev River valley (Yenokavan-2 cave), and others, and "Kmlo tools" are common implements among the products of the lithic industries (Figure 13) (Gasparyan and Sargsyan 2003; Gasparyan 2007; Gasparyan *et al*. 2005; Yeritsyan *et al*. 2009). Preliminary investigations of those sites reveal the existence of very small, mobile groups of Early Holocene hunters and gatherers who occupied caves and rock-shelters in the river canyons as well as river terraces and plateaus in high mountain depressions. While rich with lithic assemblages that show the exploitation of various obsidian sources, the relatively thin cultural deposits of these sites lack rich bioarchaeological information. Nevertheless, the limited bioarchaeological materials, together with toolkit composition, suggest hunting of wild species (sheep, goat, deer, and kulan), fishing, and collecting wild plants. Signs of domestication and a food producing economy are largely absent, which precludes the placement of these Early Holocene sites in the frame of the Neolithic but, rather, necessitates their consideration as Mesolithic and/or Proto-Neolithic with a time range of 12,000–7,500 Cal BC (based on a preliminary set of radiocarbon dates). This provides a chronological problem and cultural gap between these Early Holocene sites and the Late Neolithic sites (the so-called "Aratashen-Shulaveri-Shomutepe" culture).

The lithic assemblages of the Early Holocene sites are characterized by a large number of geometric microliths (scalene, trapeze-rectangles) as well as very special tools with continuous parallel retouch on the lateral edges executed by pressure flaking technology. These unique artifacts, called "Kmlo tools", mark the cultural specification of the time period. They have visual similarities with the so-called "Çayönü tools" known from the Near Eastern Pre-pottery Neolithic sites, but are different in many respects from the latter's techno-morphological designing concept and appear in Armenia at least from the first half of the 9th millennium BC. The functional purpose of these "Kmlo tools" is not yet clear. Similar tools with secondary shaping have been found in Early Holocene caves and Neolithic settlements of the Caucasus and regions of the Near East dated to the 8th to 7th millennia BC (Mortensen 1970; Redman 1982; Fujii 1988; Bader 1989; Bader and Tseretelli

1989; Anderson 1994; Balkan-Atlı 1994; Caneva *et al*. 1994; Rosenberg 1999; Nishiaki 2000; Kozlowski and Aurench 2005, pp. 65-73; Cauvin *et al*. 2011, pp. 6-7, 11, 29, 35). As mentioned before, research on "Kmlo tools" shows that the working edges are very often removed or refreshed with the method of a burin blow, thus this kind of tool was rarely re-retouched and reformed into a previous shape of tools.

Although our investigations of these sites have provided the first evidence for terminal Pleistocene/Early Holocene sites in Armenia, many aspects in this period, such as subsistence economy and social organization, are still unclear. New excavations of "Kmlo type" sites, especially ones with richer bioarchaeological sequences, which are likely to be located in the northern karstic environments of Armenia that are conducive to the preservation of organic materials, are important future tasks for Armenian archaeology.

References

Anderson, P. (1994) Reflection on the significance of two PPN typological classes in light of experimentation and microware analyses: Flint "Sickles" and obsidian "Çayönü" tools. In: Gebel, H.G.G. and Kozlowski, S.K. (eds.), *Neolithic chipped stone industries of the Fertile Crescent.* Berlin: ex orient, pp. 61–82.

Arimura, M., Chataigner, C. and Gasparyan, B. (2009) Kmlo-2, An Early Holocene Site in Armenia. *Neo-Lithics* 2/2009, pp.17–19.

Arimura, M., Badalyan, R., Gasparyan, B. and Chataigner, C. (2010) Current Neolithic Research in Armenia. *Neo-Lithics* 1/2010, pp. 77–85.

Arimura, M., Gasparyan, B. and Chataigner, C. (2012) Prehistoric sites in Northwest Armenia: Kmlo-2 and Tsaghkahovit. In: Matthews, R. and Curtis, J. (eds.), *Proceedings of the 7th International Congress of the Archaeology of the Ancient Near East, 12 April – 16 April 2010, The British Museum and UCL, London, Volume 3: Fieldwork and Recent Research Posters*. Glatz C., Simpson St.J., Taylor H., Tubb J. and Chapman R., Wiesbaden: Harrassowitz Verlag, pp. 135–149.

Badalyan, R., Lombard, P., Avetisyan, P., Chataigner, Ch., Shabot, J., Vila, E., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New Data on the Late Prehistory of the Southern Caucasus. The excavations at Aratashen (Armenia): Preliminary report. In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe–IIIe Millénaires avant notre ère). Leurs relations avec le Proche Orient*. Paris: CNRS Editions, pp. 37–61.

Bader, N.O. (1989) *Drevneyshiye zemledel'tsi Severnoy Mesopotamii* (Ancient farmers of the Northern Mesopotamia). Moscow: "Nauka" Publishing House (in Russian).

Bader, N.O. and Tseretelli, L.D. (1989) Mezolit Kavkaza (The Mesolithic of the Caucasus). In: Kol'tsov, L.V. (ed.), *Mesolithic of USSR*. Archaeology of the USSR series. Moscow: "Nauka" Publishing House, pp. 93–105 (in Russian).

Balkan-Atlı N. (1994) *La Néolithisation de l'Anatolie*. Varia Anatolica VII. Paris: Institut français d'études anatoliennes d'Istanbul.

Caneva, I., Conti, A., Lemorini, C. and Zampetti, D. (1994) The lithic industry at Çayönü: A Preliminary Overview of the Aceramic Sequence. In: Gebel, H.G. and Kozlowski, S.K. (eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent*. Berlin: ex orient, pp. 253–266.

Caneva, I., Lemorini, C. and Zampetti, D. (1998) Chipped stone at Aceramic Çayönü: Technology, Activity, Tradition, Innovations. In: Arsebuk, G, Mellink, M.J. and Schirmer, W. (eds), *Light on top of the Black Hill. Studies presented to Halet Cambel.* Istanbul: Ege Yayinlari, pp. 199–206.

Cauvin, J., Arenche, O., Cauvin, M.-C. and Balkan-Atlı, N. (2011) The Pre-Pottery Site of Cafer Höyük. In: Başgelen N., Özdoğan M., Kuniholm P. (eds.), *The Neolithic in Turkey: New Excavations & New Research volume 2. The Euphrates Basin*. Istanbul, Galatasaray: Archaeology & Art Publications, pp. 1–40.

Chataigner, C., Arimura, M. and Gasparyan, B. (2007) La néolithisation de L'Arménie. *Les Dossiers d'archéologie* N321, pp. 30–35.

Chataigner, C., Gasparyan, B., Montoya, C., Arimura, M., Melikyan, V., Liagre, J., Petrosyan, A., Ghukasyan, R., Colonge, D., Fourloubey, K., Arakelyan, D., Astruc, L., Nahapetyan, S., Hovsepyan, R., Balasescu, A., Tome, K. and Radu, V. (2012) From the Late Upper Palaeolithic to Neolithic in North-Western Armenia: Preliminary results. In: Avetisyan, P. and Bobokhyan, A (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 52–63.

Copeland, L. and Akkermans, P.M.M.G. (1994) A cache of 56 flint transverse arrowheads from Tell Sabi Abyad, Balikh valley, Syria. In: Gebel, H.G. and Kozlowski, S.K. (eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent. Proceedings of the First Workshop on PPN Chipped Lithic Industries*. Berlin: ex oriente, pp. 379–382.

Fujii, S. (1988) Typological Reassessment and Some Discussions on "Beaked Blades". *Bulletin of the Okayama Orient Museum* 7, pp. 1–16.

Gasparyan, B. and Sargsyan, G. (2003) Kasakhi kirchi hnagitakan hushardzanneri usumnasirutyan nakhnakan ardyunknery (Preliminary results of investigation of the archaeological monuments in the Kasakh River Canyon). In: *The Jubilee Conference "Aragatsotn. Spiritual and Cultural Heritage", dedicated to the 1700th anniversary of the unction of the Mother Temple of Holy Ejmiatsin*. Theses of the Conference. Oshakan, pp. 58−59 (in Armenian).

Gasparyan, B. (2007) *Dans les montagnes d'Arménie, 500 000 ans d'histoire avant notre ére*. Fichet de Clairfontaine, F. (ed.). Rouen: Musée archéologique de Saint-Raphael; Musée départemental des antiquités, pp. 47–51, 130–133.

Gasparyan, B., Nahapetyan, S., Sargsyan, G. and Gabrielyan, I. (2005) Kamenniy vek Tashirskogo plato (The Stone Age of the Tashir Plateau). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin*

Hayastani mshakuyty XIII (The Culture of Ancient Armenia XIII). Materials of the Republican conference. Yerevan: “Mughni” Publishing House, pp. 17–27 (in Russian).

Grigolia, G.K. (1977) *Neolit Tsentral’noy Kolkhidi. Paluri* (The Neolithic of Central Kolkhida. Paluri). Tbilisi: “Metsniereba” Publishing House (in Georgian with Russian Resume).

Kozlowski, S.K. and Aurenche, O. (2005) *Territories, Boundaries and Cultures in the Neolithic Near East*. BAR International Series 2005. Oxford: Archaeopress.

Meshveliani, T., Bar-Oz, G., Bar-Yosef, O., Belfer-Cohen, A., Boaretto, E., Jakeli, N., Koridze, I. and Matskevich, Z. (2007) Mesolithic hunters at Kotias klde, Western Georgia: Preliminary results. *Paléorient* 33/2, pp. 47–58.

Montoya, C., Balasescu, A., Joanin, S., Ollivier, V., Liagre, J., Nahapetyan, S., Ghukasyan, R., Colonge, D., Gasparyan, B. and Chataigner, C. (2013) The Upper Paleolithic site of Kalavan-1 (Armenia): An Epigravettian settlement in the Lesser Caucasus. *Journal of Human Evolution* 65, pp. 621–640.

Mortensen, P. (1970) *Tell Shimshara, The Hassuna period*. Kobenhavn.

Nishiaki, Y. (2000) *Lithic technology of Neolithic Syria*. BAR international series 850. Oxford.

Rosenberg, M. (1999) Hallan Çemi. In: Özdoğan, M. and Başgelen, N. (eds.), *Neolithic in Turkey. The cradle of civilizations. New Discoveries*. Istambul: Arkeoloji ve Sanat Yayinlari, pp. 9–18, 25–33.

Redman Ch.L. (1982) The Çayönü Tepesi chipped stone industry: 1968 and 1970 excavation seasons. In: Braidwood, L.S. and Braidwood. R.J. (eds.), *Prehistoric village Archeology in South-Eastern Turkey*. BAR International Series 138. Oxford, pp. 17–71.

Wechler, K.P. (2001) *Studien zum Neolithikum der osteuropäischen Steppe*. Mainz: von Zabern.

Yeritsyan, B., Petrosyan, A. and Gasparyan, B. (2009) Vahagni-1 karedaryan batsotya hnavayri usumnasirutyan nakhnakan ardyunknery (Preliminary results of investigation of Vahagni-1 Stone Age open-air Site). In: *Collection of Scientific articles, Yerevan-2, Scientific session dedicated to the key issues of Yerevan history*. Yerevan: Yerevan History Museum Press, pp. 33–39 (in Armenian).

Figure 1

1. Main view of the Kasakh River at its junction with tributary where Apnagyugh-7 and 8/Kmlo-1 and 2 caves are situated;

2. Main view of the Apnagyugh-8/Kmlo-2 cave from south-east.

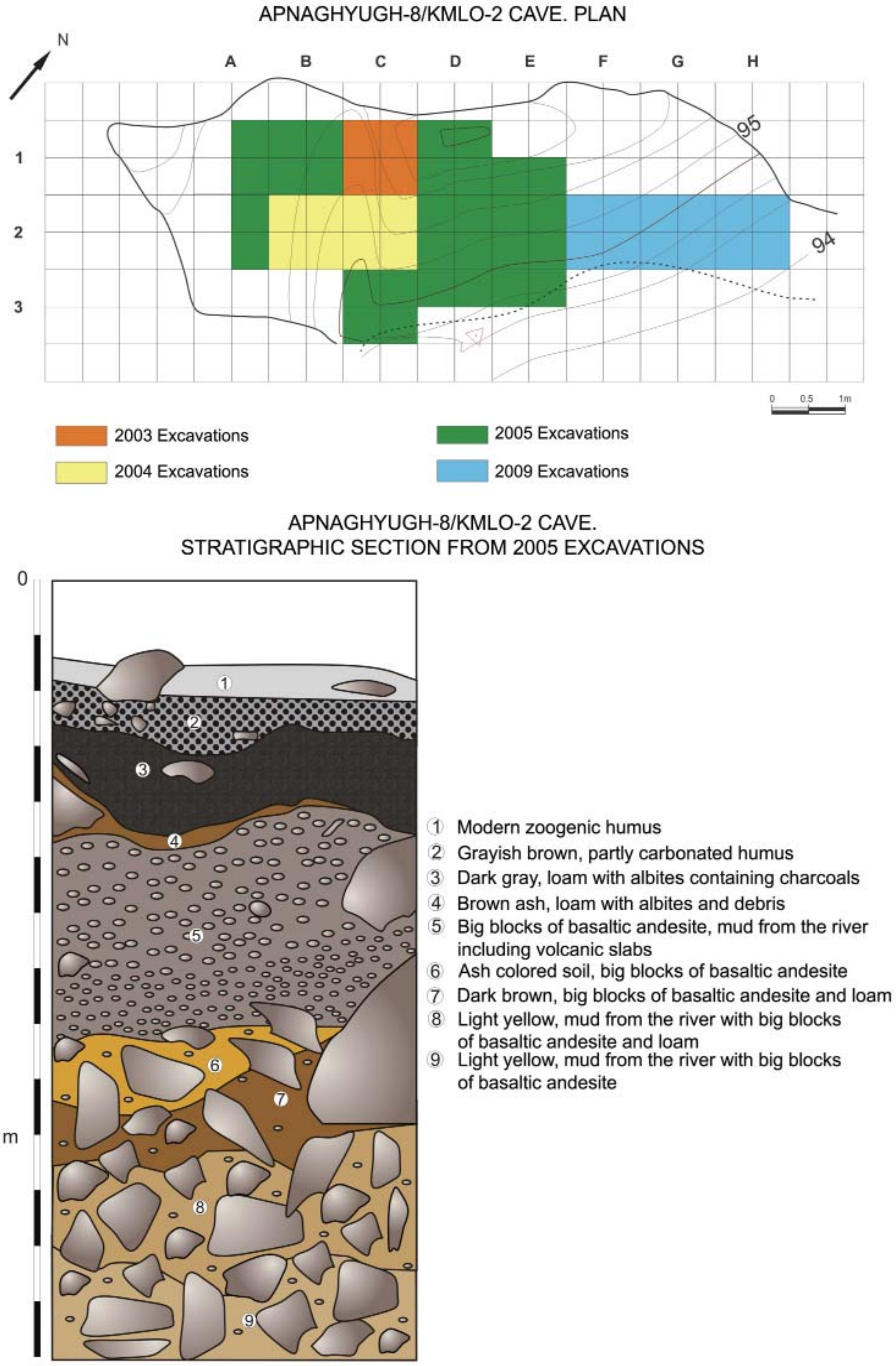


Figure 2

Topographic plan and stratigraphic section (2005 excavations) of Apnagyugh-8/Kmlo-2 cave.

Figure 3
Implements prepared with steep lamellar retouch from Apnagyugh-8/Kmlo-2 cave excavations (1-3: "Kmlo tools"; 4-5: Retouched blades).

1

2

Figure 4
1. Main view of the Kuchak-1 rock-shelter from south-west;
2. Main view of the Kuchak-1 rock-shelter from south-east.

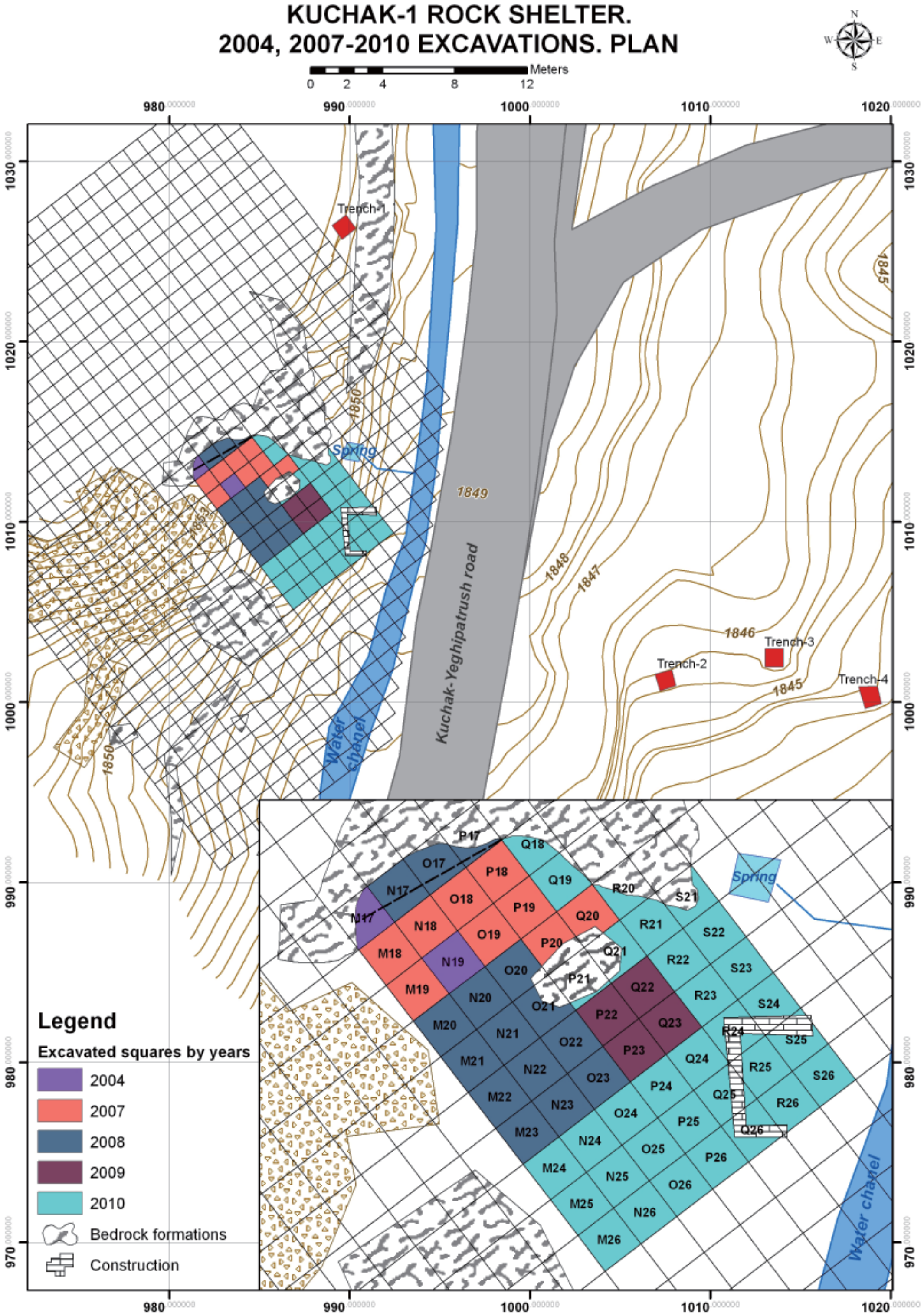


Figure 5

Topographic plan of Kuchak-1 rock-shelter showing the areas included under excavations.

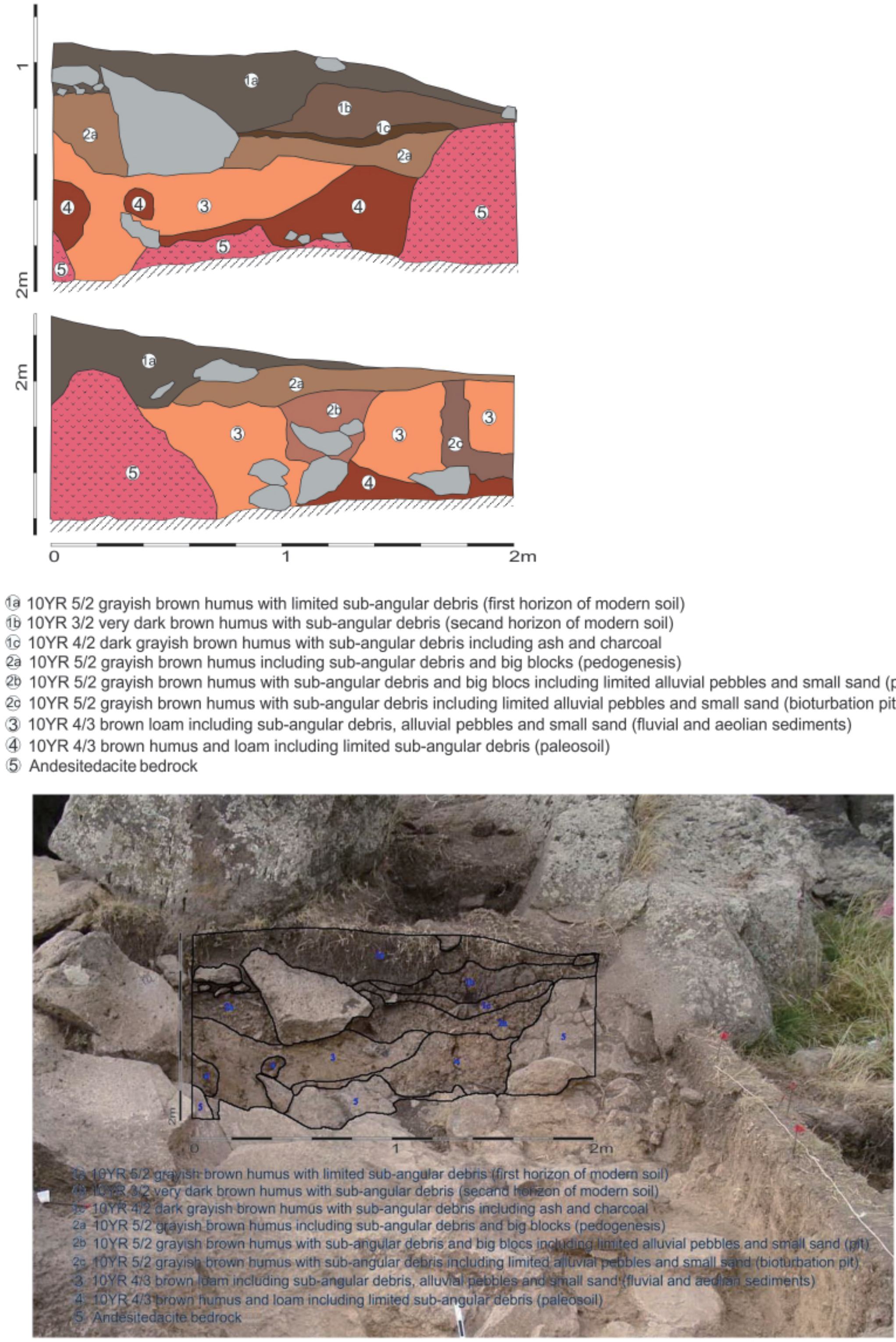


Figure 6

Stratigraphic section of the Kuchak-1 rock-shelter from 2010 excavations.

1

2

Figure 7

1. Kuchak-1 rock-shelter at the final phase of the excavations, where traces of small construction are visible (on the left end of the Trench);

2. Most complete sediment section in Kuchak-1 rock-shelter preserved under a hughe block collapsed from the roofing.

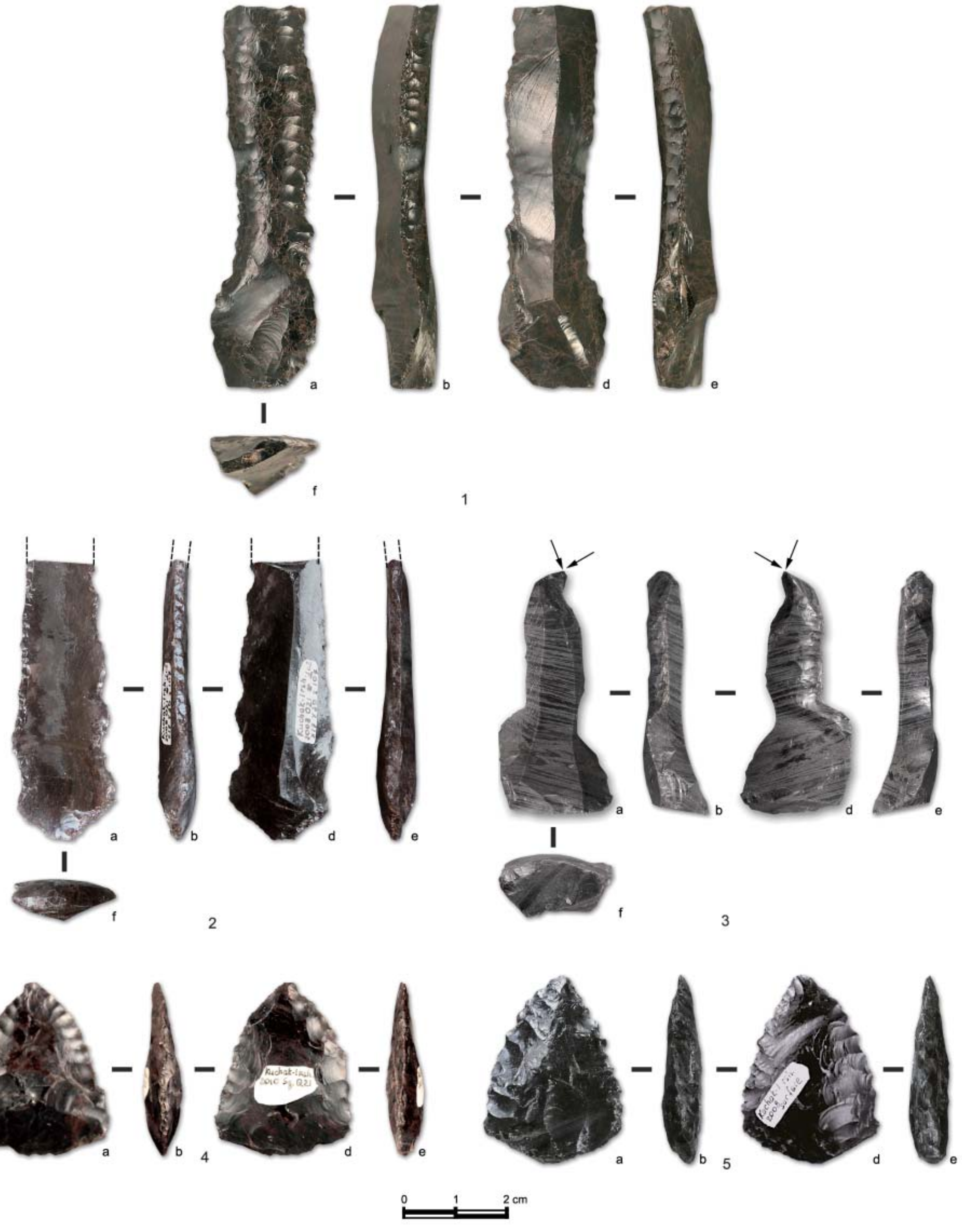


Figure 8
Implements prepared with steep lamellar retouch from Kuchak-1 rock-shelter excavations (1-3: "Kmlo tools"; 4-5: Arrowheads).

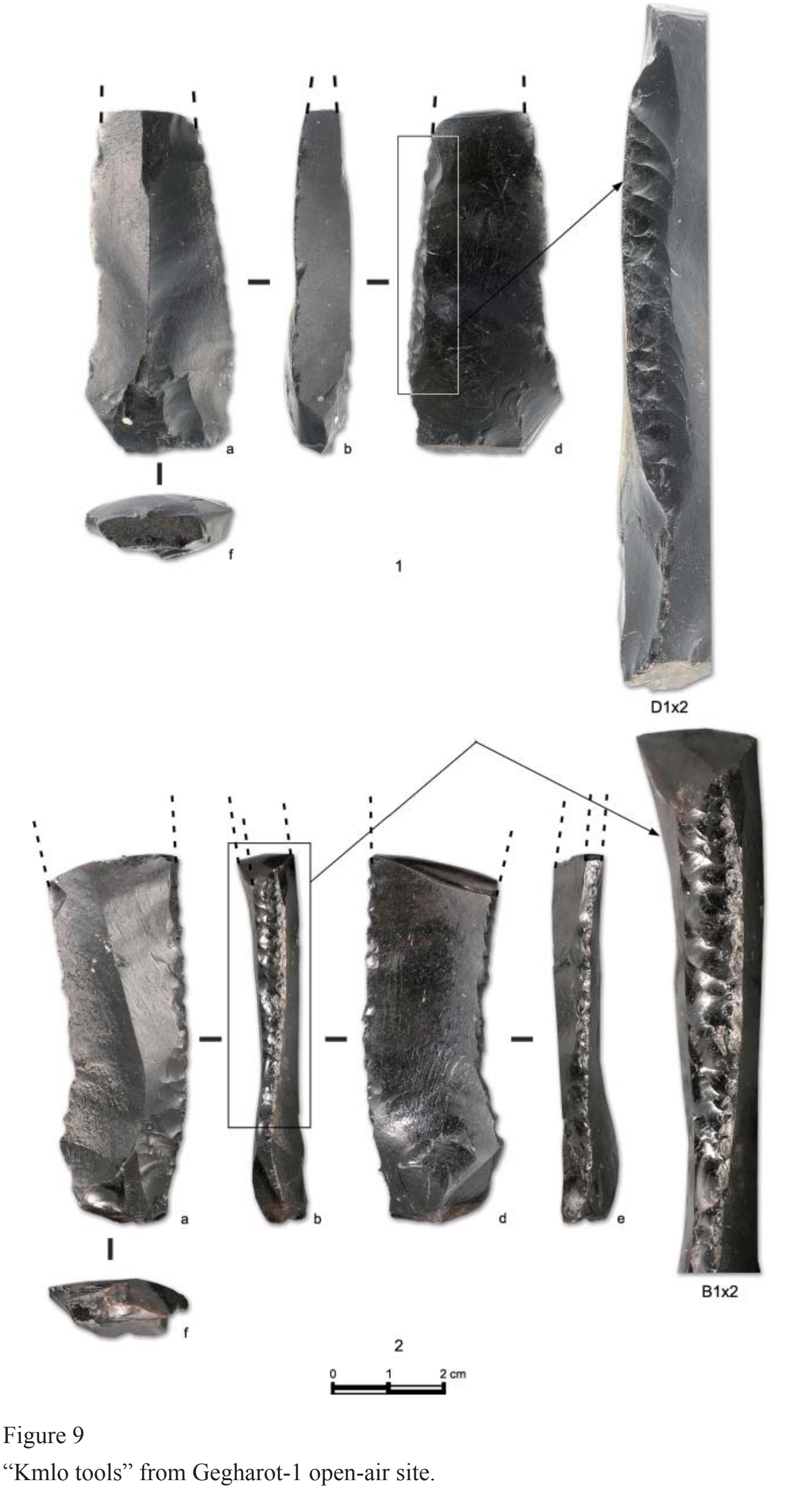


Figure 9
“Kmlo tools” from Gegharot-1 open-air site.

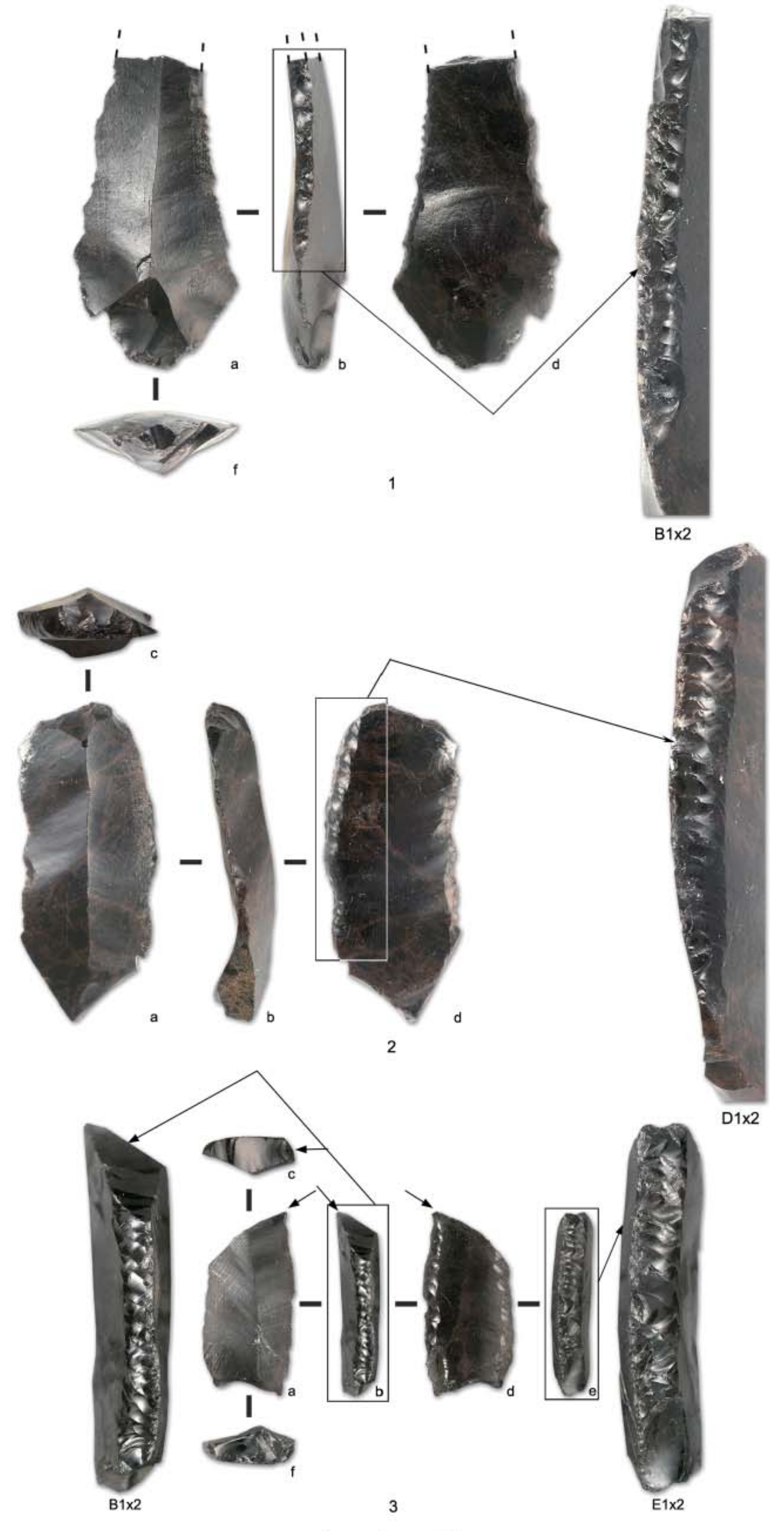


Figure 10
"Kmlo tools" from Gegharot-1 open-air site.

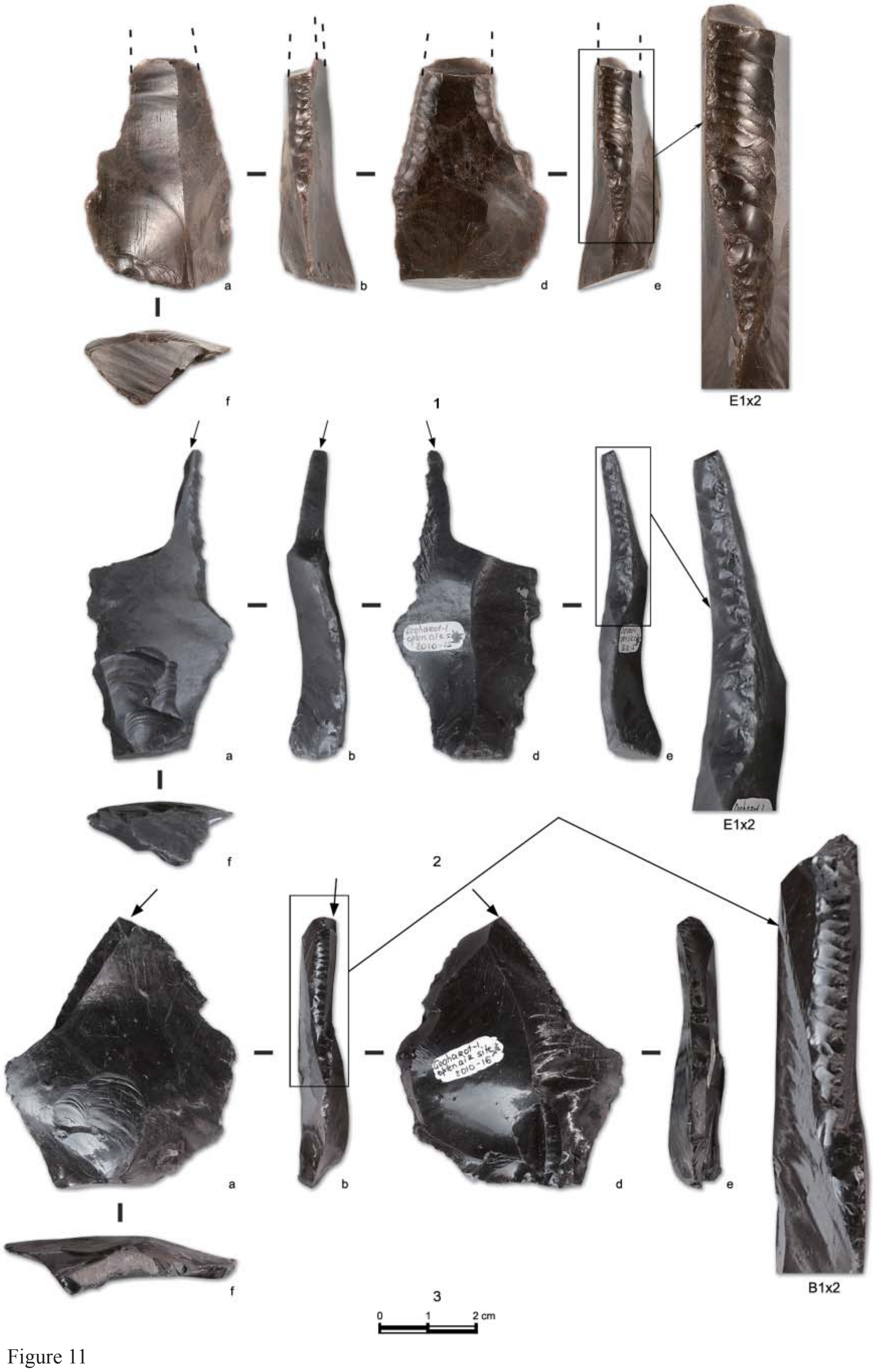


Figure 11
“Kmlo tools” from Gegharot-1 open-air site.

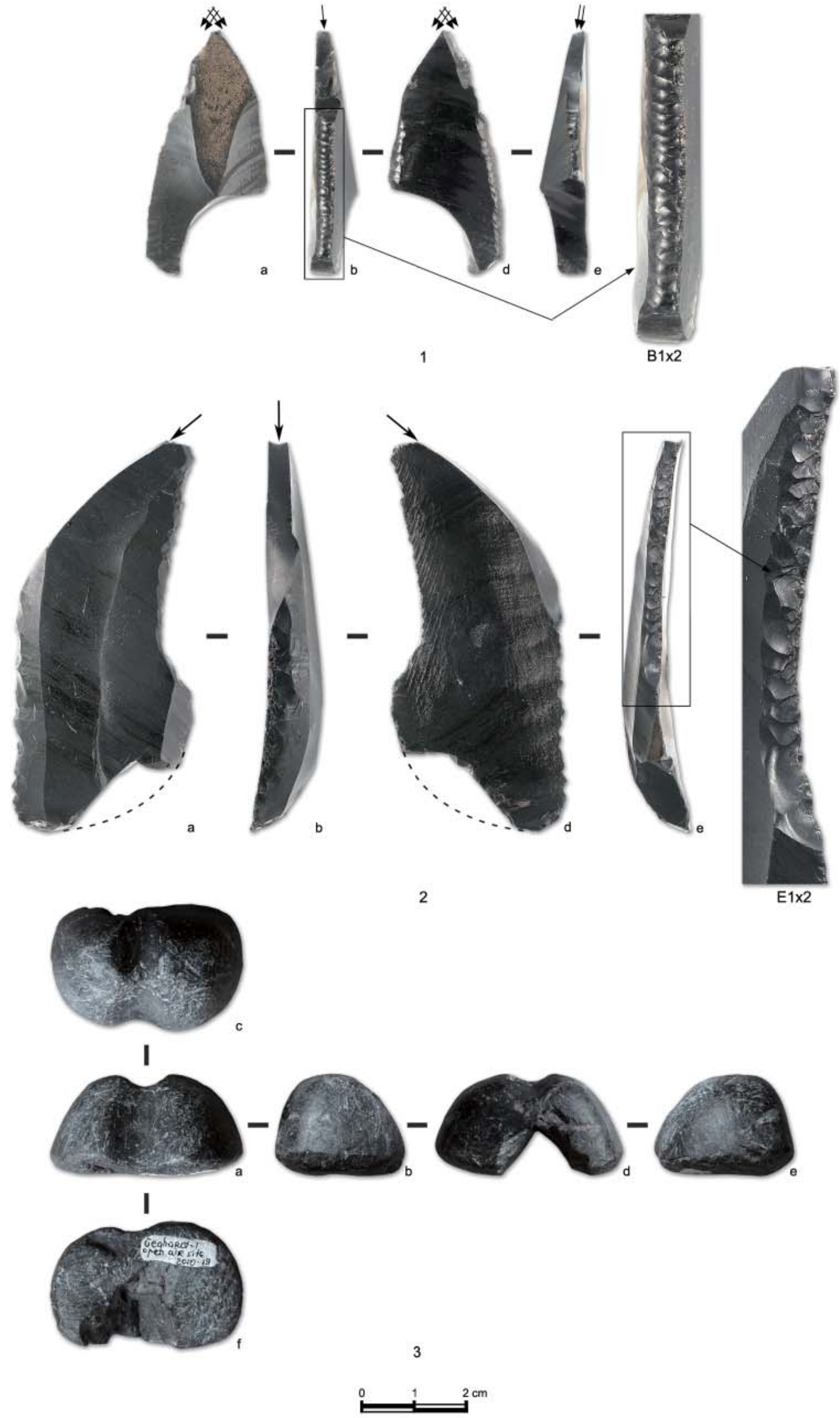


Figure 12
Implements from Gegharot-1 open-air site (1-2: “Kmlo tools”; 3: Small “shaft-straightener”).

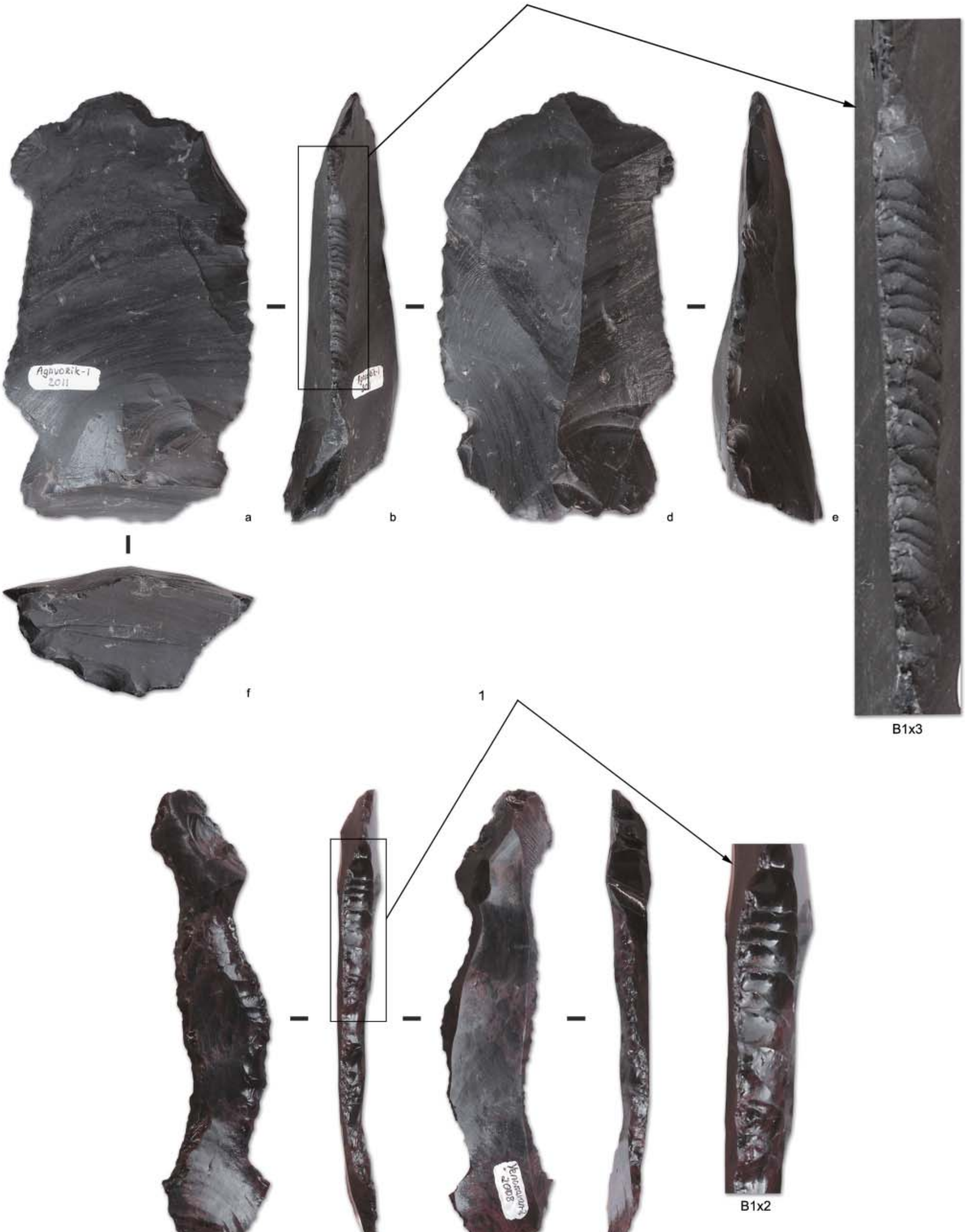


Figure 13
"Kmlo tools" from other archaeological sites of Armenia (1: Aghvorik-1 open-air site; 2: Yenokavan-2 cave).

Aknashen—the Late Neolithic Settlement of the Ararat Valley: Main Results and Prospects for the Research

Ruben Badalyan and Armine Harutyunyan

1. Introduction

Another phase in the sequence of the archaeological cultures of the southern Caucasus was discovered in 1960, with the opening of sites in the middle stream of the Kura basin. These sites are representative of the “Shomutepe” (by I. Narimanov) or “Shomutepe-Shulaveri”/“Shulaveri-Shomutepe” (by T. Kiguradze) culture. This phase is today defined as the Late Neolithic, and is mainly referred to as the 6th millennium BC.

Concurrent with that discovery, similar sites were being documented in the Ararat valley in the Republic of Armenia. These included the settlements of Kghzyak Blur, Mashtots Blur, Kasakh II, Sev Blur II, Terteri Dzor, and Agvesi bner (Sardaryan 1967). The results of studies on similar sites (Verin Khatunarkh–Aknashen, Masis Blur) in the 1970–1980s have remained unpublished[1].

Research on the Late Neolithic culture of Armenia was highly stimulated by excavations of the Aratashen settlement, conducted by the Armenian-French joint expedition in 1999–2004 (Badalyan *et al*. 2002; 2004a; 2004b; 2005; 2007; Palumbi and Badalyan 2005; Palumbi 2007; Chabot *et al*. 2009).

Consistent with the principle of the unity of the material culture, it is appropriate to consider sites from the 6th millennium BC, including the basins of the Araxes and the Kura Rivers as a sufficiently homogeneous “Aratashen-Shulaveri-Shomutepe” complex (culture). The results of excavations at the Aratashen and Aknashen settlements apparently support T. Kiguradze’s (1976)

1. Only limited and selected tools and faunal remains from the Khatunarkh-Aknashen settlement have been studied and published. See Korobkova 1987, pp. 143, 145, table 35 and Mezhlumyan 1972, p. 166, supplement 2. The excavated materials are stored at Ejmiatsin historical-ethnographic museum (in the Town of Vagharshapat).

view of them, as a single culture with two major local variations.

The importance of the “Aratashen-Shulaveri-Shomutepe” complex is determined primarily by the fact that this is one of the oldest known cultures in the southern Caucasus to be based on a production economy, providing the first documented evidence of architecture, ceramic and metal production.

The most studied settlement of the “Aratashen-Shulaveri-Shomutepe” complex in Armenia is Aknashen in the Ararat valley, located in the basin of the Sev Jur (Metsamor) River, at an altitude of 838.3 m above sea level (Armavir Marz, 6 km south of Vagharshapat, in the north-eastern outskirts of Aknashen village). The site represents a rounded artificial hill (*blur*), with a diameter of 100 m (an area of about 0.8 ha), and a relative height of about 3 m (Figure 1).

From 1969–1972, 1974–1977, and 1980–1982 the site was excavated by R.M. Torosyan, who opened an area of about 400 m^2 in the western sector of the hill. More recent excavations in Aknashen were conducted from 2004–2009 and 2011–2013, under the framework of the Armenian-French joint project to conduct research on the Neolithic-Chalcolithic cultures of Armenia (Badalyan *et al*. 2010; Arutyunyan 2008). This work was a logical extension of excavations being undertaken at the neighbouring settlement of Aratashen.

This paper outlines the stratigraphy of the Aknashen settlement, based on the results of excavations conducted in 2013.

2. Excavations at Aknashen

A total of 300 m^2 were excavated. The recorded thickness of the cultural layer exceeded 5 m (in other words, the cultural layer extended more than 2 m below the present level of the surrounding plain), but the bottom had not yet been reached. The distinct series of cultural horizons was quite clearly observed in the cultural layer. An upper horizon (I), approximately 1.5 m in depth, is almost entirely destroyed by the intrusive burials of the Middle and Late Bronze Ages (Figures 3: a, 4: 5), the Medieval occupation (traces of which are recorded through ovens-tonirs, hearths, basalt millstones, etc.), and the Early Modern period cemetery (Figures 2, 3: a). As a result, the complete planigraphic situation for this horizon is missing; *in situ* preserved materials are present only in some places—in the form of separate fragments from the layer, and often hypsometrically in asynchronous situations (Figure 3: a, b).

The materials of Horizon I are mostly represented by obsidian and ceramic fragments. The bone artifacts are extremely few and quite simple: three awls/borers, and one edged tool. Among the stone tools found *in situ*, three transverse shaft-hole axes/adzes (Figure 4: 1–3) made of hornfels and quartz diorite should be noted first. These were similar to axe in the lower layer of Nakhchivan Kültepe I (Abibullayev 1982, Table IV: 1–3). A modest number of lithics were found in Horizon I (a total of 1,506 obsidian artifacts were found at this level), but this may be a consequence of the fact that this horizon is badly preserved. In general, there are not large differences between the obsidian industries of the first and underlying horizons. They used the same "*chaines opératoires*"; the one producing flakes (semi improvised ad hoc knapping) was less important in quantity than the one producing blades, which involved very elaborate knapping techniques. Among the blades that are well preserved (sections that are at least of 5 cm long), J. Chabot have been able to confirm that three main techniques were used to produce superblade debitage: indirect percussion, pressure with a crutch, and probably pressure with a lever (so far, for this level, a couple of specimens may indicate the presence of this complex technique). All three techniques are also known from the older levels at this site.

Ceramics are represented mainly by cups and bowls of different sizes, among which there are rare fragments of the so-called "holemouth jars", and also, low-necked pots made of clay with organic inclusions. Another group of ceramics presented in this horizon in lesser quantities was made with inorganic (mineral) temper. This group differs from the first one, not only as a result of its technical and technological peculiarities, but also it is morphologically. These are coarse cylindrical vessels with a flat wide base with a protruding heel. Prior disturbance of the horizon does not allow us to determine whether these two groups of ceramics coexisted, or whether they were mixed during the later disturbance.

Unfortunately, due to the lack of reliable contexts, there are no absolute dates associated with this layer. However, its lower chronological boundary can be determined using the upper limits of Horizon II by 5,400 BC.

It should be noted that attribution of the layer mentioned above to the Chalcolithic period, as has been postulated in prior reports, was primarily based on the ceramic material—particularly on a predominant amount of pottery with organic inclusions in clay, a typical combed surface, a horizontal row of perforations, and relief decorations located below the rim. Although the combination of perforations under the rim, the notches, and combed surfaces can be traced to a wide geographical area, all sites with similar ceramics are dated within a time period beginning at the end of the 5th to the first half of the 4th millennia BC. However, unlike the pottery from Aknashen and Aratashen, it's mainly mineral-tempered—Teghut (Torosyan 1976, Table V: 4–5), Damtsvari gora, Kviriastskali (Varazashvili 1992, Table V: 1–8, 11, 12; Table VII: 2–5, 7; Table VIII: 11, 12, 14–2;

Table XVI: 1–6, Table XVII: 1–5), Berikldeebi, Tsopi (Kiguradze and Sagona 2003, p. 91), Sioni (Menabde and Kiguradze 1981, p. 114, Fig. 2: 1–5), Kechili (chaff-tempered ceramics) (Narimanov 1987, p. 34, Fig. 35: 3, 11), Leylatepe, Böyük Kesik (Narimanov *et al.* 2007, Fig. V: 1, 2, 5–7, 9, 14; Fig. XVIII: 1–8), Khazine Tepe/Hanago (Marro and Ozfirat 2003, p. 390, Pl. III: 1–6), Chinna, Ginchi (Gadzhiev 1991, Fig. 28).

Taking into account the fact that the ceramic material from Horizon "0" of Aratashen—with notches on the rim and crushed obsidian in clay mass (Palumbi 2007; Palumbi *et al*. 2014; Arutyunyan and Mnatsakanyan 2010; Arutyunyan 2011), typical for "Sioni-like sites"—is absent in Aknashen, we can conclude that the upper Horizon I of Aknashen is older than Horizon "0" of Aratashen.

The Late Neolithic "Aratashen-Shulaveri-Shomutepe" cultural layer (Horizons II–V) is deposited, directly under the Chalcolithic layer, with a total depth of about 2.5 m. In that layer, up to a depth of about 2.5 m (at the upper level of Horizon IV), burials and both Early Medieval and modern (by UGAMS dates 4083, 4084, 4085) garbage pits are recorded. A series of 37 radiocarbon dates determine the absolute date of the "Aratashen-Shulaveri-Shomutepe" layer to have occurred within the first half of the 6th millennium BC.

The general characteristics of the horizons of that layer have already been presented in a number of preliminary publications. In this paper, we will concentrate briefly on only a single aspect of the material culture.

It is noteworthy that the special part of the obsidian industry of Aknashen is represented by geometric microliths. It was assumed that the microliths were not typical for the "Aratashen-Shulaveri-Shomutepe" industry. Limited finds (Imiris gora, Khramis Didigora) seem to date only to the later phases of that culture (Kighuradze 1976, p. 160). Today we can assume that the presence or absence of the microliths in these complexes depends primarily on the specifics of the economic activity being conducted. In Aratashen, among more than 20,000 obsidian implements, there are no microliths, while at the neighbouring synchronous settlement of Aknashen there are around 150 samples—trapezoids (making the absolute majority) and single triangles have been found (Figure 5)—and their number increases systematically in the horizons from top to bottom. One of the peculiarities of the complex is the trapezoids (both high and low), with double denticulated tops (Figure 5: 5–6, 8, 13, 17–19). They are similar to the microliths from layer D (attributed to the Mesolithic period by Kh. Amirkhanov) in the Chokh settlement in Dagestan (Amirkhanov 1987, Fig. 17–1; Fig. 19–3, 4). Microliths were also discovered in Masis Blur[2], Arukhlo (Hansen *et al.*

2. The authors gratefully acknowledge the assistance of G.E. Areshian and K. Martirosyan-Olshanski, who provided access to materials documenting their work at the Masis Blur excavations.

2006, Abb. 60–5, 6; Hansen *et al*. 2007, Fig. 51–5–7] and Göy Tepe (Lyonnet and Guliyev 2010, p. 222).

While recognizing that there are significant similarities between the Late Neolithic settlements of the Araxes and Kura River basins, local anomalies in the material culture of these two "oases" should be defined. Differences in the construction techniques used (adobes at the settlements of the Kura, and the dominance of *pisé* at the Araxes River), their ceramics, the presence of anthropomorphic figurines (Arukhlo, Khramis Didigora, Shulaverisgora, Gargalartepesi) and stone vessels (Khramis Didigora) in the north, and their absence in the south, apparently support the opinion of T. Kiguradze (1976) that there existed a single culture with two major local variations (Badalyan *et al*. 2007, p. 60).

The layer of the "Aratashen-Shulaveri-Shomutepe" culture is deposited on the 20–30 cm thick clay-peat Horizon VI, preliminarily interpreted as deposits of shallow wetland environment, traced throughout squares 1–2 and 4–5, on an area covering 80 m^2, and in the Sounding A (25 m^2). Contact between Horizon VI with the upper Horizon V, and the lower Horizon VII, are expressed by 1–4 cm thick, black, and grayish, powdery layers. The buildings of Horizon V were erected directly on Horizon VI, in a manner that covers the earlier construction in the underlying Horizon VII. That layer contains only a small amount of scattered material.

Horizon VI overlaps at least 120 cm of the cultural layer—another portion of the oldest horizon, Horizon VII. This horizon was opened only in Sounding A (marked as Horizon V-3 in the previous publication [Badalyan *et al*. 2010]), and an area 1 × 1 m (2013) was excavated in the north-west corner of square 1 of the Sounding T-1A. Partially opened small cylindrical structures and walls of circular buildings have to date represented the fragments of buildings discovered in Horizon VII. The circular buildings demonstrate the presence of clearly evolved darker clay blocks, with dimensions 25 x 50 cm, and 19/20 × 14/15 cm.

Due to the relatively small number of finds, and the limited size of the areas excavated, the complex of artifacts in Horizon VII can only be described in a very preliminary way at this time. Nevertheless, it is obvious that the complex of Horizon VII has certain characteristics. First, cores taken here are morphologically quite different from the cores of the overlying horizons. They are made up of grey obsidian pebbles, and are presented by conical and semioval cores, with a single faceted platform for blades' debitage formed with a crutch (Figure 7: 1–2). Moreover, Horizons VI and VII, in terms of ceramic content, are fundamentally different from the overlying horizons. The difference primarily concerns the reduced number of ceramics in Horizons VI and VII, and by the almost complete disappearance of the local ceramics of group Grit II (see Harutyunyan this volume). As a result, Horizons VI and VII contain mostly imported painted pottery. Due to their small size and quantity, it is difficult both to attribute those to any culture, and to perform their strato-typological analysis, but it is obvious that the samples from Horizons VI and VII differ from the ceramics of the overlying horizons (Figure 6).

Eventually, the exceptional peculiarities of Horizon VII present a group of findings. Among these, first of all, are the "shaft straightener" or "sharpener", made of ophicalcite in the form of rectangular (7.5 × 6.3 × 2.7 cm) whetstone with three deep (0.9 cm) parallel grooves (Figure 7: 4), and the seal representing a rectangular (5.1 × 2.9 × 1.5 cm), flat, convex, polished bar, probably also made of ophicalcite. On the convex side, it bears an incised 8-shaped ornament (Figure 7: 3). Obviously, based on this information, we can talk about a new complex of the material culture, the attribution and the absolute chronology of which have yet to be determined.

In all cases, the identified Horizon VII, separated from the overlying horizons of the "Aratashen-Shulaveri-Shomutepe" culture by hiatus, and stratigraphically and chronologically preceding the Late Neolithic, is partially filling the gap between the Early Holocene sites and the settlements of the "Aratashen-Shulaveri-Shomutepe" culture.

References

Abibullayev, O. (1982) *Eneolit i bronza na territorii Nakhichevanskoy ASSR* (The Chalcolithic Period and Bronze Age on the Territory of Nakhichevan SSRA). Baku: "Elm" Publishing House (in Russian).

Amirkhanov, Kh. (1987) *Chokhskoe poselenie. Chelovek i ego kul'tura v mezolite i neolite gornogo Dagestana* (Chokh settlement. Man and his Culture in Mesolithic-Neolithic Periods of the Mountainous Dagestan). Moscow: "Nauka" Publishing House (in Russian).

Arutyunyan (Harutyunyan), A. (2008) Keramika poseleniya Aknashen (Ceramics of Aknashen Settlment). In: Avetisyan, P.S., Kalantaryan, A.A. and Badalyan, R.S. (eds.), *Hin Hayastani mshakuyty XIV, Nyuter Hanrapetakan gitakan nstashrjani nvirvats akademikos B.B. Piotrovsku ev H.M. Janpoladyani hishatakin* (Culture of Ancient Armenia, XIV, Materials of the Republican Conference dedicated to the memory of academician B.B. Piotrovskiy and H.M. Janpoladyan). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 37–43 (in Russian).

Arutyunyan, (Harutyunyan) A. (2011) O nekotorikh rezul'tatakh izucheniya neolit-eneoliticheskoy keramiki Araratskoy ravnini (About Some Results of the Researches on the Neolithic-Chalcolithic Pottery of the Ararat Plain). In: Gambashidze, G. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). International Scientific Conference dedicated to the memory of famous Georgian scientist and public figure academician O. Lordkipanidze (1930-2002). Collection of abstracts of the reports. Tbilis-Gori-Batumii: "Meridianii" Publishing House, pp. 51–65 (in Russian).

Arutyunyan (Harutyunyan), A. and Mnatsakanyan, A. (2010) Petrograficheskoe izuchenie neolit-eneoliticheskoy keramiki Araratskoy ravnini (The Petrographic Research on the Neolithic-Chalcolithic Ceramics of the Ararat Plain. In: Avetisyan, P. and Petrosyan, A., (eds.), *Khaldyan zorutyamb... Hodvatsneri zhoghovatsu nvirvats Boris Piotrovsku 100-amyakin* (Through Haldi's Power... Studies in honour of the 100th anniversary of the birth of Boris Piotrovsky). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 210–224 (in Russian).

Badalyan, R., Lombard, P., Avetisyan, P. and Chataigner, C. (2002). Neolit-eneoliticheskaya kul'tura Araratskoy ravnini (po materialam poseleniya Aratashen) (The Neolithic-Chalcolithic Culture of the Ararat Plain by the materials of Aratashen Settlement). In: Kalantaryan, A. and Harutyunyan, S. (eds.), *Hayastani hnaguyn mshakuyty - 2. E. Khanzadyani hobelyanin nvirvats gitazhoghovi nyuter* (*The Ancient Culture of Armenia - 2. Proceedings of the Conference Dedicated to the Anniversary of E. Khanzadyan*), Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 5–12 (in Russian).

Badalyan, R., Avetisyan, P., Lombard, P. and Chataigner, C. (2004a). Neoliticheskoe poselenie Aratashen (The Neolithic Settlement of Aratashen). In: Gambashidze, G. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). International Scientific Conference dedicated to 90th anniversary of the academician A.M. Apakidze. Collection of abstracts of the reports. Tbilisi: "Nekeri" Publishing House, pp. 31–33 (in Russian).

Badalyan, R., Lombard, P., Chataigner, C. and Avetisyan, P. (2004b). The Neolithic and Chalcolithic Phases in the Ararat Plain (Armenia): The View from Aratashen. In: Sagona, A. (ed.), *A View from the Highlands. Archaeological Studies in Honour of Charles Burney.* Ancient Near Eastern Studies, Supplement 12. Peeters, pp. 399–420.

Badalyan, R., Avetisyan, P., Lombard, P. and Chataigner, C. (2005) Poselenie Aratashen (neoliticheskiy pamyatnik v Araratskoy ravnine) (The Settlement of Aratashen [Neolithic Settlement in Ararat Plain]). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: "Mughni" Publishing House, pp. 34–41 (in Russian).

Badalyan, R., Lombard, P., Avetisyan, P., Chataigner, C., Chabot, J., Vila, E., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New data on the late prehistory of the Southern Caucasus. The excavations at Aratashen (Armenia): Preliminary report. In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe - IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS éditions, Editions Recherches sur les Civilisations, pp. 37–61.

Badalyan, R., Harutyunyan, A., Chataigner, C., Le Mort, F., Chabot, J., Brochier, J., Balasescu, A., Radu, V. and Hovsepyan, R. (2010) The Settlement of Aknashen-Khatunarkh, a Neolithic Site in the Ararat Plain (Armenia): Excavation Results 2004–2009. *TÜBA-AR* 13, pp. 185–218.

Chabot, J., Badalyan, R. and Chataigner, C. (2009) A Neolithic obsidian industry in the Southern Caucasus region: origins, technology and traceology. In: Moreau, J., Auger, R., Chabot, J. and Herzog, A. (eds.), *Proceedings of* *the 36th Symposium on Archeometry. Cahiers d'archéologie du CELAT, 25; Série Archéométrie, 7*. CELAT, pp. 151–160.

Gadzhiev, M. (1991) *Rannezemledel'cheskaya kul'tura severo-vostochnogo Kavkaza (epokha eneolita i ranney bronzi)* (The Early Farming Culture of the North-Eastern Caucasus [The Chalcolithic Period and Early Bronze Age]). Moscow: "Nauka" Publishing House (in Russian).

Hansen, S., Mirtskhulava, G., Bastert-Lamprichs, K., Benecke, N., Gatsov, I. and Nedelcheva, P. (2006) Aruchlo 2005–2006. Bericht über die Ausgrabungen in einem neolithischen Siedlungshügel. *Archäologische Mitteilungen aus Iran und Turan* 38, pp. 1–34.

Hansen, S., Mirtskhulava, G., Bastert-Lamprichs, K., Görsdorf, J., Neumann, D., Ullrich, M., Gatsov, I. and Nedelcheva, P. (2007). Aruchlo 2007. Bericht über die Ausgrabungen im neolithischen Siedlungshügel. A*rchäologische Mitteilungen aus Iran und Turan* 39, pp. 1–30.

Kigurazde, T. (1976) *Aghmosavlet amierkavkasiis adresamitsatmokmedo kulturis periodizatsia* (The Periodization of the Early Farming Culture of the Western Transcaucasia). Tbilisi: "Metsniereba" Publishing House (in Georgian).

Kiguradze, T. and Sagona, A. (2003) On the Origins of the Kura-Araxes Cultural Complex. In: Smith, A. and Rubinson, K. (eds.), *Archaeology in the borderlands. Investigations in Caucasia and beyond*. Los Angeles: Cotsen Institute Monograph 47, pp. 38–94.

Korobkova, G.F. (1987) *Khozyaystvenniye kompleksi rannix zemledel'chesko-skotovodcheskix obshchestv yuga SSSR* (Economic complexes of the early farming-cattle-breading societies of the South of the USSR). Leningrad: "Nauka" Publishing House, Leningrad Branch (in Russian).

Lyonnet, B. and Guliyev, F. (2010) Recent Discoveries on the Neolithic and Chalcolithic of Western Azerbaijan. *TÜBA-AR* 13, pp. 219–228.

Marro, C. and Özfirat, A. (2003) Pre-classical Survey in Eastern Turkey. First Preliminary Report: The Ağri Dağ (Mount Ararat) Region. *Anatolia Antiqua* XI, pp. 385–422.

Menabde, M. and Kiguradze, T. (1981) *Sionis arkeologiuri dzeglebi* (Archaeological Site of Sioni). Tbilisi: "Metsniereba" Publishing House (in Georgian).

Mezhlumyan, S. (1972) *Paleofauna epokh eneolita, bronzi i zheleza na territorii Armenii* (Paleofauna of the Eneolithic, Bronze and Iron Ages on the territory of Armenia). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Narimanov, I. (1987) *Kul'tura drevneishego zemledel'chesko-skotovodcheskogo naseleniya Azerbaijana* (Eneolit. VI–IV tis. do n.e.) (The Culture of the Ancient Farming Population of Azerbaijan [the Chalcolithic Period. VI-IV millennia BC]). Baku: "Elm" Publishing House (in Russian).

Narimanov, I. (2007) *Leylatepe. Poselenie, traditsiya, etap v etno-kul'turnoy istorii Yuzhnogo Kavkaza* (Leylatepe. Settlement, traditions, a stage in ethno-cultural history of the South Caucasus). Baku: "Elm" Publishing House.

Palumbi, G. (2007) A Preliminary Analysis on the Prehistoric Pottery from Aratashen (Armenia). In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe–IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS éditions, Editions Recherches sur les Civilisations, pp. 63–76.

Palumbi, G. and Badalyan, R. (2005) Neolit-eneoliticheskaya keramika poseleniya Aratashen (The Neolithic-Chalcolithic Pottery of Aratashen Settlement. In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: "Mughni" Publishing House, pp. 42–50 (in Russian).

Palumbi, G., Gratuze, B., Harutyunyan, A. and Chataigner, C. (2014) Obsidian-tempered pottery in the Southern Caucasus: A new approach to obsidian as a ceramic-temper. *Journal of Archaeological Science* 44, pp. 43–54.

Sardaryan, S.H. (1967) *Nakhnadaryan hasarakutyuny Hayastanum* (Primitive Society in Armenia). Yerevan: "Mitk" Publishing House (in Armenian, with Russian and English Resume).

Torosyan, R.M. (1976) *Teghuti vagh erkragortsakan bnakavairy (m.t.a. IV hazaramyak)* (The Early Farming Settlement of Teghut [IV Millennium BC]). Hnagitakan peghumnery Hayastanum (Archaeological excavations in Armenia) N14. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian with Russian Resume).

Varazashvili, V. (1992) *Rannezemledel'cheskaya kul'tura Ioro-Alazanskogo basseina* (The Early Farming Culture of the Iori-Alazani Basin). Tbilisi: "Metsniereba" Publishing House (in Russian).

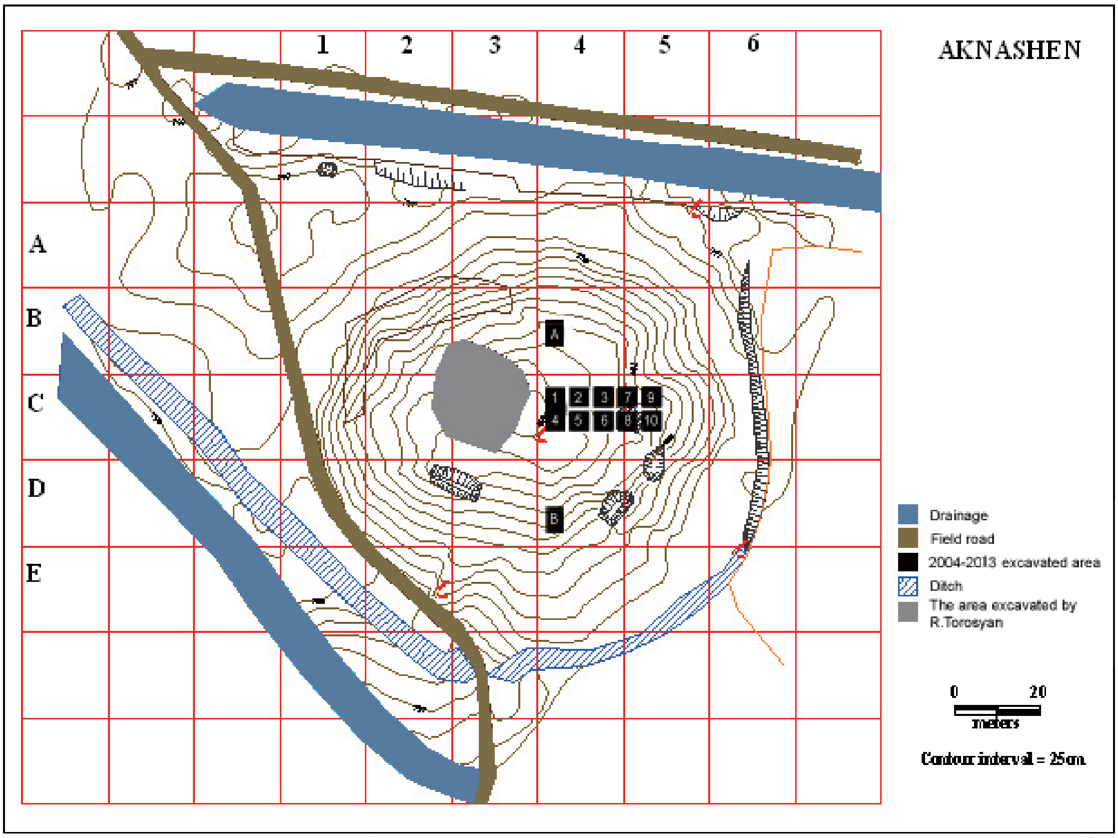


Figure 1
Topographic plan of the Aknashen settlement.

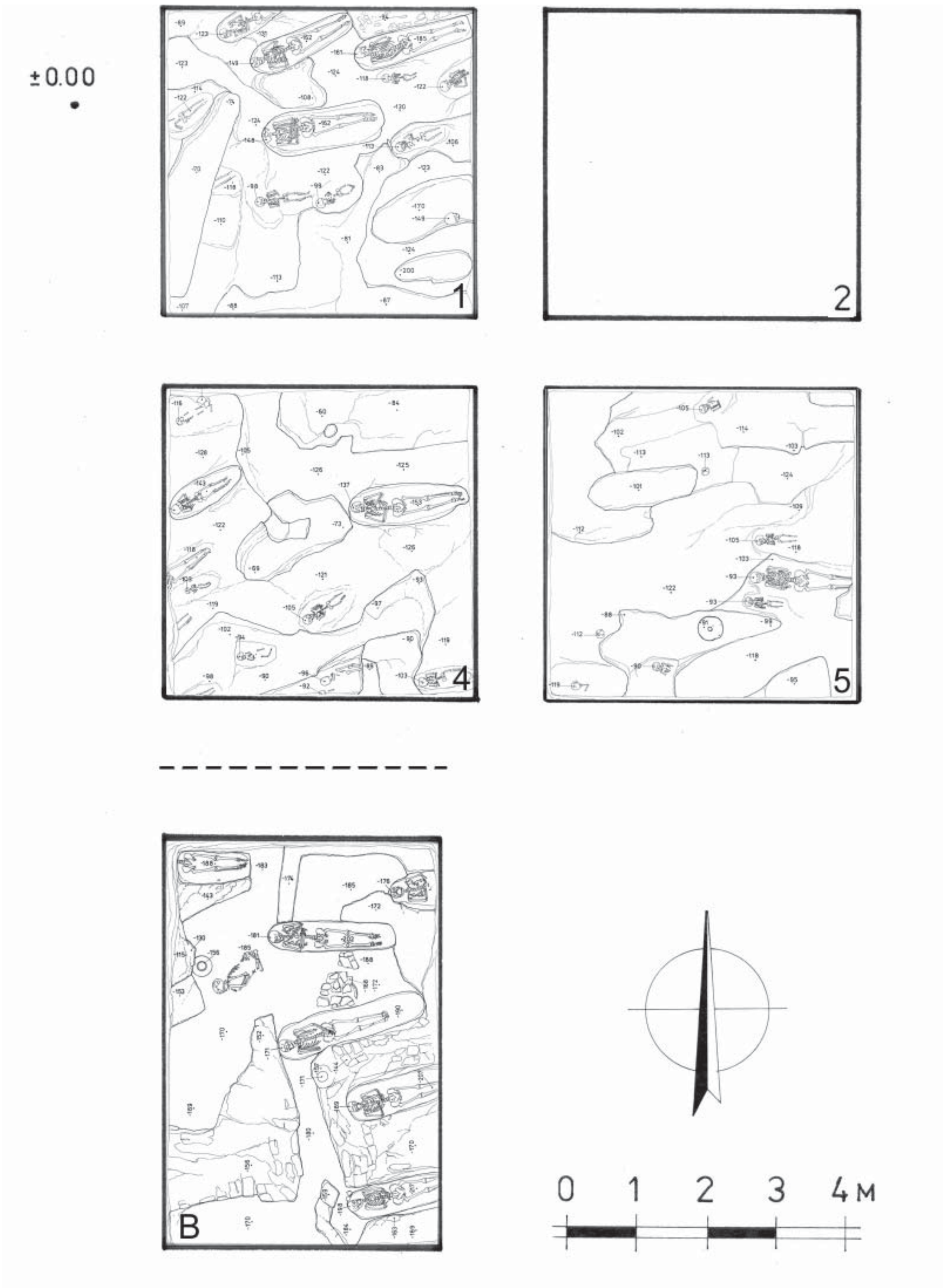


Figure 2

Aknashen settlement. The plan of Horizon I, Squares 1, 4–5, and Sounding B.

Figure 3
Aknashen settlement. Horizon I. a. Sounding B. Early modern period burials (NN 2, 3, 8), Late Bronze Age burials (N 5) and the Chalcolithic vessel (UF 3, F.1); b. Square 3, UF 3.

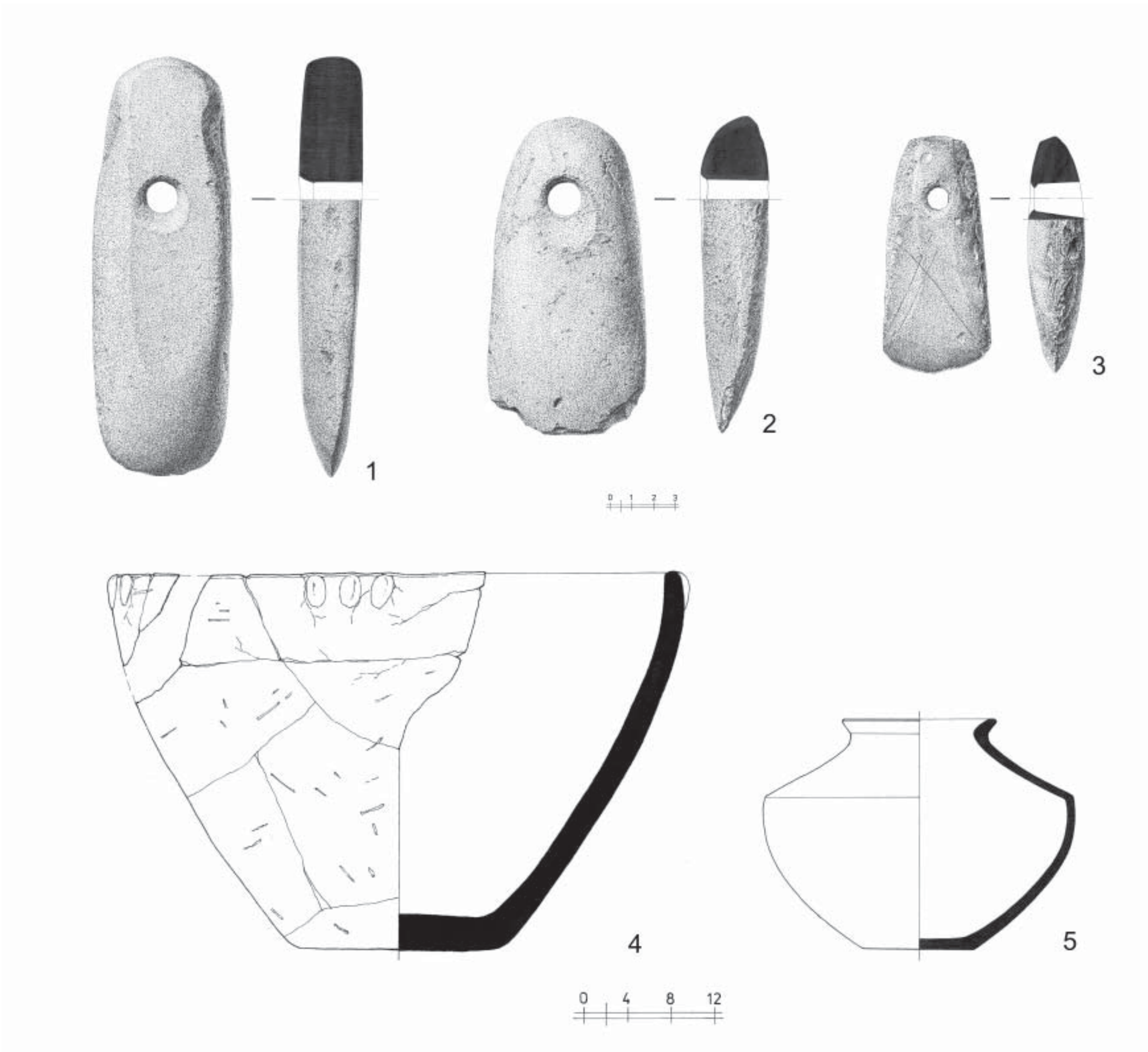
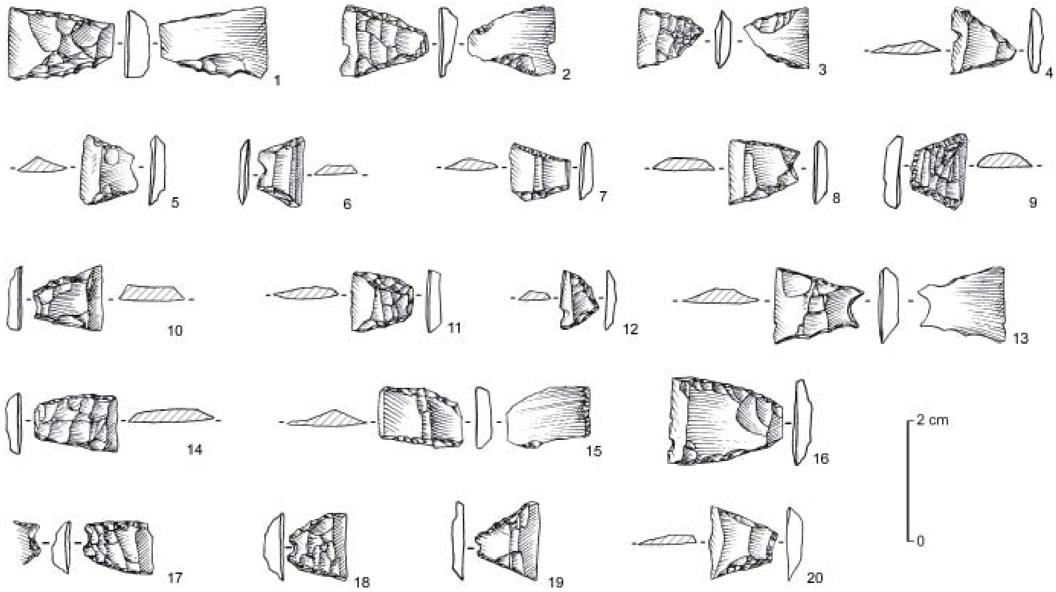


Figure 4
Aknashen settlement. Horizon I. 1–3. Stone axes (square 3, UF 3); 4. Chalcolithic vessel (UF 3, F.1); 5. Late Bronze Age vessel (burial N 5).



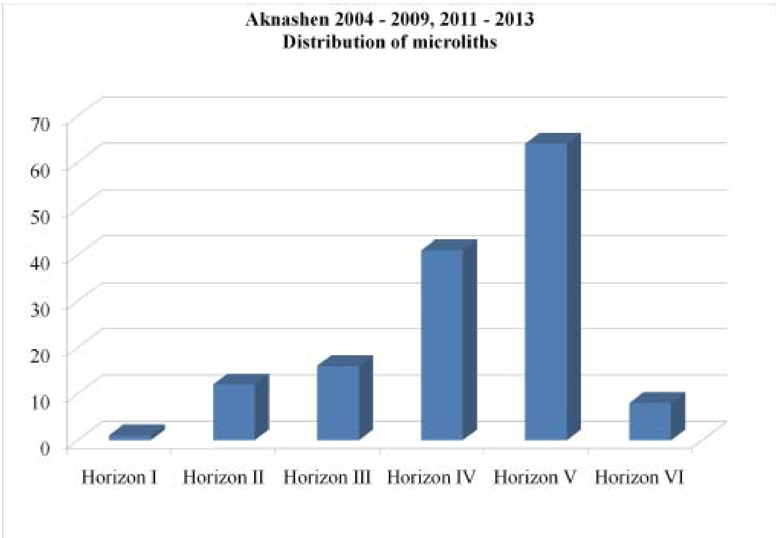


Figure 5
Aknashen settlement. Geometric microliths and their distributions by the horizons.

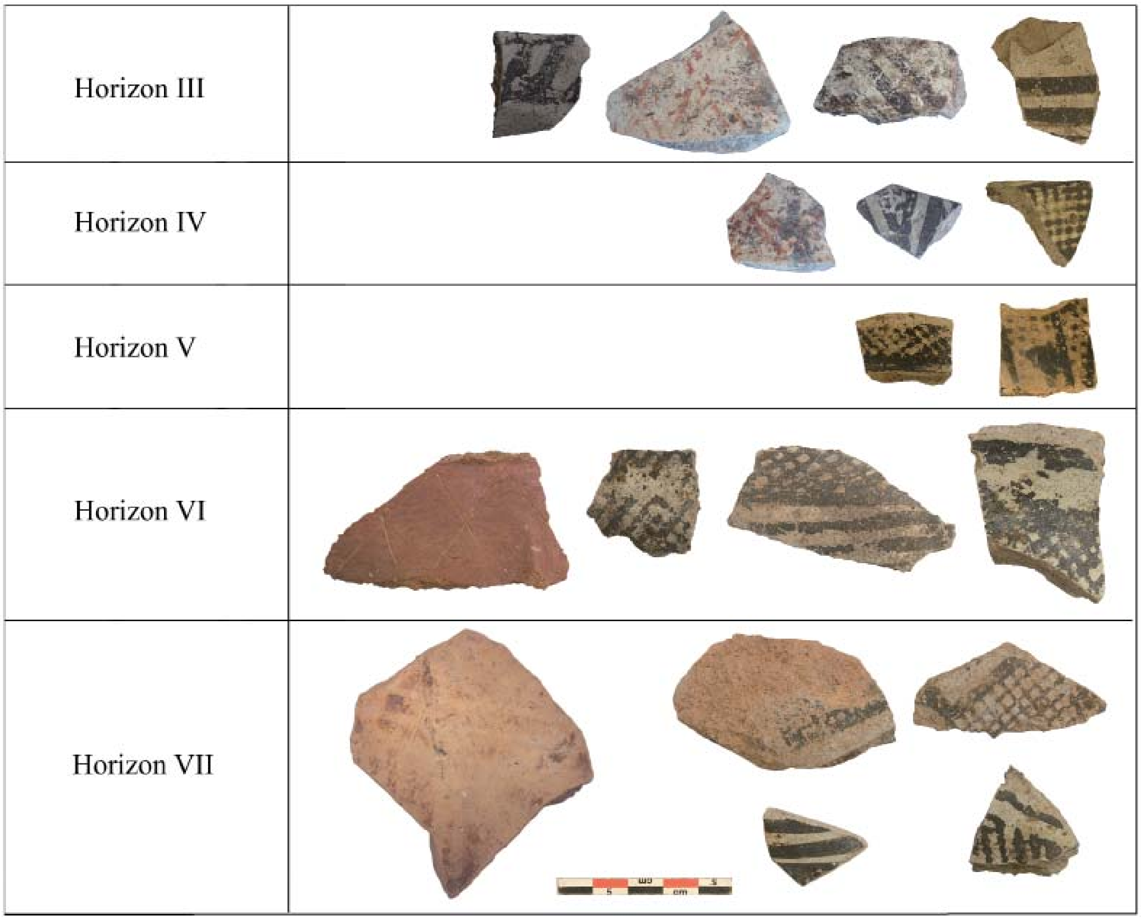


Figure 6

Aknashen settlement. Distribution of painted pottery by the horizons.

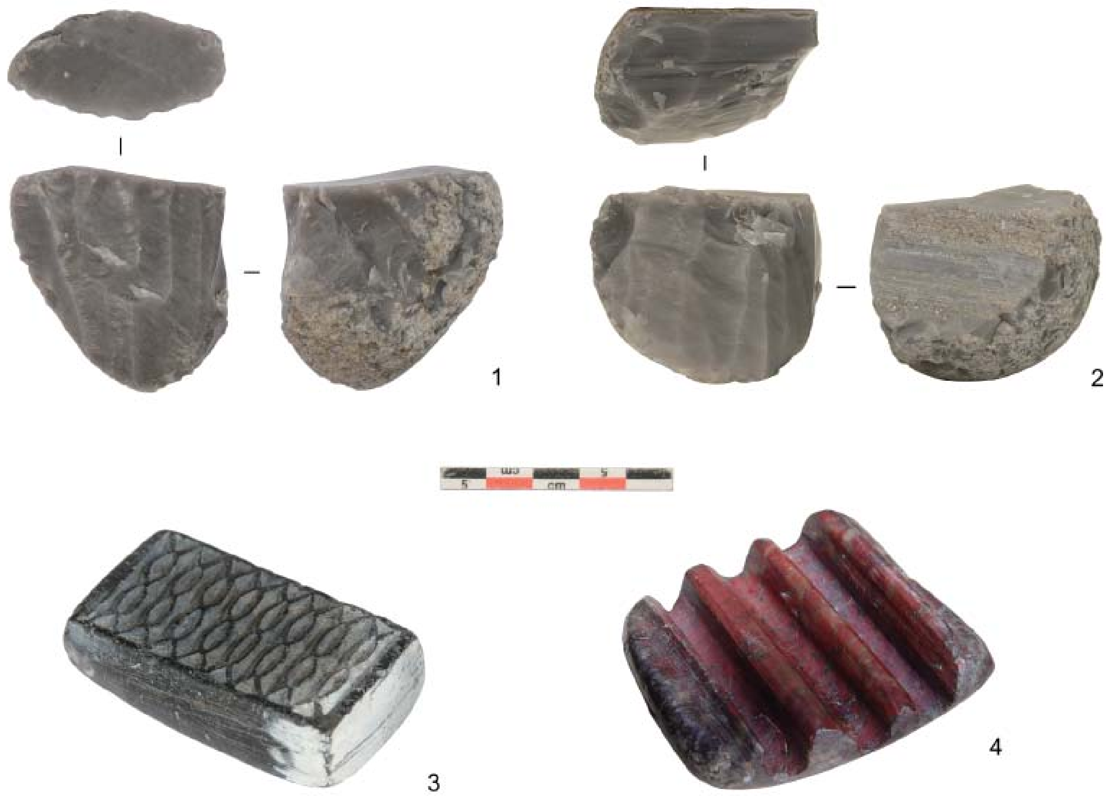


Figure 7

Aknashen settlement. Materials from Horizon VII.

1-2. Conical and semioval cores, with a single faceted platform made from grey obsidian pebbles; 3. Seal representing a rectangular, flat, convex, polished bar made of ophicalcite with incised 8-shaped ornament on convex side; 4. "Shaft straightener" or "sharpener" made of ophicalcite in the form of rectangular whetstone with three deep parallel grooves.

Preliminary Results of the 2012 Excavations at the Late Neolithic Settlement of Masis Blur

Armine Hayrapetyan, Kristine Martirosyan-Olshansky, Gregory E. Areshian and Pavel Avetisyan

1. Introduction

The recent decades of archaeological investigations at Late Neolithic sites of Armenia have been quite fruitful due to the joint efforts of local expeditions and international collaborators. First, the systematic investigations at the settlements of Aratashen and Aknashen-Khatunarkh (Badalyan *et al*. 2004; 2005; 2007; 2010; Arimura *et al.* 2010) in the Ararat plain yielded rich archaeological materials and information for understanding the culture of the inhabitants of the region at the beginning of the Middle Holocene, defined as a local variant of the "Shulaveri-Shomutepe" culture. Long-term investigations at series of tells, uncovered mainly in the middle flows of the Kura River in Georgia and Azerbaijan attributed to the Late Neolithic/Early Eneolithic (Early Chalcolithic) period, shed light on numerous aspects of the mentioned culture (e.g. Kushnareva 1997; Munchayev 1982; Munchayev and Merpert 1981; Narimanov 1987; Kiguradze and Menabde 2004). Meanwhile, the scarcity of well documented and published information on the subject, as well as numerous objective obstacles and difficulties related to specific characteristics of the Neolithic settlements in terms of the level of their preservation and identification have been a serious hindrance to complementing the pattern of the Late Neolithic culture in Armenia.

The impressive results of recent investigations in Armenia which raised a number of important unanswered questions created a necessity for searching for new unknown or inadequately investigated settlements both in the vicinity of the known ones and beyond.

The Neolithic settlement of Masis Blur was chosen for renewed excavations. The site is located in the south-western edge of Norabats village, about 2 km north from the town of Masis in the Ararat Marz[1]. The first investigations at Masis Blur were carried out by the expedition of the Archaeological Research Laboratory of the Yerevan State University in 1985-1986 (Areshian 1986; 1987).

The excavations of the settlement realized in September – October 2012 by the joint American-Armenian expedition of the Cotsen Institute of Archaeology, UCLA and the Institute of Archaeology and Ethnography of the National Academy of Sciences of the Republic of Armenia[2] were aimed to investigate the cultural layers which were uncovered in the 1980's. According to oral accounts of some of the elder local inhabitants, the hill, which stood about 2.5 m above the surrounding fields, was visible until 1971. The settlement, representing previously a round-shaped artificial hill, was severely damaged during the construction of a greenhouse system in the 1970's and later by agricultural activities. Before the beginning of renewed investigations at Masis Blur, the territory of the site had been turned into a cultivated field and the outline of the former hill was no longer visible (Figure 1).

The primary goals of the research were to determine the existence of cultural layers, the conditions of their preservation and the extent of the site, the depth of cultural deposits, as well as to address chronological issues regarding the attribution of the settlement to the Neolithic period.

Three 5 × 5 m test trenches were established along the north-south axis within a 20 × 20 m grid laid on the topographic map. The trenches from north to south are numbered as follows: M9/1, L10/4 and M11/1. In the course of excavations a fourth trench, M10/1, was placed east to L10/4.

2. Excavation results

The topsoil was rich with large amount of materials - ceramic sherds, obsidian implements, and even entire nuclei which probably represent artifacts from the upper destroyed layers of the settlement. The first traces of undisturbed cultural layer were uncovered in trench L10/4 where the main excavations started after the removal of 17–20 cm of the cultivated topsoil.

The first constructions were found 3–4 cm below the cultivated topsoil (862.61 m above sea level). Dark brown and light yellowish interlacing outlines scattered all over the trench enabled distinguishing an entire building with adjacent constructions at the depth of 10–15 cm (Figure 2). Alongside the uncovered architectural remains small-scale open-air fireplaces (diameter 30–40 cm), obsidian blades, and bone tools were found, which testify to intensive habitation in the area under

1. Marz (*մարզ*) is the Armenian word for "province".

2. Project co-directed by Gregory E. Areshian (CIOA), Pavel Avetisyan (IAE), field director of excavations Kristine Martirosyan-Olshansky (CIOA), trench supervisors Armine Hayrapetyan (IAE) and Esmeralda Agolly (CIOA).

investigation.

Trenches M9/1 and M11/1 to the north and south of the central L10/4 – M10/1 operation revealed large quantities of bone, obsidian, and ground stone artifacts. Although, it must be noted, that the upper layers in these trenches, particularly in Trench M9/1, have been severely damaged by modern agricultural activities that took place on the territory of the site. Multiple traces of ancient construction activities and fragments of walls were scattered across these trenches. The first intact layers in Trench M9/1, defined by dwelling remains, were recorded at the depth of 80 cm (Figure 3). Investigations of the cultural layers in these trenches in coming seasons will certainly shed light on the building activities of the Neolithic inhabitants of Masis Blur. In the north-western corner of Trench M11/1 a segment of an intact, small circular structure was discovered at a depth of 3–4 cm below the topsoil layer (Figure 4). The northern segment of the structure, if at all present, is currently under an unexcavated unit and further investigations are necessary to establish the degree of its preservation and its diameter. Nevertheless, judging by the visible remains of this structure, functionally it seems to belong to the group of storage bin type structures uncovered in L10/4 and M10/1. The presence of this structure segment also suggests that domestic structures belonging to this architectural layer extended further south, towards the assumed limits[3] of the settlement.

2.1. Architectural remains

In the joint L10/4 – M10/1 operation 22 clay structures were uncovered, 3 of which were more or less complete and most probably represent round dwellings with a diameter of 3 m. Two other dwelling structures were only partially excavated (Figures 5 and 6).

The mentioned structures revealed a certain peculiarity of building technique. In particular the walls, 26–28 cm thick, are made of two completely different types of clays. One of these is reddish brown (Munsel 7.5YR 4/3-brown), very viscous, without visible inclusions and forms the core of clay bundles. It could not have served as an external surface as it cracks and becomes unstable when dry. This core was covered with alight yellowish dry clay mass which seems to have inclusions of straw and sand; there are brown particles visible in the yellowish mass (dry – 2.5Y 6/4, wet – 2.5Y 4/4), which is up to 3 cm thick. Traces of straw were recorded in the broken surfaces as well.

Here we can observe the application of two different techniques which were known to the Neolithic inhabitants of different sites throughout the Near East. The first, described as the

3. Due to the lack of satellite and aerial imagery of the site predating the destruction of the mound, we again rely on oral accounts of the local villagers to estimate where the boundary of the visible mound would have been.

pisé (*fr.*) technique, consists of clay mass shaped in bundles or filled and/or pressed between face boards (Aurenche 2004). The second technique describes preparation of mud "clods" or "pads" (*motte – fr.*) from the mixture of clay tempered with cut straw (*torchis – fr.*). The application of this combined building technique would enhance thermal stability and water permeability of dwellings. As recorded in one of the dwellings (S006) the wall refinishing was completed by applying a layer of yellowish clay plaster to the internal surface.

Only in one of the above described dwellings a distinct floor surface was recorded represented by a thin hard layer (0.5–0.7 cm – in the southern part of S004, loci 103 and 322).

Alongside the described dwellings, other structures pertaining to household activities or storage (silos) were located in outdoor areas. These structures have thin walls up to 10–12 cm wide made of the described light yellowish clay clods. One of the structures (S011) differs from the aforementioned ones and represents a straight row of alternating dark and light clay rectangles (*pisé* and clods). At the first stage of investigations, it was not possible to associate the latter based on its possible function with any building or a workshop area.

The excavations also uncovered remains of a second architectural layer (structures S019 – S023) under the above mentioned structures. The outlines of walls of this layer can be clearly distinguished on the surface underneath the upper layer, leaving no doubt regarding their belonging to a different layer. These structures were excavated only to a height of 3–4 cm in order to distinguish from the surrounding surface. Further investigations of the second architectural layer will clarify the dynamics of building activity at the settlement (see the profile drawings in the Figure 7).

2.2. Workshop areas

Features consisting of pebble (3–5 cm in size) accumulations were uncovered both inside and outside excavated buildings, mainly under the walls, often accompanied by finds of complete bone or obsidian tools. Such situations were uncovered in two central nearly complete buildings (S003/S005 and S004 – F1-F8). The only feature with relatively larger pebbles (10–12 cm stones) was found in the burnt section of building S004, where over a dozen pebbles were uncovered. In association with these pebbles a stone axe and two exhausted obsidian nuclei were also found.

2.3. Hearths and firepits

The "hearths" or firepits uncovered alongside the abovementioned structures represent small round ash-patches with a diameter of around 30 cm (S017, loc. 113; S018, loc. 112[4]). Two of these were unearthed in the center of a dwelling (F5, loc. 110/ F10, loc. 115); these two features overlap, with a slight shift of location, and probably belong to two consecutive phases of the same floor. The small size of the firepits and fine ashes with small fragments of charcoal suggests that, due to the physical limitations of the living space and possibly other inconveniences, the main fire was probably burnt outside and only warm charcoal was brought inside when needed.

2.4. *In situ* finds

On the junction of two trenches (L10/4 and M10/1) an entire circular dwelling with 2.70–2.90 m in diameter was uncovered (S004) the central part of which remained under the bulk separating the trenches. In order to complete the excavations of the structure part of the bulk was removed. Right under the removed topsoil was a dark brown spot with a reddish edges measuring over 1 m in diameter. The building was entirely excavated both from inside and outside. In its north-eastern part the wall was burnt and partially baked due to the fire. Judging from the soot attested in the cracks of the clod-*pisé* mass, which had tuned into "bricks," it may be assumed that the mentioned traces of fire exceed the typical scale of hearths and represent a localized conflagration. This hypothesis is supported by the large number of objects found *in situ* in the excavated units (Locus 319 and 322). The majority of the finds was found intact and could still be functional at the time of the fire. The largest number of artifacts was uncovered in the darkest part of the burnt layer, where the fire would have had the most intensity, at a depth of 15–17 cm below the topsoil layer. The quantity and the quality of artifacts, along with their undisturbed context, suggest that the structure was abandoned during the fire and the inhabitants did not return to retrieve their belongings.

Among the most notable finds a bifacially incised, rectangular stamp (length: 5.5 cm) must be mentioned, it is made of light bluish serpentinite (?) with horizontal striations on one side and a cross hatched decoration on the other (Figure 8).

"Arrow straighteners", two exhausted obsidian nuclei, as well as a stone axe of green steatite, and a large number of bone and obsidian tools were also found in the same context. In total, among all artifacts found during the 2012 excavations season, over 140 objects were made of bone. Indeed, the abundance of bone tools and their incredible variety require a detailed and nuanced investigation in order to shed light on the significance of this industry at Masis Blur. Preliminary observations have identified the following major categories of bone tools: awls, points, needles and

4. These two "hearths" were outlined by 5–7 cm wide clay bands and were defined as separate structures – S017 and S018. In all other cases (without structure outlines) they were recorded as features – F5/F10.

pins, scrapers, spoons, and spatulas (Figure 9).

Representing the largest part of material finds from Masis Blur, the lithic assemblage is still under investigation and will be presented more thoroughly in forthcoming publications. However, preliminary observations show that the chipped stone industry at the site is based on blade production and is dominated by obsidian (over 99%). The assemblage of the macrolithic artifacts represents numerous varieties of the ground stone industry. At this early stage of research archaeobotanical and archaeozoological studies are also in progress. It should be mentioned that a large number of fish and turtle remains were found in the excavated contexts.

Regarding pottery finds we must stress that, despite a large quantity of sherds collected on the surface and from the topsoil, which most likely originate from the upper, destroyed levels of the tell, only very few sherds (1–2 pieces at most in each trench) were found from the undisturbed layers that we were excavating.

3. Conclusions

During the 2012 excavations of the Masis Blur settlement, the first (upper) building horizon of preserved cultural layers was uncovered right below the topsoil in the central part of the investigated area. This horizon is represented by circular buildings with a diameter up to 3 m, which are associated with numerous small structures of household functionality. The total preserved depth of this horizon does not exceed 35 cm. Under that layer structures belonging to the second building horizon were uncovered and outlined, which is indicative of the significant potential for the presence of multiple cultural layers at the site.

Combining this with the data fromother excavated trenches, in which the uppermost intact cultural layers appear as deep as 80 cm from the present surface of the site and contain structures with significant differences both in building techniques and architectural aspects, the preserved cultural layers of the site seem to contain at least three, and likely more, building horizons.

In terms of cultural-chronological attribution of materials, the finds of this season present obvious parallels with the Late Neolithic materials from settlements of Aratashen and Aknashen-Khatunarkh, while the architectural features seem to substantially diverge from the building traditions presented by those sites. The upper layers excavated in 2012 date to the beginning of the 6th millennium Cal BC through radiocarbon analysis (Table 1).

References

Areshian, G.E. (1986) Excavations of Masis-Blur (Yengija) Settlement. In: *Scientific Reports of 1985 Archaeological Excavations*. Yerevan: Archaeological Research Laboratory of Yerevan State University, pp. 1–18 (in Armenian).

Areshian, G.E. (1987) Excavations of Masis-Blur Settlement. In: *Reports of 1986 Archaeological Fieldwork of the Theme of "Archaeological Sources of Armenia" of the Archaeological Research Laboratory*. Yerevan: Yerevan State University, pp. 4–7, 75–80 (in Armenian).

Arimura, M., Badalyan, R., Gasparyan, B. and Chataigner, C. (2010) Current Neolithic Research in Armenia. *Neo-Lithics* 1/10, pp. 77–85.

Auranche, O. (ed.) (2004) *Dicionnaire illustré multilingue de l'architecture du Proche Orient Ancien. 2e tirage*. Lyon: Maison de l'Orient et de la Méditerranée – Jean Pouilloux.

Badalyan, R., Lombard, P., Chataigner, C. and Avetisyan, P. (2004) The Neolithic and Chalcolithic phases in the Ararat Plain (Armenia): The view from Aratashen. In Sagona, A. (ed.), *A View from the Highlands–Archaeological Studies in Honour of Charles Burney.* Ancient Near Eastern Studies, Supplement 12. Leuwen: Peteers Press, pp. 399–420.

Badalyan, R., Avetisyan, P., Lombard, P., and Chataigner, C. (2005) Poselenie Aratashen (Neoliticheskiy pamyatnik v Araratskoy doline) (The Settlement of Aratashen [Neolithic site in the Arart Plain]). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty XIII* (The Ancient Culture of Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 34–41 (in Russian).

Badalyan, R., Lombard, P., Avestisyan, P., Chataigner, C., Chabot, J., Vila, E., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New Data on the Late Prehistory of the Southern Caucasus. The Excavations at Aratashen (Armenia): Preliminary report. In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe milléннaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS Éditions, pp. 37–61.

Kiguradze, T. and Menabde, M. (2004) The Neolithic of Georgia. In: Sagona, A. (ed.). *A View from the Highlands. Archaeological Studies in Honour of Charles Burney*. Belgium: Peeters, pp. 345–398.

Martirosyan-Olshansky, K., Areshian, G.E., Avetisyan, P.S. and Hayrapetyan, A. (2013) Masis Blur: A Late Neolithic Settlement in the Plain of Ararat, Armenia. *Backdirt 2013*, pp. 142–146.

Munchayev, R.M. (1982) Eneolit Kavkaza (Eneolithic of the Caucasus). In: Masson, V.M. and Merpert, N.Ya. (eds.), *Eneolit SSSR, Arkheologiya SSSR* (Eneolithic of the USSR, Arcaeology of the USSR). Moscow: "Nauka" Publishing House, pp. 94–137 (in Russian).

Munchayev, R. and Merpert, N. (1981) *Rannezemledel'cheskie poseleniya Severnoy Mesopotamii* (Ancient Farming Settlements of the Northern Mesopotamia). Moscow: "Nauka" Publishing House (in Russian).

Narimanov, I.G. (1987) *Kul'tura drevneyshego zemledel'chesko-skotovodcheskogo naseleniya Azerbaijana (epokha eneolita, VI – IV tis. do n.e.)* (The Culture of the Ancient Agricultural and Stockbreeding Population of Azerbaijan [the Eneolithic Period, VI –IV Millennium BC]). Baku: "Elm" Publishing House (in Russian).

Table 1

Radiocarbon dates from the upper layers of Masis Blur settlement (2012 excavations).

Laboratory Sample No.	*Sample Designation*	*$\delta^{13}C^{a}$*	*Conventional ^{14}C age[b] (BP yrs)*	*Calibrated ^{14}C age[c] (cal BC yrs)*
UCIAMS-121528	MB-1 2012.L10/4.105.1034	-25.1	6935±25	5880 - 5740
UCIAMS-121529	MB-2 2012.M9/1.212.2110	-25.8	6995±20	5980 - 5945 (0.21) 5925 - 5835 (0.78)
UCIAMS-121530	MB-3 2012.M10/1.319.3085	-24.4	6940±25	5885 - 5745
UCIAMS-121531	MB-4 2012.M11/1.023.0259	-25.6	6765±25	5715 - 5630

[a] IRMS measurements of $\delta^{13}C$ values measured to precision of <0.1‰ relative to PDB

[b] Conventional ^{14}C ages as defined in Stuiver and Polach (1977).

[c] ^{14}C ages are calibrated using CALIB 6.0 protocols and the IntCal09 data set. Single interval 2σ range calibration values are expressed for intercepts representing ≥0.95 of the relative area under the probability distribution. If relative area is ≥0.1, that value is listed in parenthesis. In cases of multiple intercepts, the 2σ ranges with relative areas under probability distribution of ≥0.05 are noted in parenthesis for intercept separations of ≥20 yrs. Calibrated age ranges are rounded to nearest 5 year increment.

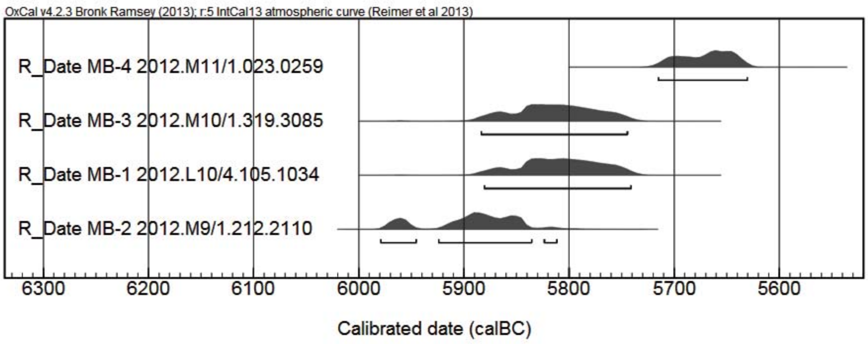


Figure 1
View of Masis Blur settlement, 2012 excavations. Aerial image.

Figure 2
Masis Blur settlement. The first preserved horizon in the joint operation L10/4 – M10/1, view to the west.

Figure 3
Masis Blur settlement. The intact horizon in the Trench M9/1.

Figure 4
Masis Blur settlement. Architectural remains of the Trench M11/1.

Figure 5
Masis Blur settlement. General view of the joint operation L10/4 – M10/1.

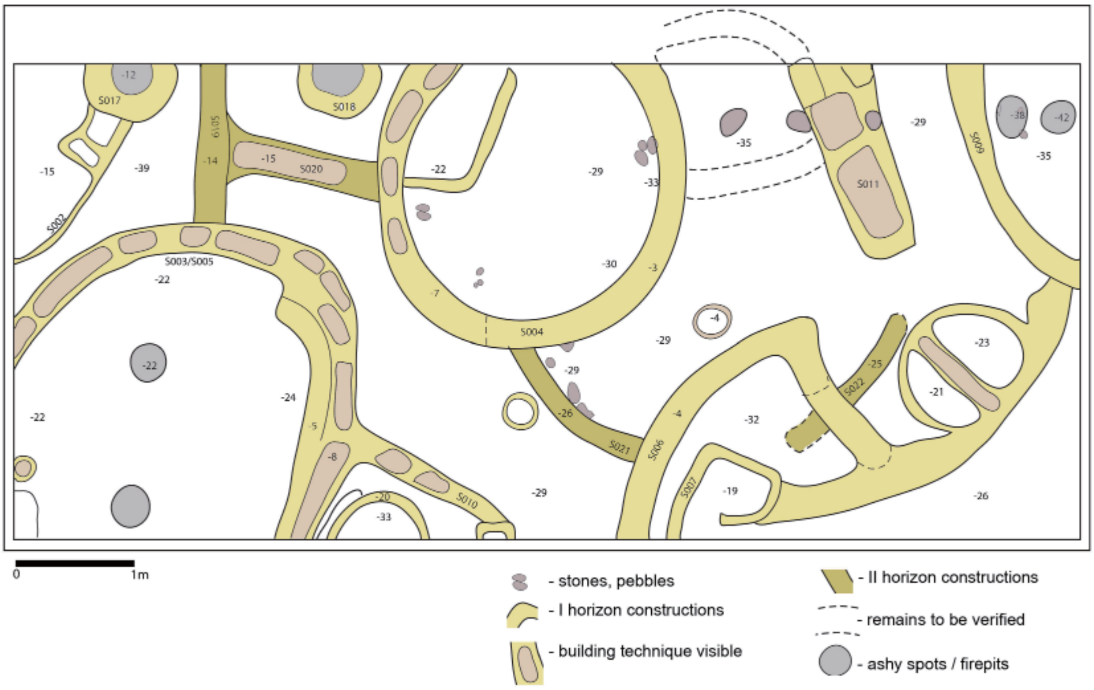
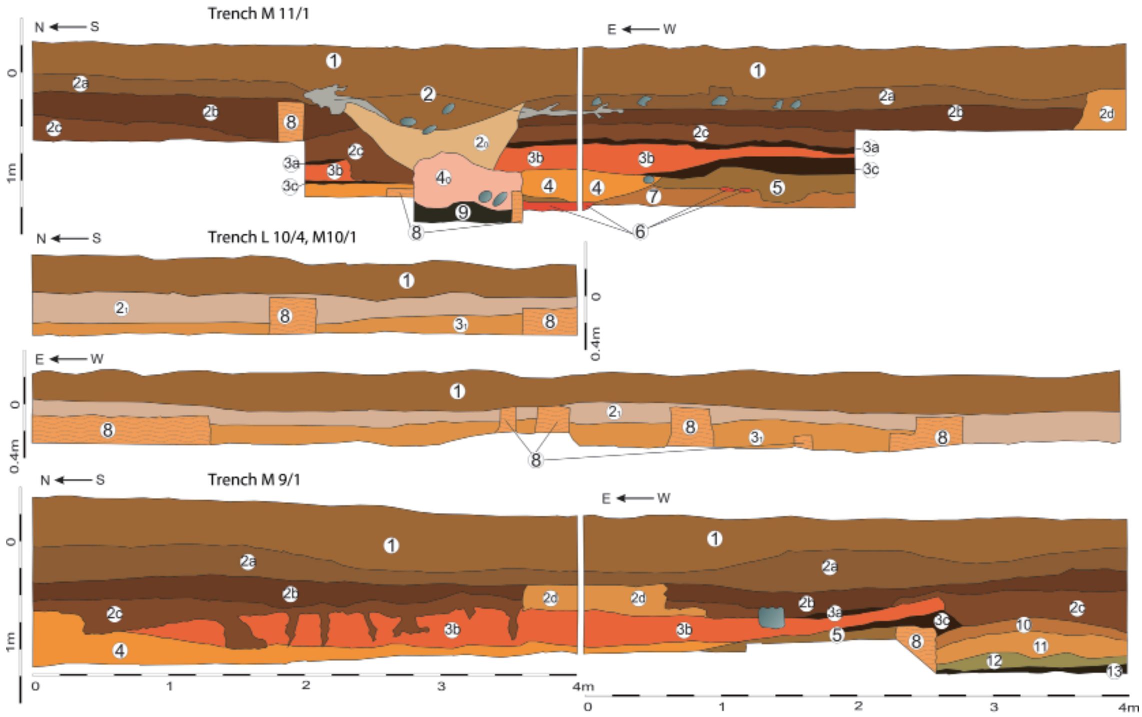


Figure 6
Masis Blur settlement. L10/4 – M10/1 operation layout, with outlines of the building technique traces.



1 - modern soil - 10YR 4/2; 2 - dark gray ash (firepit) - 10YR 4/1; 2_0 - brown loam, ash and charcoal (pit) - 10YR 5/3; 2_1 - pale brown loam, ash and charcoal, limited alluvial pebbles - 10YR 6/3; 2_a, 2_b, 2_c - secondary sedimentation - 10YR 3/2, 2/, 3/3; 2_d - brown loam - 10YR 5/3; 3_1, 4 - yellowish brown loam, 10YR 5/4; 3_a, 3_c - very dark brown loam - 10YR 2/2; 3_b - brown loam, angular big blocs - 10YR 5/3; 4_0 - brown loam, ash, charcoal (pit) - 10YR 4/3; 5 - very dark brown sandy clay - 10YR 3/3; 6 - strong brown clay of fair solidity - 7.5YR 5/6; 7 - dark yellowish brown clay - 10YR 4/4; 8 - Constructions; 9- very dark gray ash - 10YR 3/1; 10 - dark yellowish brown loam - 10YR 4/4; 11 - yellowish brown sandy clay - 10YR 5/4; 12 - olive loam - 5Y 5/3; 13 - very dark grayish brown loam - 2.5Y 3/2

Figure 7

Masis Blur settlement. Drawings of profiles of the Trenches M9/1, L10/4-M10/1, M11/1.

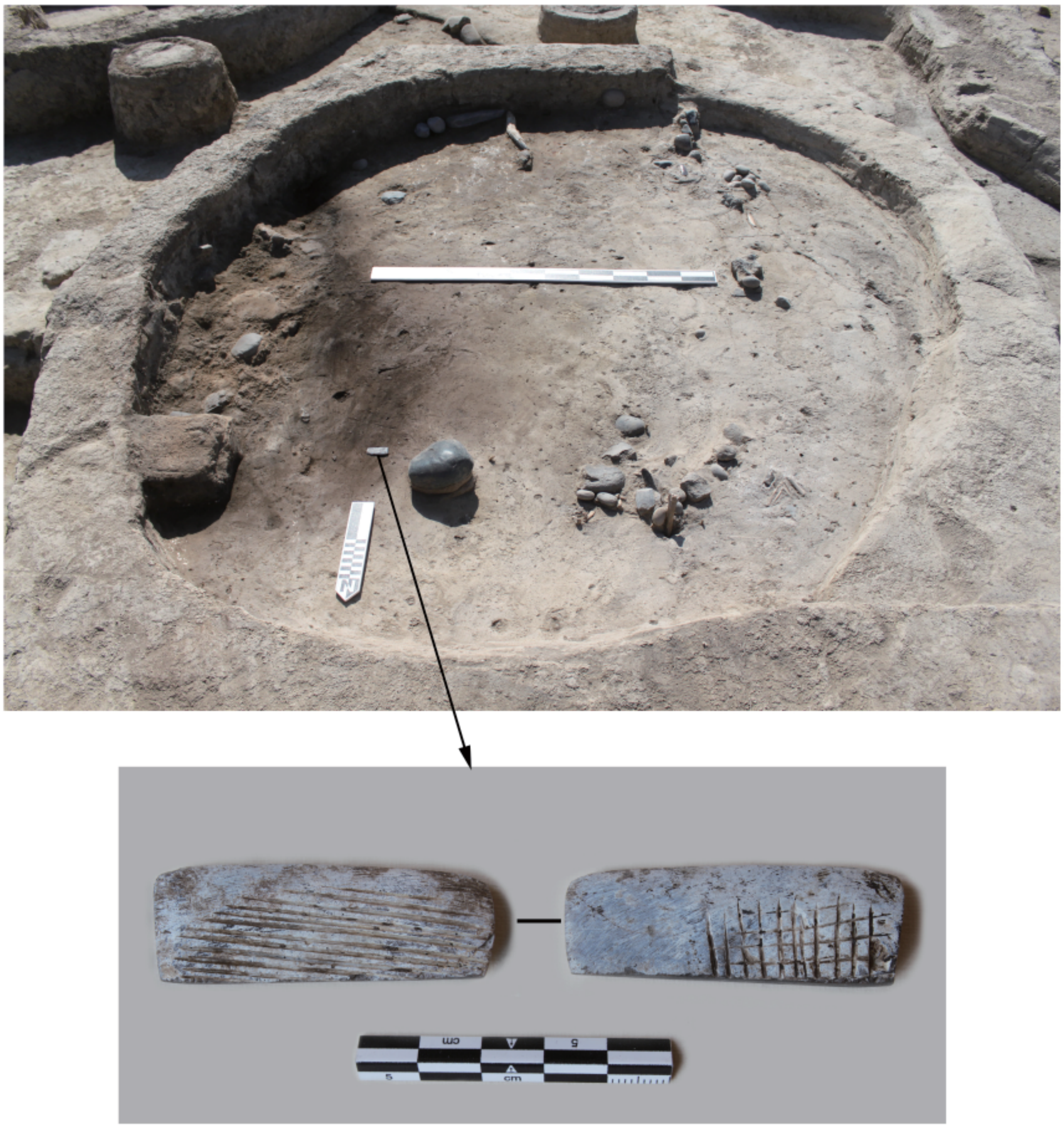


Figure 8
Masis Blur settlement. The *in situ* find of a stone stamp with bifacial incisions.

Figure 9

Bone tools from Masis Blur excavations. 1: Bone spoon with a perforated handle; 2: Palette made of a scapulae bone; 3–4: Bone knives / scrapers; 5, 6, 8: Arrows / darts; 9–10: Pointed tools with spatula shaped handles; 7, 11–15: Pointed tools – awls and punchers.

On Neolithic Pottery from the Settlement of Aknashen in the Ararat Valley

Armine Harutyunyan

– Dedicated to the memory of A. Kh. Mnatsakanyan –

1. Introduction

Recent comprehensive typological and archaeometrical studies of Neolithic-Chalcolithic ceramics from the settlements of Aratashen (Badalyan *et al*. 2007) and Aknashen (Badalyan *et al*. 2010) in the Ararat valley have allowed us to identify a pottery group with unique morphological and technological features.

Pottery from the Aknashen settlement (about 7,000 pieces) is represented by fragments of bodies, rims, bases, and a few complete samples that give an overview of the vessels' morphology. All the pottery can be classified into two groups according to its technical and technological characteristics: ceramics with organic inclusions ("Chaff-tempered"), and ceramics with inorganic (mineral) inclusions ("Grit-tempered") (Arutyunyan 2008). In addition to the groups mentioned, there are a small number of fragments from high-quality imported ceramics.

The "Grit-tempered" pottery, in turn, can be categorized into two separate subgroups, conventionally called "Grit-tempered I" ware, and "Grit-tempered II" ware. Despite the fact that both subgroups of the "Grit-tempered" pottery contain mineral inclusions, there are some substantial differences in the nature of the inclusions, in the production techniques, and in how the vessels were treated.

The main goal of this paper is to analyze differences between these two groups using petrographic research[1] of ceramic samples from the Aratashen and Aknashen settlements, as well as

1. Petrographic research of the ceramics from Aknashen was conducted in 2007–2008 (grant by Project Discovery, No. 2007-RC-004), and again in 2011–2012 (grant by the National Committee of the Science of the Ministry of Science and Education, RA "The Origins and Development of the Ceramic Production in Armenia (the Neolithic period–Early Bronze Age)", 11–6a635).

petrographic, chemical and x-ray diffraction analyses of the clay samples collected from these sites (Arutyunyan and Mnatsakanian 2010; Arutyunyan 2011), and a separation of the "Grit-tempered II" ware of all ceramics.

The systematic discovery of ceramic samples from the "Grit-tempered II" ware in specific stratigraphic locations requires careful analysis. In this paper, we try to present complete information about these ceramics. Since complete descriptions of all the aforementioned groups of Neolithic-Eneolithic pottery from the Akanashen and Aratashen sites have already been presented in previous publications, ceramics with organic inclusions will not be considered here. With regard to the "Grit-tempered I" ware, it is discussed only when necessary for the purposes of providing a comparison.

2. The "Grit-tempered II" pottery and its stratigraphic distribution

Ceramics from "Grit-tempered II" ware are characterized by their fine sherd. The clay used for producing these vessels is sifted and large particles are removed. The surface of the sherd is properly smoothed, covered by engobe or obviously slipped and well burnished. The thickness of potsherds varies from 0.5–1.0 to 0.9–1.2 mm. This pottery has a homogenous color, and its external surface is light (shades of reddish-yellowish-brown), while the internal surface is darker, or greyish-black (see Table 1 which compares the variations in surface colors of the "Grit-tempered II" and "Grit-tempered I" ceramics). Fracture is coarse, medium grained, or fine-grained (1–1.5 mm). It has small cracks running in different directions. Cross section is often striped, with thin edges repeating the color on both surfaces, and has a dark grey core. Most likely the pottery was sculpted with coils, although, unlike the "Grit-tempered I" ware ceramics, it is very difficult to determine the coil dimensions visually.

With regard to the shape of these artifacts, the vessels include deep and shallow bowls with cylindrical or flared bodies and flat bases, low-necked jars with smooth transitions from the bodies into the necks, and simple, flattened, or sharpened rims. Unlike "Grit-tempered I" ceramics, the typical bulge on the base is absent here, and the transition from the rounded walls into the base is smooth (Figure 1: 7–13).

As has already been mentioned in previous publications, the "Grit-tempered I" ceramics (Figure 1: 1–6) is coarser in both its contents and in regard to the technique used to shape it. It is represented by barrel-shaped or cylindrical vessels on a flat wide base with a protruding heel, sometimes with rounded shoulders and a simple, incurved rim, without any additional surface treatment (like slipping or burnishing). Low-necked vessels are completely absent.

According to the characteristics, the “Grit-tempered I” ceramics were more primitive, and were made without any special technological skills. If we assume that the population of the Ararat valley was independently producing ceramics (familiarity with the properties of clays having been acquired by practice in adobe construction), then the ceramics of this group are quite suitable for the initial stage of pottery production. Moreover, the petrographic peculiarities of the clays studied indicate that in the production of the ceramics from the Aknashen and Aratashen sites, the same clay with natural sand inclusions of lavas, crystals, and volcanic glass was used, as in the ceramics from the “Grit-tempered I” ware, often without any artificially added inclusions. However, as can be seen from the stratigraphic distribution (Figures 2 and 3), the higher quality ceramics from the “Grit-tempered II” group appear earlier, and in comparatively small numbers. The possibility that they were imported is absolutely excluded, as the results of the petrographic analysis showed that both groups of pottery were made of the same clay, identical in its chemical and mineralogical content. We can assume that the differences between the two were a result of the different functional purposes of the vessels. The coarse ceramics from the “Grit-tempered I” group may have been used for the storage and processing of products and the “Grit-tempered II” pottery may have served as tableware.

Referring to the stratigraphic position of the ceramics discussed, it should be noted that the upper layer of the hill, sometimes up to 2 m in depth, had been greatly disturbed by later intrusive burials and digs that resulted in some distortion of the stratigraphic distribution of the ceramics in the horizons. Despite this, as shown in Figure 2, with the discovery of pottery from all groups throughout the thickness of the cultural layer, the ceramics with organic inclusions are in the absolute majority only in Horizon I (0–1.56 m depth), and the number of these ceramics found in the underlying horizons is dramatically fewer. At the same time, the ceramics with inorganic inclusions from Horizon II are in the greatest number. Horizon III marks a special place in the history of the settlement: probably as the result of an event which caused the settlement to be abandoned for some time. Ceramics from the “Grit-tempered I” ware group were found *in situ* in the interior part of the collapsed adobe buildings. During the same period, the number of ceramics from the “Grit-tempered II” ware group increased[2], and was predominant in Horizon IV. While considering the ceramics by their stratigraphic horizons, the dimensions of the fragments found, the probability of finding complete or semi-complete vessels in specific layers is taken into account. For example, the largest pottery fragments of the “Chaff-tempered” group were found only in the

2. In the most undisturbed upper layers (as in Sounding A, excavations of 2006), the “Grit-tempered II” ceramics are found as single samples, while in Horizon III these ceramics are in the majority.

upper layer, and sherds of smaller size in Horizon V were associated with the burrows and diggings of animals and various intrusions. As was expected, the ceramics of "Grit-tempered I" ware were well preserved in Horizons II and III. In contrast with the ceramics from other groups, "Grit-tempered II" ware was more fragmented. Most of the restorable samples derived from Horizons III and IV, and in Horizon V, this ceramic prevailed, despite the small number of quite fragmented samples (2% of the total number of ceramics found).

The most interesting find occurred in Horizon IV (Ak.2011, Tr.3, UF 8, F13, Fig. 1: 13). This find was an ovoid-shaped vessel (26.5 × 39 cm in diameter and 11.8 cm high) with a horizontal spout in the middle of the rounded body, flat based, but with smooth transition to the walls. Although, the ovoid-shaped vessels are known from the "Aratashen-Shulaveri-Shomutepe" culture (Kiguradze 1976: 162, Table 39: 2, Table 40: 17), the specific analogy between this one and synchronous materials found in other sites in the region is unknown. The vessels with a spout on the body are also known from Halaf culture sites (Munchayev and Merpert 1981: p. 237, Fig. 83: 4; Stein 2009–2010: Fig. 4).

3. Ceramic discs

In this context, it is worth mentioning ceramic discs which were fashioned from the "Grit-tempered II" potsherds, and traditionally defined as spindle whorls (Figure 4). These are 2.8–6 cm in diameter and 0.75–1.25 cm thick, rounded, flat objects with a hole in the center. A few samples bear incompletely drilled holes on the internal side. The edges of most of these samples are well-ground; one sample with a blind hole has rough-hewn edges, which hardly form a rounded shape (Figure 4: 5). Five of thirteen samples of complete and fragmented disks occurred in Horizons V and IV, where this type of pottery predominated; one sample was unearthed from Horizon III, and two samples were unearthed from Horizon II. One piece is made of the imported ceramics potsherd (Figure 4: 1). The sherd is dense, made of homogenous, fine clay, and has light greenish-yellow color (pale yellow 5Y 8/2). A large discoid spindle whorl was found in Trench 8 - UF 8, F 14 (2011, Horizon V) *in situ*, among the lithics, bone tools and accumulated fish vertebrae (Figure 4: 10).

Another tool made of a potsherd from the "Grit-tempered II" ware was found in Horizon III (Figure 4: 3). The item is an oval-shaped object, with similarly ground edges, although it was obviously used for some other purpose than the spindle whorls. Perhaps it was used as a polisher.

Discs/spindle whorls made of potsherds not only spread across a wide geographical area, but also presented a long chronological existence. They are known from the sites of the Hassuna culture, and were widespread in the Halaf period, along with clay conical and biconical spindle whorls (Lloyd *et al.* 1945: Plate X: 1–12; Munchayev and Merpert 1981, p. 133, Fig. 39, p. 230; Arimura *et al*. 2000, p. 251).

4. The results of petrographic studies of the "Grit tempered II" ceramics group

In recent years, petrographic research was conducted on 300 fragments of ceramics from the Aratashen and Aknashen settlements—including 65 ceramic fragments of the "Grit-tempered II" pottery. This work was conducted jointly with A.Kh. Mnatsakanyan (Institute of Geological Sciences of NAS RA) (Arutyunyana and Mnatsakanian 2010). The fragments studied were selected on the basis of the characteristic features of well-stratified layers. These are mainly body fragments, but also include determinative sherds of rims and bases. Clays from the surrounding sources were also studied (Arutyunyan 2011). The analyses showed that the ceramics of all the chronological and morphological groups from both sites are made of local clay, which by its chemical composition corresponds with the hydromica group, with small amounts of chlorite, montmorillonite, and rarely kaolinite. The clay contains a natural admixture of lava, crystals, and volcanic glass (12–14%, ranging from 0.5 to 1.3–1.5 mm), and by composition is similar to the inclusions appearing in the ceramics. The local lacustrine and alluvial-lacustrine-type clays are formed by erosion and redeposition of loose pyroclastic medium-acid material, the source of which may be specific to the Aragats volcanic complex deposits of ash flow that formed the thick layers of ignimbrite tuffs of the Quaternary period.

The clay mixture of "Grit-tempered II" ware is mainly represented by a brecciated structure defined by the presence of debris, and isolations of the light dispersed clay (or hydromica material) in a binding mass. Inhomogeneous composition of the ceramic paste most likely is a result of insufficient mixing/blunging, when the less plastic clay pieces acquired angular, isolated forms, and remained hard after firing. The binding mass was mainly represented by fired (in varying degrees) opacitized hydromica units of the cryptofibred, flaky form, with a low fraction of silt inclusions, almost the complete absence of volcanic ash, and without any trace of vitrification.

The sand fraction did not play a significant role—its content varied from 1–2% to 5–7% (its maximum content of 10–12% was observed in a single sample). The sand fraction consists of crystalloclasts and rarely lithoclasts, formed by the destruction and rewashing of the ancient granites, quartzites—less by neoformed obsidians and volcanic glasses. The dimensions and the quantities are natural. According to some authors, the amount of the sand inclusions being less than 10% does not affect the plastic properties of clays (Glushkov 1996), and the normal, rational proportion of admixtures is considered to be between 20 and 50% (Rye 1981). Therefore, the sand admixture did not play an important role for the potters. When compared with the natural clay of the region, it becomes clear that in this case the raw clay was subjected to a special treatment: it was sieved, probably, washed, and cleaned of large particles. Grog seems to have played a more important role, if not in terms of technology, then from the traditional or ideological aspect. Grog (0.4–1.5 mm in size) is present in small amounts (4–5%, and sometimes reaches 7%), but is represented in all the fragments, including both the low-temperature samples with indistinct, sinuous edges, and the high-temperature ones, with a clear line of division, and cracks along the contour.

The pottery differs by its high degree of porosity (from 10–12% to 32–37%), a characteristic that is not typical for ceramics from the "Grit-tempered I" ware. Pores are often interconnected in intermittent stripes, merging with cracks that may indicate an active role of the fluid phase in the dehydration of clay foundations during the firing process. The formations of a small number of the pores may also be associated with the burnout of organic inclusions (natural or artificial such as dung for example) in the clay.

The presence of the isotropic opal in the diatoms and in the undissociated crustalloclasts of calcite, and the absence of vitrification suggests that the temperature of the pottery firing was in the range of 600–650 °C. The character of the fracture banding of the majority of the studied sherds may indicate the reductive conditions of the firing, with the periodic moderate or low flow of oxygen.

A slight discrepancy between the composition of the clay and the finished product, expressed in the absence of volcanic ash in many samples of the "Grit-tempered II" ceramics, but typical for the local clays, requires further study. A possible explanation is the higher temperature of firing, although the existence of other sources of raw clay may also be considered.

Thus, the separation of the "Grit-tempered II" ceramics within the Neolithic pottery of Aknashen settlement has an objective base, due to its technological and morphological peculiarity. Meanwhile, similar materials are not known in the "Aratashen-Shulaveri-Shomutepe" culture. Only some samples from Arukhlo I are relatively close to the "Grit-tempered II" ceramics in composition, morphology, and surface treatment (Hansen *et al*. 2006, Abb. 33; Hansen *et al*. 2007, Abb. 18).

The lack of archaeological data from the surrounding region of the Ararat valley necessitates that we refer to parallels, which can be drawn from the sites of geographically more distant areas. Analogies for the "Grit-tempered I" and "Grit-tempered II" ceramics can be found among the materials of some sites excavated in recent years in the upper reaches of the Tigris River (Salat Cami Yani: Miyake 2011, Sumaki Höyük: Erim-Özdogan 2011a), Til Huzur-Yayvantepe (Caneva 2011), Hakemi Use (Tekin 2011), and the Euphrates: Akarçay tepe (Arimura *et al*. 2000; Özbaşaran and Duru 2011), Tell Seker al-Aheimar (Nishiaki and Le Mière 2005) and among pottery from the previously known sites of Çayönü (Erim-Özdoğan 2011b). Despite the fact that all of these sites are older than Aknashen (dates for the material we are interested in refer to the second half of the 7th millennium BC), the nature of the development of the pottery types from ones with mineral inclusions (grit-tempered, transitional period from the PPN to PN), to the types with organic inclusions (chaff-tempered), suggest a pattern similar to that observed in Aknashen. Since the early phases of the existence of the many sites of so-called “DFBW” ceramics (Dark-faced Burnished Ware or Early Dark Ware) have been detected, it shares peculiarities with the “Grit-tempered II” ceramics. If, for the sites of the Khabur Basin, for example Tell Seker al-Aheimar (Nishiaki and Le Mière 2005, p. 61), this kind of pottery is considered as imported, it is local for the basin of the Tigris River (e.g. Sumaki Höyük) (Erim-Özdoğan 2011a, p. 30).

The need for further detailed research regarding both the composition of the raw clay, and the comparative typology of its material is quite evident.

References

Arimura, M., Balkan-Atlı, N., Borell, F., Cruells, W., Duru, G., Erım-Özdoğan, A., Ibanez, J., Miyake, Y., Molist M. and Özbaşaran, M. (2000) A New Neolithic Settlement in the Urfa Region: Akarçay tepe, 1999. *Anatolia Antiqua* VIII, pp. 227–255.

Arutyunyan (Harutyunyan) A. (2008) Keramika poseleniya Aknashen (Ceramics of Aknashen Settlement). In: Avetisyan, P.S., Kalantaryan, A.A. and Badalyan, R.S. (eds.), *Hin Hayastani mshakuyty XIV, Nyuter Hanrapetakan gitakan nstashrjani nvirvats akademikos B.B. Piotrovsku ev H.M. Janpoladyani hishatakin* (Culture of Ancient Armenia, XIV, Materials of the Republican Conference dedicated to the memory of academician B.B. Piotrovskiy and H.M. Janpoladyan). Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 37–43 (in Russian).

Arutyunyan (Harutyunyan), A. and Mnatsakanyan, A. (2010) Petrograficheskoe izuchenie neolit-eneoliticheskoy keramiki Araratskoy ravnini (The Petrographic Research on the Neolithic-Chalcolithic Ceramics of the Ararat Plain. In: Avetisyan, P. and Petrosyan, A. (eds.), *Khaldyan zorutyamb... Hodvatsneri zhoghovatsu nvirvats Boris Piotrovsku 100-amyakin* (Through Haldi's Power... Studies in honour of the 100th anniversary of the birth of Boris Piotrovsky). Yerevan: National Academy of Sciences of the Republic of Armenia “Gitutyun” Publishing House, pp. 210–224 (in Russian).

Arutyunyan, (Harutyunyan) A. (2011) O nekotorikh rezul'tatakh izucheniya neolit-eneoliticheskoy keramiki Araratskoy ravnini (About Some Results of the Researches on the Neolithic-Chalcolithic Pottery of the Ararat Plain. In: Gambashidze, G. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza* (Archaeology, Ethnology and Folkloristic of the Caucasus). International Scientific Conference dedicated to the memory of famous Georgian scientist and public figure academician O. Lordkipanidze (1930-2002). Collection of abstracts of the reports. Tbilis-Gori-Batumii: "Meridianii" Publishing House (in Russian).

Badalyan, R., Lombard, P., Avetisyan, P., Chataigner, C., Chabot, J., Vila, E., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New data on the late prehistory of the Southern Caucasus. The excavations at Aratashen (Armenia): Preliminary report. In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe – IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris, pp. 37–61.

Badalyan, R., Harutyunyan, A., Chataigner, C., Le Mort, F., Chabot, J., Brochier, J., Balasescu, A., Radu, V. and Hovsepyan, R. (2010) The Settlement of Aknashen-Khatunarkh, a Neolithic site in the Ararat plain (Armenia): Excavation results 2004–2009. *TÜBA-AR* 13, pp. 185–218.

Caneva, I. (2011) Til Huzur-Yayvantepe. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Tigris basin*. Istanbul: Archaeology & Art Publication, pp. 173–184.

Erim-Özdoğan, A. (2011a) Sumaki Höyük. A New Neolithic Settlement in the Upper Tigris Basin. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Tigris basin.* Istanbul: Archaeology & Art Publication, pp. 19–60.

Erim-Özdoğan, A. (2011b) Çayönü. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Tigris basin.* Istanbul: Archaeology & Art Publication, pp. 185–269.

Glushkov, I. (1996) *Keramika kak arkheologicheskij istochnik* (Pottery as an Archaeological Source). Novosibirsk: IAE SD RAS (in Russian).

Hansen, S., Mirtskhulava, G., Bastert-Lamprichs, K., Benecke, N., Gatsov, I. and Nedelcheva, P. (2006) Aruchlo 2005–2006. Bericht über die Ausgrabungen in einem neolithischen Siedlungshügel. *Archäologische Mitteilungen aus Iran und Turan* 38, pp. 1–30.

Hansen, S., Mirtskhulava, G., Bastert-Lamprichs, K., Görsdorf, J., Neumann, D., Ullrich, M., Gatsov, I. and Nedelcheva, P. (2007) Aruchlo 2007. Bericht über die Ausgrabungen im neolithischen Siedlungshügel. *Archäologische Mitteilungen aus Iran und Turan* 39, pp. 1–34.

Kigurazde, T. (1976) *Aghmosavlet amierkavkasiis adresamitsatmokmedo kulturis periodizatsia (*The Periodization of the Early Farming Culture of the Western Transcaucasia). Tbilisi: "Metsniereba" Publishing House (in Georgian).

Lloyd, S., Safar, F. and Braidwood, R. (1945) Tell Hassuna Excavations by the Iraq Government Directorate General of Antiquities in 1943 and 1944. *Journal of Near Eastern Studies* 4 (4), pp. 255–289.

Miyake, Y. (2011) Salat Cami Yani. A Pottery Neolithic Site in the Tigris Valley. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Tigris basin.* Istanbul: Archaeology & Art Publication, pp. 129–149.

Munchayev, P. and Merpert, N. (1981) *Rannezemledel'cheskie poseleniya Severnoy Mesopotamii* (The Early Farming Settlements of the Northern Mesopotamia). Moscow: "Nauka" Publishing House (in Russian).

Nishiaki, Y. and Le Mière, M. (2005) The oldest Pottery Neolithic of Upper Mesopotamia: New Evidence from Tell Seker al-Aheimar, the Khabur, Northeast Syria. *Paléorient* 31/2, pp. 55–68.

Özbaşaran, M. and Duru, G. (2011) Akarçay Tepe, A PPNB and PN Settlement in Middle Euphrates - Urfa. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Euphrates basin.* Istanbul: Archaeology & Art Publication, pp. 165–202.

Rye, O. (1981) *Pottery technology: Principles and Reconstructions. Manuals on Archaeology 4*. Taraxacum & Washington.

Stein, G. (2009-2010) *Tell Zeidan annual report* (http://oi.uchicago.edu/pdf/09_10_Zeidan.pdf).

Tekin, H. (2011) Hakemi Use. A Newly Discovered Late Neolithic Site in Southeastern Anatolia. In: Özdoğan, M., Başgelen, N. and Kuniholm, P. (eds.), *The Neolithic in Turkey. New excavations & new research. The Tigris basin*. Istanbul: Archaeology & Art Publication, pp. 151–172.

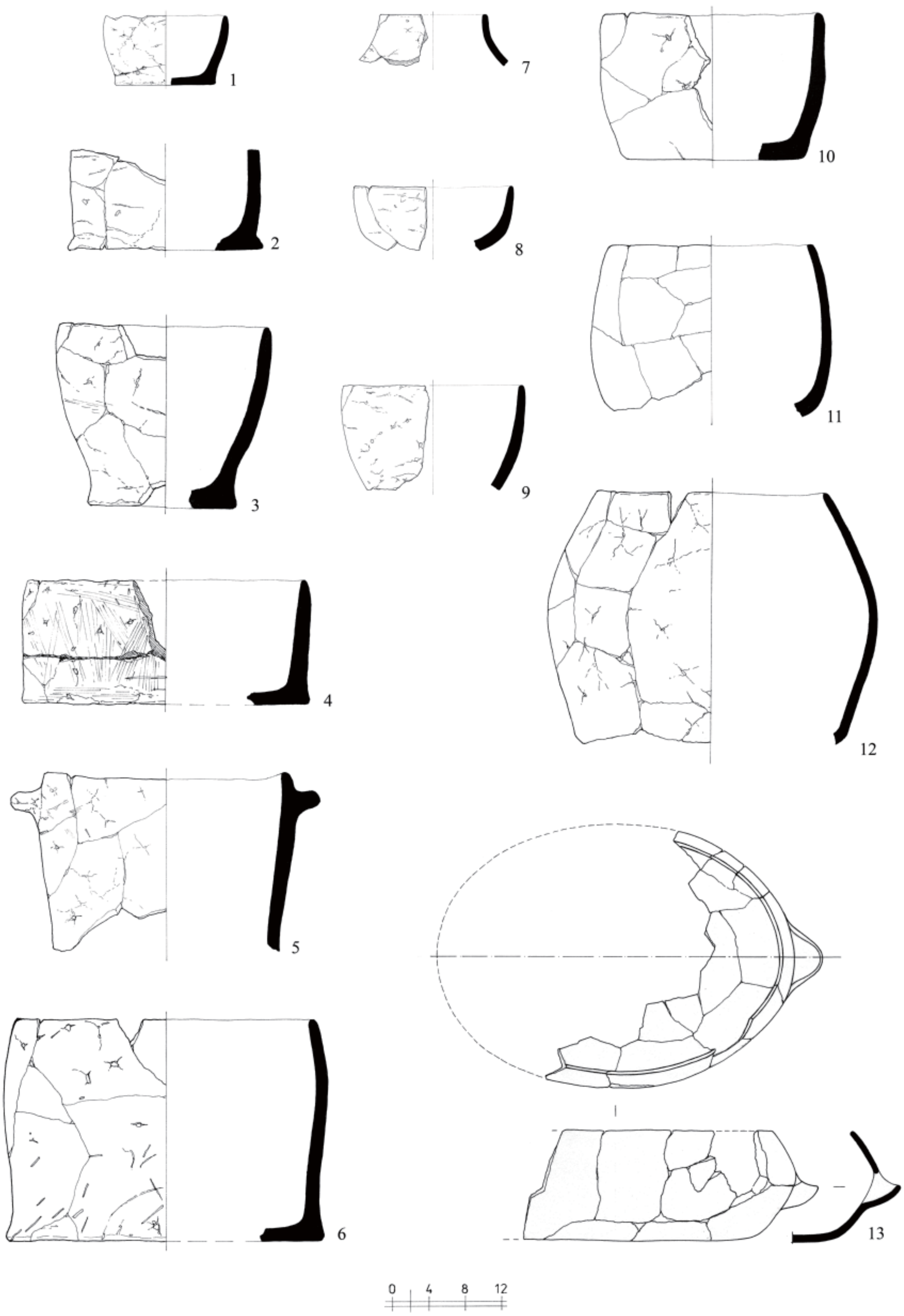
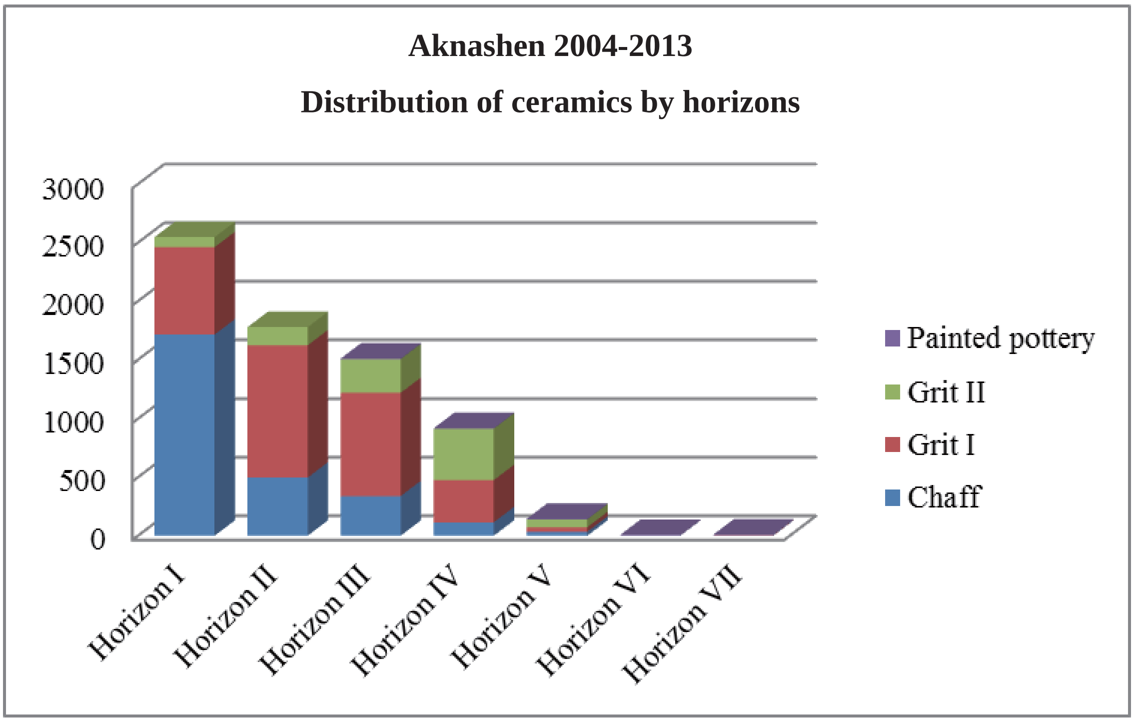


Figure 1
Aknashen settlement. The ceramics of the “Grit-tempered I” ware (1–6) and “Grit-tempered II” ware (7–13).

Table 1
A comparative table of color variations between the external and internal surfaces of “Grit-tempered II” and “Grit-tempered I” ceramics in Aknashen (using Munsell soil color charts 2000).

<table>
<tr><th colspan="2">Grit-tempered II</th><th colspan="2">Grit-tempered I</th></tr>
<tr><th>External surface</th><th>Internal surface</th><th>External surface</th><th>Internal surface</th></tr>
<tr><td rowspan="5">brown (7.5YR 5/2, 5/3, 5/4; 10YR 5/3)</td><td>brown (7.5YR 5/3)</td><td rowspan="5">brown (10YR 5/3)</td><td rowspan="5">light yellowish brown (10YR 6/4)</td></tr>
<tr><td>light reddish brown (5YR 6/4)</td></tr>
<tr><td>reddish yellow (5YR 6/6)</td></tr>
<tr><td>dark gray (10YR 4/1)</td></tr>
<tr><td>dark grayish brown (10YR 4/2)</td></tr>
<tr><td colspan="2" rowspan="3"></td><td>dark gray (2.5Y 4/1)</td><td>light brownish gray (2.5Y 6/2)</td></tr>
<tr><td>dark gray (Gray 1 4/N)</td><td>brown (7.5YR 5/3)</td></tr>
<tr><td>dark reddish gray (5YR 4/2)</td><td>reddish yellow (7.5YR 6/6)</td></tr>
<tr><td>dark grayish brown (10YR 4/2)</td><td>dark gray (10YR 4/1)</td><td colspan="2"></td></tr>
<tr><td rowspan="5">light brown (7.5YR 6/4, 6/6)</td><td>brown (10YR 5/3</td><td rowspan="3">light brown (7.5YR 6/4)</td><td rowspan="3">light brown (7.5YR 6/4)</td></tr>
<tr><td>light brown (7.5YR 6/4)</td></tr>
<tr><td>grayish brown (10YR 5/2)</td></tr>
<tr><td>light brownish gray (10YR 6/2)</td><td rowspan="2">light yellowish brown (10YR 6/4)</td><td rowspan="2">light yellowish brown (10YR 6/4)</td></tr>
<tr><td>dark gray (Gray 1 4/N)</td></tr>
<tr><td>pale brown (10YR 6/3)</td><td>dark gray (10YR 4/1)</td><td rowspan="3">pale brown (10YR 6/3)</td><td rowspan="3">light red (2.5YR 6/8)</td></tr>
<tr><td rowspan="2">pale brown (10YR 6/3)</td><td>dark gray (10YR 4/1)</td></tr>
<tr><td>gray (10YR 6/1)</td></tr>
<tr><td rowspan="2">pink (5YR 7/4) /</td><td>light red (2.5YR 6/6)</td><td colspan="2" rowspan="2"></td></tr>
<tr><td>gray(Gray 1 5/N)</td></tr>
<tr><td colspan="2"></td><td>light red (10R 6/6, 6/8; 2.5YR 6/6, 7/8)</td><td>light red (10R 6/6, 6/8; 2.5YR 6/6, 7/8)</td></tr>
<tr><td rowspan="3">reddish brown (5YR 5/3, 5/4)</td><td>grayish brown (10YR 5/2)</td><td rowspan="3">reddish brown (5YR 5/4)</td><td rowspan="3">yellowish red (5YR 5/6)</td></tr>
<tr><td>light reddish brown (5YR 6/4)</td></tr>
<tr><td>very pale brown (10YR 7/3)</td></tr>
<tr><td>reddish yellow (5YR 6/6)</td><td>yellowish red (5YR 5/6)</td><td>reddish yellow (5YR 6/6, 6/8)</td><td>reddish yellow (5YR 6/6, 6/8)</td></tr>
</table>



	Chaff	Grit I	Grit II	Painted pottery	Total
Horizon I	1714	746	86		**2546**
Horizon II	496	1126	155		**1777**
Horizon III	338	882	284	4	**1508**
Horizon IV	114	360	440	3	**917**
Horizon V	33	39	67	4	**143**
Horizon VI	1			5	**6**
Horizon VII	1	2		5	**8**
Total	**2697**	**3155**	**1032**	**21**	**6905**

Figure 2
Aknashen 2004–2013. The stratigraphic distribution of the pottery.

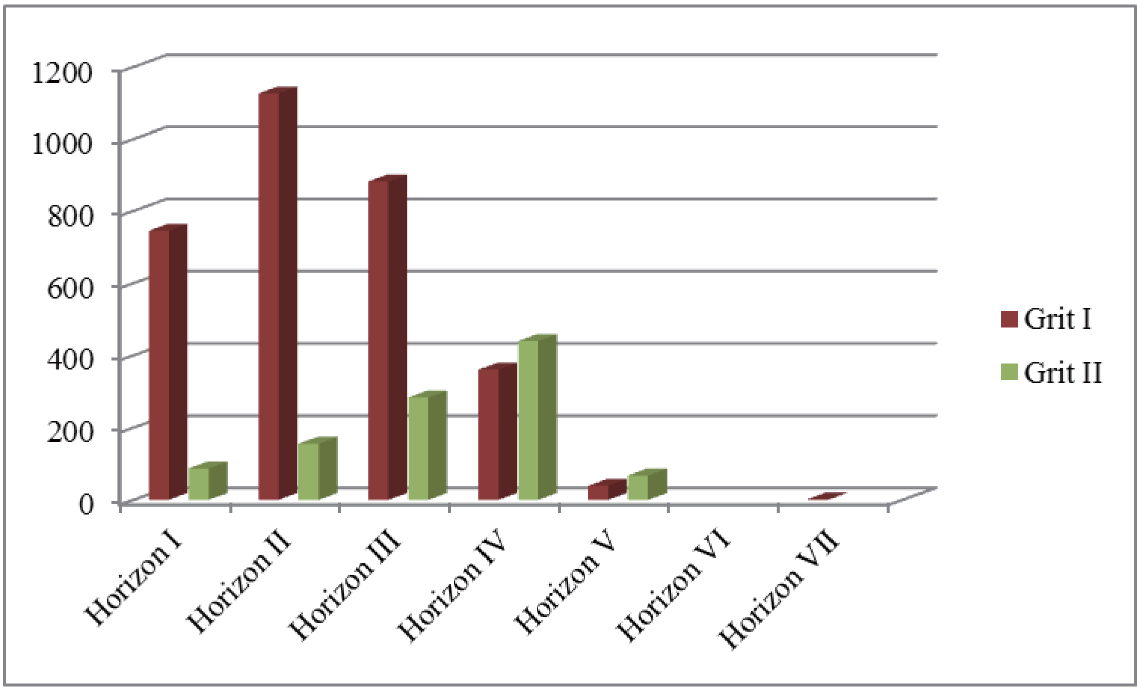


Figure 3

Proportion of the ceramics from the “Grit-tempered I” and “Grit-tempered II” groups.

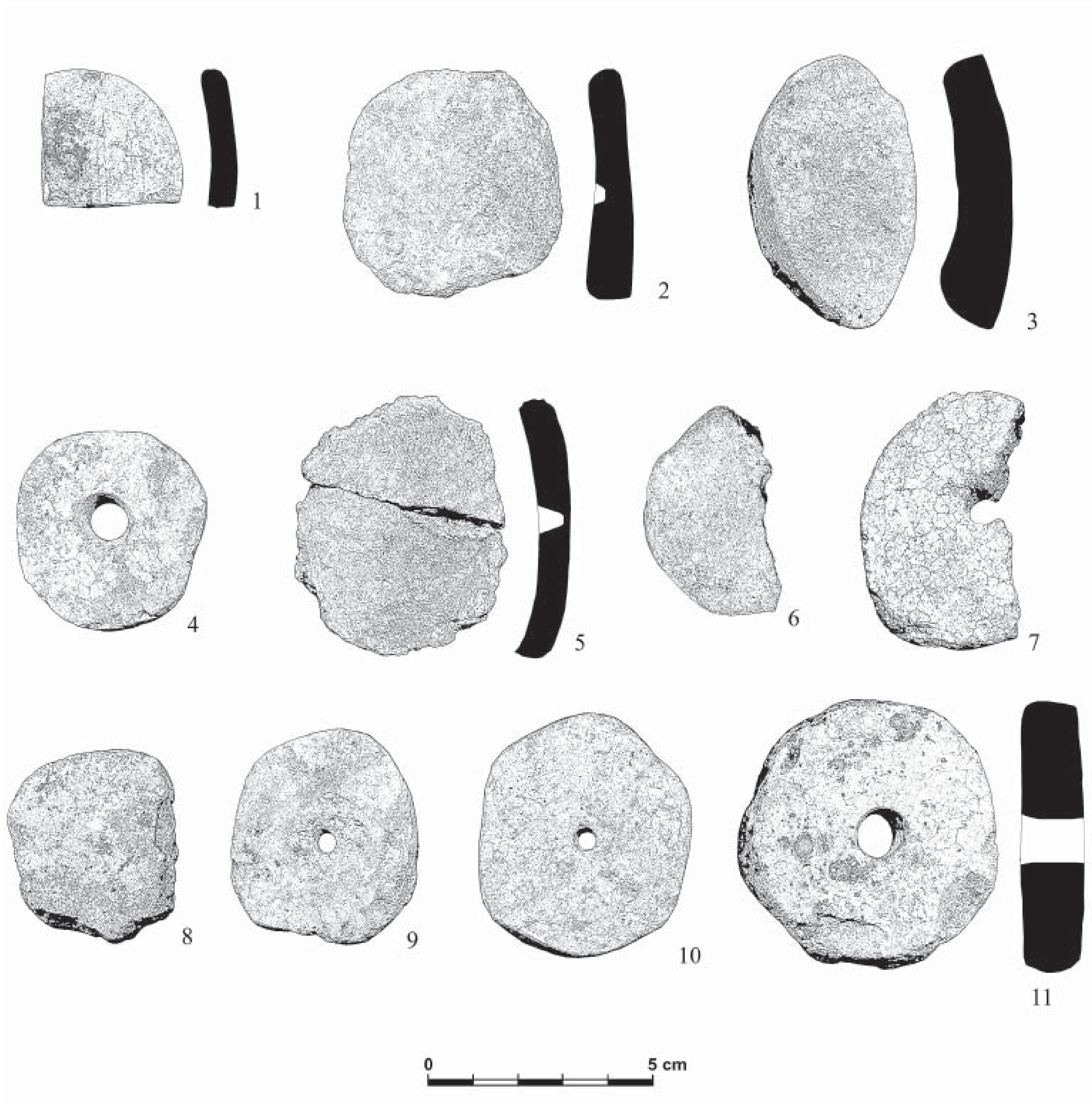


Figure 4
Aknashen settlement. Discs/spindle whorls (1, 2, 4–11) and polisher (3) made from the “Grit-tempered II” ware sherds.

Chalcolithic

About Some Types of Decorations on the Chalcolithic Pottery of the Southern Caucasus

Diana Zardaryan

1. Introduction

Society's transition from the nomadic lifestyle of hunters and gatherers to a sedentary way of life—which included the development of agriculture and cattle husbandry—required diverse, durable ware that could be produced quickly and easily. Together with the development of ceramic shapes, which varied according to their functional purposes, symbolic patterns were routinely used to decorate this pottery. These decorations symbolized a certain culture bearer's way of thinking, and served as an expression of his aesthetic interpretation of natural phenomena. The symbols also represented real objects, such as the objects of worship for example.

The methods used to apply these artistic treatments to ancient farmers' ceramics were quite variable. The pottery surface could be left untreated or slipped, burnished, painted, and otherwise decorated. All these various treatments were popular in the Neolithic-Chalcolithic period, but the most interesting and informative pottery is the painted and decorated ware. The painted pottery of the southern Caucasus could be monochrome, bichrome, and polychrome. It was mainly imported from the Near East, but there is also evidence of the existence of locally made painted ware.

The pottery decorations can be divided into the following groups, according to their techno-morphological characteristics:

Relief knobs and ellipsoids, ledges, buttons, rings, dots, horseshoe-like applications, ropes, strips, waves and zigzags, and anthropomorphic and zoomorphic applications were moulded from clay pieces, and then attached to the ware surfaces, or pulled out of it;

Impressed notches, nail impressions, oval imprints, round imprints, punctuated impressions, relief impressions, cord impressions, grain patterns, and pinched-out rims, etc. were made with fingers, or by using special tools, which were pressed into the wet surfaces;

Incised lines, waves, zigzags, and chevrons were designs made on damp surfaces with sharp objects;

Perforated openings were created by making through-holes and blind holes, and by pressing soft surfaces with an awl; and

Combed surfaceswere a specific decorative treatment made by smoothing a wet surface with a comb.

The rare or frequent usage of specific kinds of decorations depended on the particular period and traditions of the time and the functional peculiarities of the vessels bearing specific decorations were of great importance. Some types of decorations—the favourites of the early potters—were used for a relatively long time, compared with other decorations. Among these were relief knobs and ellipsoids, anthropomorphic applications, impressed notches, and perforations.

2. A comparison of Late Chalcolithic pottery from the Areni-1 cave with pottery from other sites

Excavations of the Areni-1 cave provided the stratigraphic sequence of the three Late Chalcolithic Horizons, together with an enormous collection of ceramic material. With knowledge of the stratigraphy and contexts, it became possible to define the peculiarities of the pottery production of the Late Chalcolithic period, and a comparative analysis with the ceramics from other sites of the southern Caucasus allowed us to posit some general patterns of its development (particularly the decorations).

Among the Late Chalcolithic pottery from the Areni-1 cave, the decorated pottery is quite remarkable. It represents almost all the groups and kinds of decorations known to have been used in Neolithic-Chalcolithic pottery production. The most part of these were the **relief decorations** (36% of the general number). Moreover, the most commonly used were **relief knobs** and **ellipsoids** (57% of all relief decorations, and 20.4% of the general number of all the pottery decorations of Areni-1), which were located either below the rim, or on the shoulder of the vessel. On the pottery from Areni-1 these take conical, hemispherical, and oval shapes, and their diameters range from 4.0 to 0.7 cm. These shapes decorate vessels from the First, Second and Third Chalcolithic Horizons (Figure 1).

In the Third Horizon of Areni-1 (Late Chalcolithic I, 4,300–4,000 Cal BC), such decorations are found both on pithoi, or large storage vessels, and jars, on which the decorations are mostly located on the shoulders in the form of one, two, or more rows of knobs. One such fragment resembles the vessel from Ovçular Tepesi (Marro *et al*. 2011, p. 60, Photo 3).

The ellipsoid relief decorations appeared in the Second Horizon (Late Chalcolithic II, 4,000–3,800 Cal BC). These were attached to the rim vertically. The relief knobs were used mainly to decorate the rims, but sometimes they appeared on the shoulders, too. The number of decorations on the pottery varied from one to three. Morphologically, the vessels decorated with relief knobs/ellipsoids in this Horizon were high-necked jars, pithoi, bowls, and cauldrons. It is quite interesting to note that these decorations are very rare among the ceramics of the synchronous sites of Teghut, Leylatepe, and Böyük Kesik.

It is worth mentioning that the relief knobs and ellipsoids from the Second and the Third Horizons often create compositions with other kinds of decorations (outside and within the same category) (Figure 2: 3, 8). These can also be found on the painted vessels (Figure 2: 3, 9).

In the First Horizon (Late Chalcolithic III, 3,700–3,400 Cal BC) the relief knobs usually appeared on the Kura-Araxes-like vessels, reflecting the transition from the Late Chalcolithic to the Early Bronze Age, with one knob or double knobs placed below the rim of the jar, and on the shoulders of the bowls. The use of these decorations decreased slightly in this period, as they were mainly being replaced by ledge-rims. The same changes were observed on pottery from the synchronous sites of Nerkin Godedzor and Ahvesi Ghrer.

The appearance of relief knobs was first noticed on the ware of Umm Dabaghiyah (Mellaart 1975, p. 139, table 80), which is dated back to the beginning of the Pottery Neolithic or PNA (6,500–6,000 Cal BC). In the southern Caucasus, such decorations appeared in the "Aratashen-Shulaveri-Shomutepe" cultural tradition (6,000–5,200 Cal BC), localized below the rim, on the shoulder, or in the lower part of the storage vessels, and on smaller jars. Most often, the knobs were organized into groups and rows, and were sometimes surrounded by other varieties of relief decorations (relief stripes, horse-shoe like applications, rings, etc.). The relief knobs and ellipsoid applications are mostly known from the early agricultural settlements of the Shulaverisgora I-III, VI-IX, Imirisgora VII-I, Arukhlo-I, Khramis Didigora V-VII, Shomutepe (Chelidze and Gogelia 2004, p. 47, Fig. 3; p. 62, Plate VIII: 1-10; p. 63, Plate IX: 2, 7; p. 64, Plate X: 1, 3-4, 9; pp. 72-73, Plates XVIII-XIX; Hansen *et al.* 2007, S. 15, Abb.31, S.16, Abb. 35–37; Munchayev 1982, table XXXI: 3-4; table XXXIV: 1-3, 6; table XXXV: 5; table XXXVI: 6, 11; table XXXVII: 1-4, 6, 12; table XXXVII: 1, 22-23, 25-26, 28-31; table XXXIX: 1-2, 4, 6, 8, 10-12, 14, 18).

In the first phase of the Middle Chalcolithic period (4,800–4,500 Cal BC) the relief knobs and ellipsoids appeared on the pottery of Aknashen (I) (Harutyunyan 2008, table 1: 17, 20-21; table 2: 3-4, 7, 12-13, 18, 20), Kültepe I in Nakhijevan (Abibullayev 1982, table IX: 6, 8), and

Alikemektepesi (Makhmudov and Narimanov 1972, p. 481). During the second phase of this period (4,500–4,300 Cal BC), these decorations were being used on the vessels from Shengavit I (Munchayev 1982, table XLVII: 10), Adablur (Sardaryan 2004, pp. 152-153, table XXVIII: 1-3, table XXIX: 1, 3-4, 7). There also, as on the early pottery, the knobs were usually arranged in groups and located on the upper parts of the vessels, or sometimes decorate the whole body (like the pot from Damtsvari Gora) (Kiguradze and Sagona 2003, Fig. 3.12). During the Middle Chalcolithic, the relief decorations were typical of those on large storage vessels, cauldrons, and deep bowls.

It is noteworthy that these kinds of decorations derived from the Neolithic period and continued to exist up to the Early Bronze Age on the Kura-Araxes pottery. Here also these appear as one knob, or two or three adjacent knobs, on the deep bowls and large vessels (Badalyan and Avetisyan 2007, p. 248, Plate IV: 13; p. 269, Plate V: 2, 7; Sagona 1984, Fig. 4: 5, Fig. 19: 2, Fig. 25: 7-8, Fig. 37: 2).

Anthropomorphic applications, best known from the ceramic material in the earliest sites, are also evident in the Late Chalcolithic layers of the Areni-1 cave. However, here it is present on just one fragment from a large, brown, thick-walled storage vessel from the Third Horizon (Figure 2: 12). The application depicts a human as a five-pointed figure (length from head to toes is 11 cm, the distance from one hand to the other is 10 cm). As already mentioned, anthropomorphic applications are typical for relatively early periods, particularly in the “Aratashen-Shulaveri-Shomutepe” culture. Some of the vessels from Imirisgora, Khramis Didigora, Arukhlo I, Shomutepe decorated with anthropomorphic applications are similar to those from Umm Dabaghiyah and Tell Sotto, although morphologically this ware is different (Akhundov 2012, p. 340, table 174; Chelidze and Gogelia 2004, p. 65, Plate XI: 1-5; Munchayev 1982, p. 113, table XXXIX: 16). Potsherds with anthropomorphic decorations of the Middle Chalcolithic period, apparently, have not been recorded yet.

At the site of Ovçular Tepesi (located not far from Areni-1), synchronous with the Third Horizon of the Areni-1 cave, the vessels with zoomorphic applications (Marro *et al*. 2011, p. 60, Photo 4; p. 62, Photo 5) were found, but no anthropomorphic ones. An anthropomorphic application depicting a man was found on a large vessel from the site of Abdal Aziztepe (Aliyev and Narimanov 2001, pp. 65, 122, table XIX). All these kinds of decorations are found on grain storage vessels. Most likely, the anthropomorphic applications on the ceramics could play the role of the anthropomorphic figurines, and could “protect” the contents of the “special” pots.

Impressed decorations were another popular artistic treatment used by the early potters (27%). **Impressed notches** and **grooves** carved on rims were the second most prevalent embellishment used (15% of all the varieties of the decorations) and it is found on pottery from three studied horizons of Areni-1 (Figure 3). In the Third Horizon, fine or deep notches covered the rims of jars, and grooves were etched on the edges of braziers, cauldrons, and bowls. In the Second Horizon fine notches adorned the thin rims of high-necked jars, and the braziers were decorated with either notches or grooves. Rows of notches on the vessels were applied to the rims obliquely or perpendicularly, and sometimes those orientations changed.

In the First Horizon, oblique notches decorated the rims of the horned brazier (Figure 3: 1). Besides the notches, this brazier exhibits other kinds of decoration such as round impressions and through-holes. The impressed grooves in this horizon decorated the rims of storage vessels.

The first notches appeared on pithoi from sites of the "Aratashen-Shulaveri-Shomutepe" tradition, and look like deep grooves—turning the rim into a toothed edge. This kind of decoration continued to exist until the final phase of the Late Chalcolithic period, appearing as either fine notches or wide grooves. Among the sites where the impressed decorations were present are Shulaverisgora (II), Chalagantepe, Kechili, Alikemektepesi, Tsopi, Samele Klde, Sioni, Aratashen Horizon 0, Ovçular Tepesi, Böyük Kesik, Leylatepe, Samertskhle Klde (Bakhshaliyev *et al.* 2010, table XVII; Kiguradze and Sagona 2003, pp. 51-53, Fig. 3.6: 1, 7-8; Fig. 3.7: 1, 3-5, 13; Fig. 3.8: 1-4; Kushnareva and Chubinishvili 1970, pp. 31-32, ill. 9: 18; pp. 46-47, ill. 18: 21; Museyibli 2007, table XIX, 3; Narimanov 1987, p. 231, ill. 3: 2, 10; p. 242, ill. 46; Narimanov *et al.* 2007, ill. V, 1-2, 9; Palumbi 2007, pp. 66, 68-69, Fig. 3, ill. 5; Munchayev 1982, p. 149, table XXXVII: 7-9), etc.

Perforations were among the most frequently used pottery decorations of the Neolithic-Chalcolithic period (15%). Impressing the wet surface with an awl created a horizontal row of holes. This kind of decoration is seen mostly on pottery from the Third and Second Horizons in Areni-1 (Figure 4). These decorations are quite famous for their use on ceramic material from the Middle and Late Chalcolithic sites, and can be seen mainly on braziers with undercut bases and flared sides, or on those with rounded bases and straight walls.

Some researchers consider that the perforated braziers from southern Caucasus sites were used as strainers or funnels, and, according to them, the holes had a functional purpose. This suggestion originates from early publications concerning perforated pottery from Mesopotamia. So, the earliest ceramics with perforations appear in the Hassuna and Halaf cultures (6,200–5,100 Cal BC), and among the material from Tell Hassuna and Tepe Gaura, where it's presented both on real strainers with perforated bodies and bases, and bowls with some perforations below the rim (Perkins 1949, pp. 2, 51, 167). These vessels, or strainers, were used for processing milk and making cheese

(Salque *et al.* 2012).

Concerning the perforated pottery from the southern Caucasus, this point of view seems acceptable for the vessels bearing numerous perforations all over their bodies and/or bases, as are those from Ilanlitepe, Böyük Kesik and Didube (Kiguradze and Sagona 2003, Fig. 3.18: 3, 6-7; Museyibli 2007, table XXII: 16; Narimanov 1987, p. 238, ill. 42). As for the ware with perforations below the rim, these seem to be decorated pottery and could not be used as strainers. Moreover, there are examples that confirm this point of view, among the ceramic material from the Third and the Second Horizons of Areni-1.

Along with perforated pottery with through-holes (Figure 4: 1-4), there is also a collection of ceramics decorated by “incompletely perforated”, or blind holes (Figure 4: 5, 10, 11). The latter are used to decorate either the external or the internal surfaces. Also worth mentioning are the high-necked jars decorated with a row of perforations below the rim. With regard to the pottery from Areni-1 that has been described, its morphological features prohibit its use as strainers, since the perforations have no capacity for filtration.

In the First Horizon, the perforated decorations appear only on braziers, and only in the form of through-holes. Sometimes these are accompanied by other decorations (Figure 3: 1).

The pottery with perforated decorations from Areni-1 finds its parallels among the ceramic materials of Aratashen, Aknashen, Kechili, Mashtotsblur, Terteri Dzor, Adablur, Tsopi, Ovçular Tepesi, Teghut, Böyük Kesik, Khizanaatgora (Harutyunyan 2008, table II: 14-16, 21; Kiguradze and Sagona 2003, Fig. 3.21: 3; Kushnareva and Chubinishvili 1970, p. 32; Museyibli 2007, table XVIII: 9, table XXII: 13, table XXIII: 2, 5, 8, 9; Narimanov 1987, p. 231, ill. 3: 1, 11; Torosyan 1976, p. 77, ill. 14; p. 82, table V: 4; Palumbi 2007, pp. 70-71, plate 2, ill. 7; plate 3, ill. 1-3; Sardaryan 2001, p. 152, table XXVIII: 5-7; p. 153, table XXIX: 2, 6, 8; Munchayev 1982, table XLVII: 1-2), etc.

Thus, among the wide assortment of pottery decorations found—anthropomorphic applications, impressed notches and grooves, and perforated decorative treatments—were those most used by the Neolithic-Chalcolithic population of the Near East and the southern Caucasus. Possibly, each of these types of decorations had a symbolic meaning and was applied by the early potters for a specific purpose.

Unfortunately, to date there has been no special study devoted to solving the problem of the decorated pottery of the Neolithic-Chalcolithic period of the southern Caucasus. Descriptions of this ware are only mentioned briefly in publications. In our opinion, this subject deserves more attention, including a study of the typology, technical and technological features of the ceramics.

Knowing the significance of the various applications of certain types of decorations on certain types of ware, made for certain purposes, could help us understand the development of cultural and spiritual specificities among early societies.

References

Abibullayev, O. (1982) *Eneolit i bronza na territorii Nakhichevanskoy ASSR* (Enaeolithic Period and Bronze Age on the Territory of Nakhichevan SSRA). Baku: "Elm" Publishing House (in Russian).

Akhundov, T.I. (2012) *U istokov kavkazskoy tzivilizatzii. Neolit Azerbaijana. Kniga pervaya. Shomutepe* (At the Origins of the Caucasian Civilization. Neolithic Period of Azerbaijan. Book One. Shomutepe). Baku: "Elm" Publishing House (in Russian).

Aliyev, N., Narimanov, I. (2001) *Kul'tura severnogo Azerbaijana v epokhu pozdnego eneolita* (The Culture of the Northern Azerbaijan in the Late Chalcolithic Period). Baku: "Elm" Publishing House (in Russian).

Badalyan, R. and Avetisyan, P. (2007) *Bronze and Early Iron Age Archaeological Sites in Armenia – I. Mt. Aragats and its Surrounding Region*. BAR international series 1697. Oxford.

Bakhshaliyev, V., Marro, C. and Ashurov, S. (2010) Ovçulartəpəsi (2006–2008-ci il tədqiqatlarının ilk nəticələri) (Ovçulartepesi. First Preliminary report: the 2006-2008 seasons). Baku: "Elm" Publishing House (in Azeri, Russian and English).

Chelidze, I. and Gogelia, D. (2004) Arukhlo I: An Early Farming Site. *Journal of Georgian Archaeology* 1, pp. 46–92.

Hansen, S., Mirtskhulava, G., Bastert-Lamprichs, K., Gatsov, I., Nedelcheva, P., Neumann, D. and Ullrich, M. (2007) Aruchlo 2007. Berichtüber die Ausgrabungen in einem neolithischen Siedlungshügel. *Archäologische Mitteilungen aus Iran und Turan* 39, pp. 1–30.

Harutyunyan, A. (2008) Keramika poseleniya Aknashen (Ceramics of Aknashen Settlement). In: Avetisyan, P.S., Kalantaryan, A.A. and Badalyan, R.S. (eds.), *Hin Hayastani mshakuyty XIV, Nyuter Hanrapetakan gitakan nstashrjani nvirvats akademikos B.B. Piotrovsku ev H.M. Janpoladyani hishatakin* (Culture of Ancient Armenia, XIV, Materials of the Republican Conference dedicated to the memory of academician B.B. Piotrovskiy and H.M. Janpoladyan). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 37–43 (in Russian).

Kiguradze, T. and Sagona, A. (2003) On the Origins of the Kura-Araxes Cultural Complex. In: Adam, T.S. and Runbinson, K.S. (eds.), *Archaeology in the Borderlands. Investigations in Transcaucasia and Beyond*. Los Angeles: Cotsen Institute of Archaeology, University of California, pp. 38–94.

Kushnareva, K.Kh. and Chubinishvili, T.N. (1970) *Drevniye kul'turi Yuzhnogo Kavkaza (V – III tis. do n.e.)* (AncientCultures of Southern Caucasus [V – III mill. BC]). Leningrad: "Nauka" Publishing House, Leningrad Branch (in Russian with English Resume).

Marro, C., Bakhshaliyev, V. and Ashurov, S. (2011) Excavations at Ovçular Tepesi (Nakhchivan, Azerbaijan). Second Preliminary Report: The 2009–2010 seasons. *Anatolia Antiqua* XIX, pp. 53–100.

Makhmudov, F.R. and Narimanov, I.G. (1972) O raskopkakh na poselenii Alikemek-tepesi (About the Excavations at Alikemek-tepesi settlement). In: Ribakov, B.A. (ed.), *Arkheologicheskie Otkritiya 1971 goda* (Archaeological Discoveries for year 1971). Moscow: "Nauka" Publishing House, pp. 480–481 (in Russian).

Mellaart, J. (1975) *The Neolithic of the Near East*. New York: Scribner's.

Munchayev, R.M. (1982) Eneolit Kavkaza (Eneolithic of Caucasus). In: Masson, V.M. and Merpert, N.Ya. (eds.), *Eneolit SSSR* (Eneolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 100–164 (in Russian).

Museyibli, N.A. (2007) *Böyük Kesik. Eneolit Dövrü Yaşayış Məskəni* (Chalcolithic settlement Beyuk Kesik). Baku: "Nafta Press" Publishing House (in Azeri, Russian and English).

Narimanov, I. (1987) *Kul'tura drevneishego zemledel'chesko-skotovodcheskogo naseleniya Azerbaijana (Eneolit. VI–IV tis. do n.e.)* (The Culture of the Ancient Farming Population of Azerbaijan [the Chalcolithic Period. VI-IV millennia BC]). Baku: "Elm" Publishing House (in Russian).

Narimanov, I.G., Akhundov, T.I. and Aliyev, N.G. (2007) *Leylatepe*. Baku: "Elm" Publishing House (in Russian).

Palumbi, G. (2007) Upper-Mesopotamia and Transcaucasia in the Late Chalcolithic Period (4000–3500 BC). In: Lyonnet, B. (ed.), *Les Cultures du Caucase (VIe - IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris: CNRS Editions, pp. 63–76.

Perkins, A.L. (1949) *The Comparative Archaeology of the Early Mesopotamia*. Studies in Ancient Civilizations, Number 25. Chicago: The University of Chicago Press.

Sagona, A. (1984) *The Caucasian Region in the Early Bronze Age*. BAR international series 214. Oxford.

Salque, M., Bogucki, P., Pyzel, J., Sobkowiak-Tabaka, I., Grygiel, R., Szmyt, M. and Evershed, R. (2012) Earliest evidence for cheese making in the sixth millennium BC in northern Europe. *Nature* (doi:10.1038/nature11698).

Sardaryan, S. (2004) *Hayastany kaghakakrtutyan orran* (Armenia−the Cradle of Civilization), Yerevan: Yerevan State University Press (in Armenian).

Torosyan, R.M. (1976) *Teghuti vagh erkragortsakan bnakavairy (m.t.a. IV hazaramyak)* (The Early Farming Settlement of Teghut [IV Millennium BC]). Hnagitakan peghumnery Hayastanum (Archaeological excavations in Armenia) N14. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian with Russian Resume).

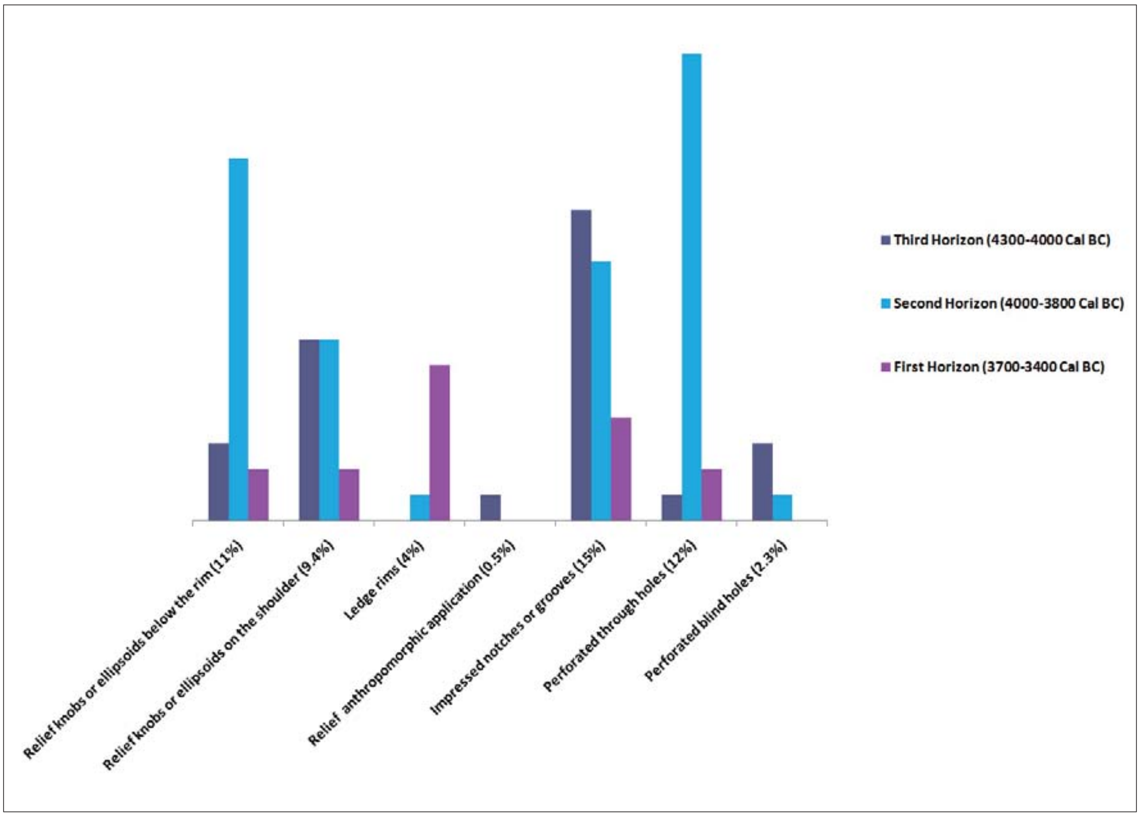


Figure 1
The quantitative comparison of the relief, impressed and perforated decorations of the pottery from three Late Chalcolithic Horizons of Areni-1 cave.

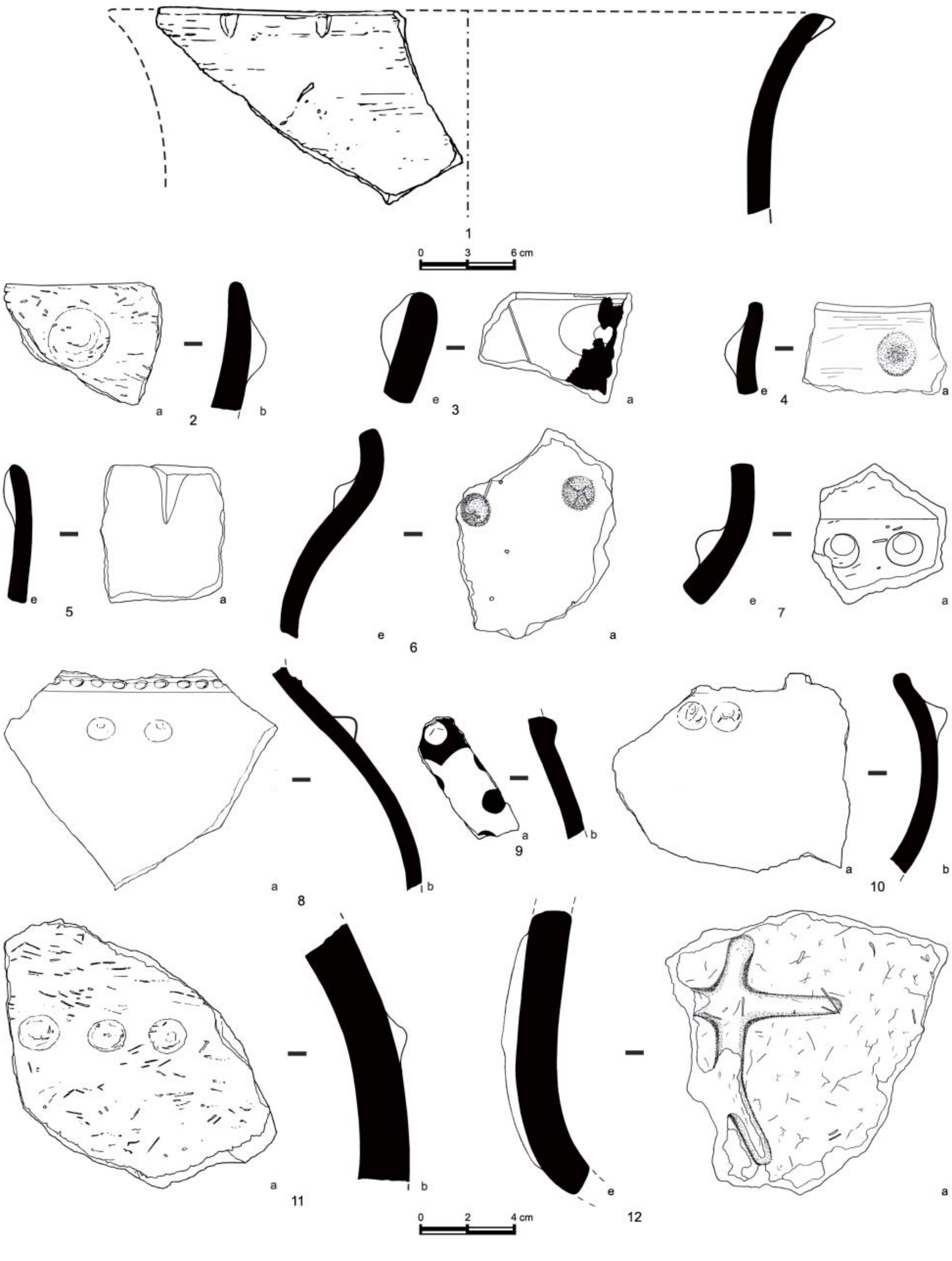


Figure 2
Relief decorations.
1-5. Knobs/ellipsoids below the rim; 6-1. Knobs/ellipsoids on the shoulder; 12. Anthropomorphic application (10: Horizon I; 1, 4-6, 9: Horizon II; 2-3, 7-8, 11-12: Horizon III).

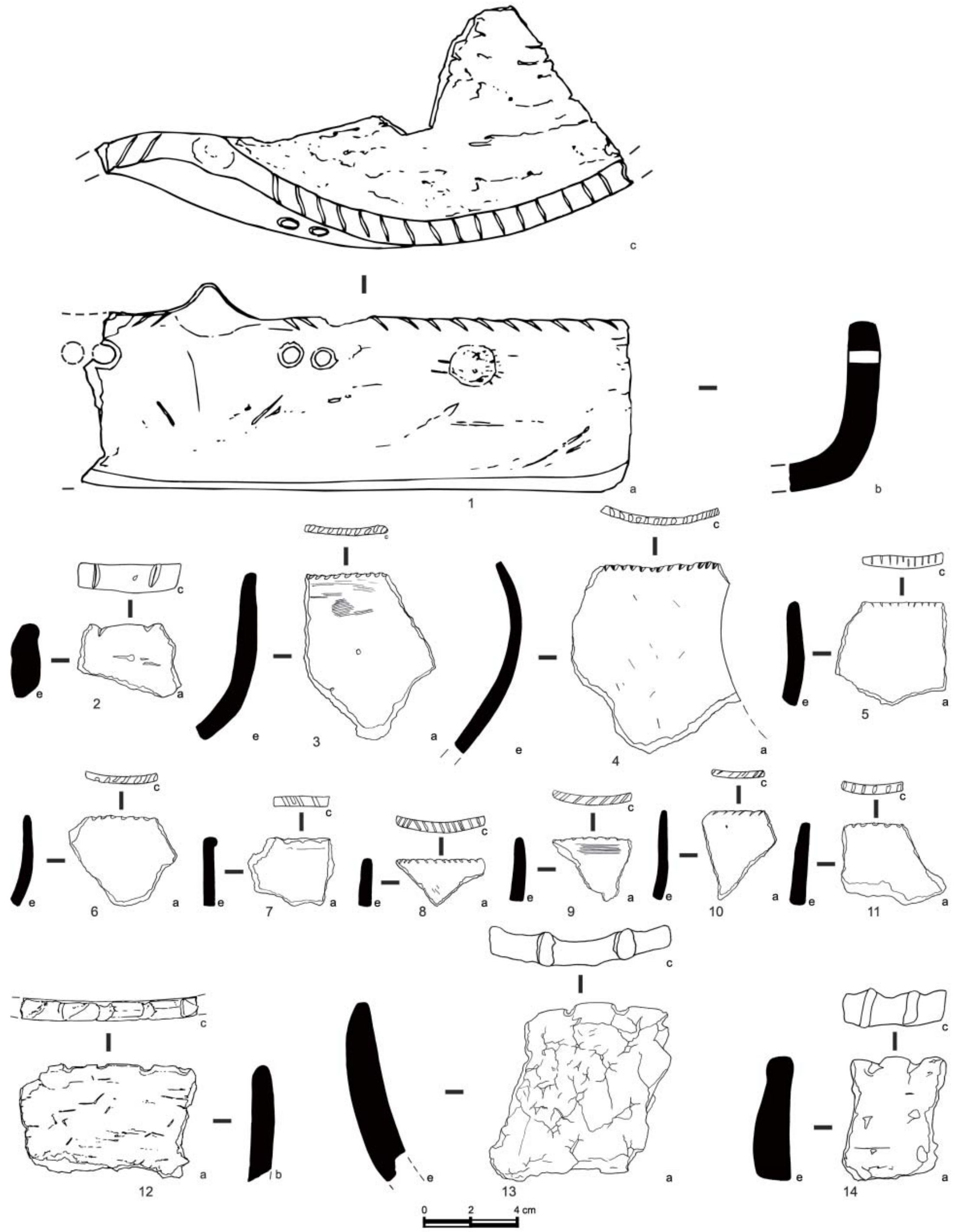


Figure 3

Impressed decorations. Notches and grooves.

1. Horned brazier with notches, perforated and impressed decorations.

(1, 12: Horizon I; 2, 5-6, 10: Horizon II; 3-4, 7-9, 11, 13-14: Horizon III).

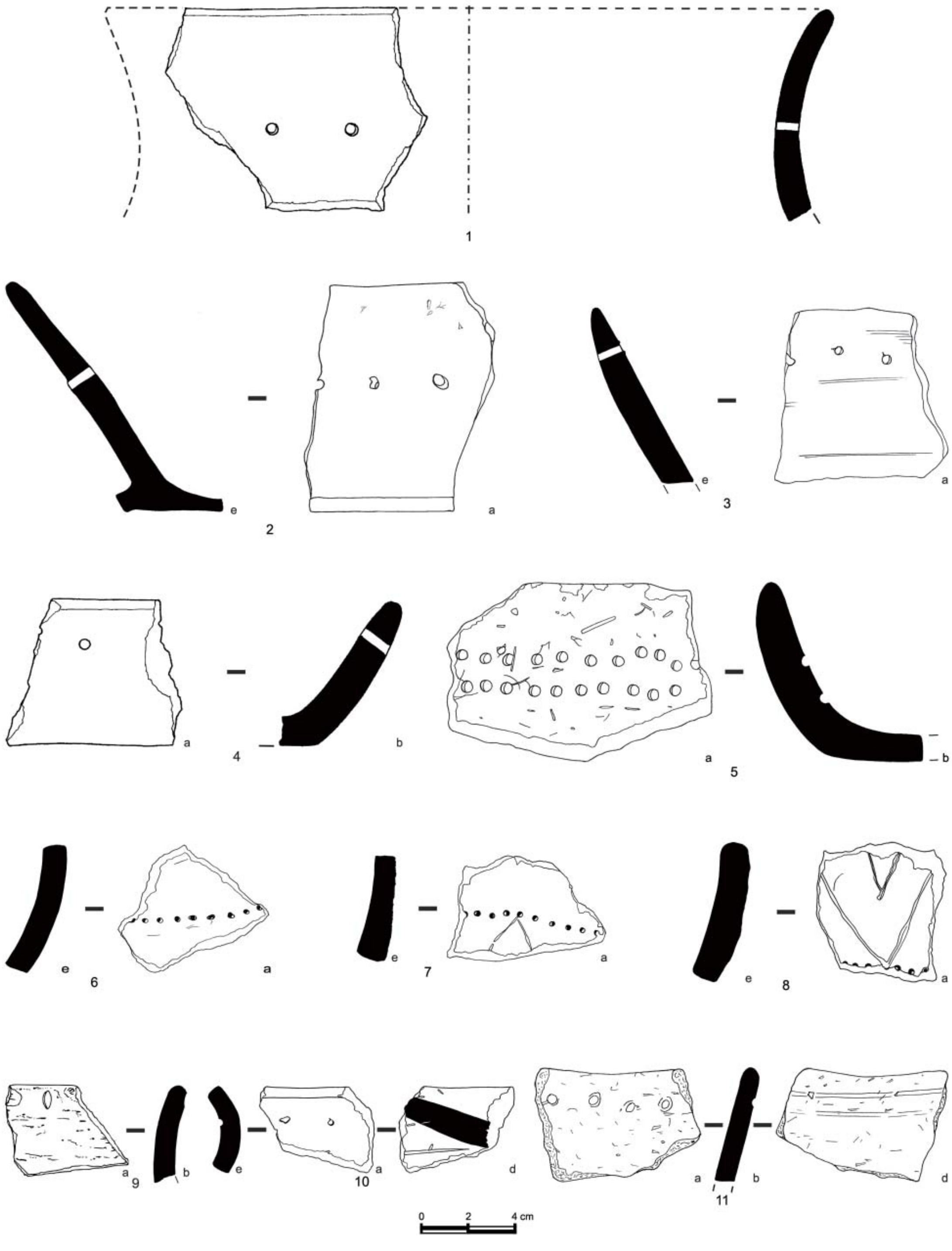


Figure 4

Perforated and impressed decorations.

1-4. Through-holes; 5, 10-11. Blind holes; 6-8. Punctuated decorations; 9. Grain pattern.

(1-4, 6-9: Horizon II; 5, 10-11: Horizon III).

Weaving the Ancient Past: Chalcolithic Basket and Textile Technology at the Areni-1 Cave, Armenia

Lyssa Stapleton, Lusine Margaryan, Gregory E. Areshian, Ron Pinhasi and Boris Gasparyan

1. Introduction

Before our ancestors began to fire pottery or smelt metals, they made hats, garments, containers, bags, floor coverings and clothing by twisting and weaving plant and animal fiber. Due to the poor preservation of organic material in most archaeological sites, archaeologists rarely have the opportunity to study both the tools used for weaving and the woven material itself. Areni-1 cave in the Arpa River Valley (southern Armenia) has a unique microclimate which facilitated the desiccation of organic remains including fragments of baskets and textiles.

Six trenches are currently being excavated at Areni-1. Trenches 1, 2 and 3 have produced woven material dating to the Late Chalcolithic sequence. Trench 1 is located in the main or first gallery inside the cave and contains artifacts and features that are clearly related to funerary ritual including human remains and wine making paraphernalia dating to 4,000–3,800 Cal BC (Barnard *et al.* 2011; Areshian *et al.* 2012; Wilkinson *et al*. 2012). Trench 2 is adjacent to Trench 1 and has produced pots containing cremations, as well as isolated human remains recovered from loci between the pots. Trench 3 is located outside the cave and the main entrance to the first gallery, under the overhang of the cave. This trench has Medieval dwellings cutting into at least three Late Chalcolithic occupational phases designated as Chalcolithic Horizons I – III (4,300–3,400 Cal BC). Of the three horizons, the first tends to be most truncated; it is present only within the limits of Trench 3 and was damaged by an Early Medieval (7th–9th centuries) house or hut and by High Medieval (11th–13th centuries) storage pits and ovens. Horizon I is represented by strengthened and repeatedly rebuilt dirt floors with household pits and jar burials under them and dates to the final phase of the Late Chalcolithic (3,700–3,400 Cal BC). Chalcolithic Horizon II occupies a more extensive area. It begins in Trench 3, outside the entrance to the first gallery. Horizon II underlies Horizon I but is separated from it by a layer of zoogenic humus (dung). It extends into the cave, to the rear part of the first gallery and across to the limits of Trenches 1 and 2. In Trench 3 Horizon II is also characterized by strengthened and repeatedly finished floors and includes wooden constructs or buildings and large, unfired bins. A set of radiocarbon dates from Horizon II provides an absolute time range between 4,000–3,800 Cal BC, which places it in the middle phase of the Late Chalcolithic. The third Chalcolithic Horizon encompasses a rather small area and appears in multiple locales underlying Horizon II in Trench 3 and also inside the first gallery, within the limits of Trenches 1 and 2. Traces of plastered floors and partially destroyed stone constructs (damaged by intrusive bins dug during the time of occupation of Horizon II) are recorded in Trench 3. Radiocarbon dates for this Horizon range between 4,300–4,000 Cal BC placing them in the early phase of the Late Chalcolithic.

2. The anatomy of a woven artifact

Baskets and textiles are both the result of the intentional weaving of fibers. The terms “basket” and “textile” are often definitionally separated, perhaps somewhat arbitrarily, by both end-use and construction technique. Baskets generally serve as vessels or other containers or as mats for sitting and sleeping, floor coverings, in the construction of mud-brick architecture, and as burial shrouds and grave liners. Textiles, which are made from softer and more pliable fibers, are used for clothing, bed linens, and to create soft bags or other containers that need to have more flexibility than a basket. A large variety of fibers are used in weaving textiles and baskets including bast fibers from plants and trees as well as hair and wool. Textile fibers generally receive more pre-treatment than the fibers used in basket making. These pre-treatments can include splitting, peeling, retting, combing, and spinning and weaving on a loom or other device (see Adovasio 1977, p. 1; Barber 1992, p. 5; Seiler-Baldinger 1994, pp. 5-47). Looms are necessary for the creation of most textiles simply because spun fibers are so pliable, the loom gives them the tension required for weaving. However, there are textiles that are not loom woven, these techniques include interlacing to create a mesh by looping with fingers or needles (crochet, lace-making, knotting, knitting and macramé) (Emery 2009, pp. 59-69; Seiler-Baldinger 1994, pp. 5-25) or construction with the aid of other tools such as the kumihimo and weaving with tablets or cards (Barber 1991, p. 118; Knudsen 2012, p. 254). Looms, like the textiles created on them, rarely survive in the archaeological record.

Archaeologists are therefore often forced to use related rather than direct evidence to discuss ancient textile technology. Common artifacts related to the process of textile construction are spindle whorls, loom weights, and needles. Even without the actual textiles, these objects inform archaeologists about ancient weaving technology: spindle whorls allow researchers to calculate the weight and tension of spun fibers; a smaller whorl will spin faster and create a tighter thread (Barber 1991, p. 53; Grömer 2012, p. 41). The shape of a whorl can indicate whether it was placed at the top or bottom of the spindle (high whorl or low whorl) and this, in turn, may indicate the type of fiber being spun: high whorl spindles are better for producing an "S" twist and are therefore more suitable for linen. The size and weight of a spindle whorl affects the thickness and tension of the spun thread just as the weight of a loom weight affects the tension of the warp fibers of the textile. Loom weights help us to understand the size and construction of looms (Barber 1991, pp. 93-113). It should be noted that weights are not in all cases evidence for loom weaving: they can be used as fishnet weights, to hold down roof thatching, to tie bags, or as weights for devices like the kumihimo (Barber 1991, p. 97; Gleba and Mannering 2012, p. 15; Knudsen 2012, p. 254). Artifacts like needles and awls can also be an indicator that weaving activities were taking place.

When woven artifacts or evidence for them (i.e. impressions in clay or pseudomorphs in corroded metal) are discovered in an archaeological context, fiber identification can be aided by determining the direction of spin: linen has a preferential spin in an "S" (or \) direction and Elizabeth Wayland Barber contends that cotton and hemp tend spin in the opposite, "Z" (or /) direction (1991, p. 66). If these fibers are spun in opposition to their natural inclination, the resulting thread is likely to unravel. Using fibers spun in opposite directions for the warp and weft will create a tightly woven textile due to the opposing tension on the two axes.

3. Identifying textile technology at Areni-1

The Chalcolithic textile (001.2010.013) (Figure 1) found at Areni-1 cave was certainly loom woven, probably on a warp-weighted loom (Figure 2) though a horizontal ground loom or even a waist or band loom could also have been used. The existence of a starter or header row (Figures 1 and 3), however, makes the use of a warp-weighted loom most likely (Burnham 1965, p. 173; Barber 1991, p. 99; Grömer 2012, p. 41).

This textile fragment (Figure 1) is woven of spun linen (*Linum usitatissimum*), was excavated in Trench 1 and belongs to Horizon II and dates to 3,950–3,790 Cal BC (2 sigma range)[1].

1. UCIAMS-96016, 5065±15 BP.

Linen is the most common fiber used to make textiles until the development of wool bearing sheep around the third millennium BC (Good 1998, p. 40; Shishlina *et al*. 2003). Both the warp and weft fibers of 001.2010.013 are spun in an “S” direction. They are tightly spun to a 45–55° angle of twist for the warp and 45–47° for the weft. The textile is woven in a plain (or tabby) weave: a simple “one over, one under” technique. The notation for this weave is 1/1, indicating how many warp threads the weft passes over to create the pattern. The process of passing the weft thread around the outermost warps on each pass secures the edges of a loom woven textile; this edge is called the selvage. Neither selvage edge is intact on 001.20120.013 but a basket weave header, consisting of one warp thread crossed by two weft threads, is intact as is the fringe created by knots that tied off the warps when the textile was removed from the loom (Figure 1).

No looms or fragments of looms have been found at Areni-1. This is not entirely surprising considering the ritual nature of most of the Chalcolithic remains; weaving is an activity that typically takes place in a domestic setting. Weights however, have been found in abundance. The majority of these were excavated in Trench 3. Twelve of the forty-four cylindrical clay weights as well as two of three very large clay weights are all from the same excavation unit and date to Chalcolithic Horizon I. Meanwhile, the entire single textile fragment as well as the basketry fragments belong to Horizons II and III.

The quality of a loom woven textile is dependent of the skill of the person who spun the thread, the skill of the weaver, and the proportions and construction of the loom. Loom weights can be made from any convenient material that can be perforated or incised so that it can be suspended from the warp thread: fired clay, stone, or even wood (Figures 2 and 4). Only six of the fifty weights from Areni-1 are immediately recognizable as loom weights. These include three small stone weights (Figure 5: 1-3) and three very large and heavy clay weights (Figure 5: 4-6). The other forty-four are made of fired clay and are long and cylindrical in shape (Figure 6). These weights are unusually small and light for a warp-weighted loom, but are similar to cylindrical clay weights found at the Bronze Age Greek site of Sitagroi (Elster 2003, p. 241) and at Neolithic sites in Poland (Barber 1991, pp. 99-100). There is, in fact, a direct relationship between the diameter of the warp thread and the weight of the loom weight. Together, they decide the tension of the woven textile and thread: a larger diameter thread requires a heavier loom weight. According to Anderson Strand and Nosch (forthcoming), a thread of ≤0.3 mm requires c. 10 g in warp tension, a 0.3–0.4 mm thread requires c. 15–20 g of tension, a 0.4-0.6 mm thread requires c. 25–30 g of tension and 0.8–1.0 mm thread requires c. 40 g of warp tension (also see Mårtensson *et al*. 2009, p. 378; Baxter *et al*. 2010).

The cylindrical clay weights from Areni-1 weigh between 6 and 10 grams[2] and measure between 4.5 and 6 cm long and are 1 to 1.5 cm in diameter. The three ovoid stone weights (Figure 5: 1-3) with an incised depression for attaching the warp weigh between 26 and 32 grams and the three large clay weights (Figure 5: 4-6) weigh between 1 and 1.5 kg. The threads used in the single Chalcolithic textile (001.2010.013, Figures 1 and 3) recovered from Areni-1 are approximately 5 mm. The small, cylindrical clay weights (Figure 6), therefore, could have been used to weave this light-weight, almost gauzy fabric on a warp-weighted loom. The stone and unfired clay weights, however, would have been far too heavy.

4. Basket weaving technology at Areni-1

Baskets are created from plant fibers that are generally thicker and more resilient than textile fibers. While splitting, heating, dying, bending, and bundling are often used to treat these fibers; baskets are never woven on a loom and generally have a different end-use than textiles (Adovasio 1977, p. 1; Crowfoot 1954, p. 414; Wendrich 1999, pp. 31-35). Tools such as awls (Figure 7) and needles are often used in the construction of a basket and thread or cordage may be used to create a more secure weave or to fasten the end of the weaving bundle or the baskets edge. The techniques of basket making are generally classified into three weave types: twining, coiling, and plaiting. Within each of these three classes are a large number of sub-classes; all are mutually exclusive based on technique or “features of manufacture” (Adovasio 1977, p. 1; Wendrich 1999, pp. 41-42).

To date, 19 basketry artifacts have been recovered from Areni-1 cave, the majority of them from burial contexts of Chalcolithic Horizon II. The only *in situ*, non-burial context that basketry has been found in is in Trench 3 where there were stacked fragments of mats fixed to a floor in the Horizon III layer. Context gives us two usages for basketry at Areni-1, as burial goods and for floor coverings.

At least two of the basketry fragments have been directly dated – from Locus 40 a matting fragment date to 4,040–3,800 Cal BC (2 sigma range)[3]. The floor mat from Trench 3 dates to 3,980–3,790 Cal BC (2 sigma range)[4].

The basketry artifacts are of two construction types: twill plaited mats and one small, coiled basket. All of the basketry artifacts excavated thus far are woven from the same reed, a species of *Calamagrostis* that still grows locally. Awls are often used to create twined and coiled

2. Eight of the forty-four cylindrical clay weights are complete or close enough to complete to estimate the original weight.

3. OxA-23913, 5144±30 BP.

4. OxA-28783, 5110±32 BP.

baskets but in general, the construction of baskets leaves behind few tools to indicate how they were manufactured.

The single coiled basket (001.2010.020) (Figure 8) from Areni-1 comes from Locus 63 in Trench 1, a context that has a firm relative date in the Chalcolithic. This Locus comprises an infant burial inside a plaster vessel. The infant was placed on top of the small, coiled basket and was also accompanied by numerous other fragments of twill plaited basketry mat, a container made of horn, and other items.

Coiled baskets are constructed with two elements that can best be described as a passive bundle with an active wrapping (Wendrich 1999, p. 86; Seiler-Baldinger 1994, p. 33). The passive bundle is the foundation of the basket, controlling its size and shape while the active wrapping secures and covers the bundles (Figure 8) and can be used to create a surface design. The wrapping elements are inserted into the small space between bundles; each stitch is inserted through the previous coil of bundle. This may require an awl to either create a hole for insertion or to force the elements through.

All 19 of the basketry mat fragments from Areni-1 are woven in a twill plait with strips of reed. Many of the weave patterns are two-toned, an effect created by alternating the outer, glossier surface of the reed with the inner, darker surface (Figures 9 and 10). Twill weaving, also called plaiting, is a technique involving single elements or sets of element that cross over two or more element sets (Adovasio 1977, p. 99). Twill plaiting is used to manufacture flat objects; it is difficult to make a curved wall using this technique. A twill weave is described according to the patterned created by passing one set of elements over another. A simple twill weave noted as "1/1 with single elements sets", means that a single element crosses over and under only one element or element set on the opposing axis. A twill weave described as 1/3 with a single element set would indicate that one element crossed over one element or element set, then three. A 2/2 twill with a two elements set describes a weave where a set of two elements crosses over then under two elements or element sets. The principle interval for the twill plaited mats from Areni-1 is 3/3 with single element sets like those found in fragment 001.2010.003 from Locus 40 (Figure 9)[5]. A "principal interval" is the most frequent pattern of element crossing (Adovasio 1977, p. 107). Changes to the principal interval to create a different pattern are called shifts. Several of the mat fragments from Areni-1 are woven with complex patterns created with multiple shifts in both axes. A basketry mat fragment (001.2010.001) from Locus 63 is shown in Figure 10. This pattern is noted as follows: The principal

5. Locus 40 is a painted pottery vessel excavated from Trench 1 and containing the partial remains of an adult woman accompanied by several fragments of basketry mat.

interval is 3/3 with single elements sets. A pattern shift to 3/1/3, 3/3/3, 3/5/3 on one axis creates a step pattern that eventually forms a box (Figure 10).

Six of the mat pieces have fragmentary but intact edges giving us an understanding of how the mats were finished and weave elements secured. The element sets used to weave the Areni-1 baskets are both folded over at the edge and then rewoven into the body of the mat, creating a self edge (Figures 9 and 10). This method of finishing is called a "self" edge because it utilizes elements from the body of the basket rather than introducing a new weaving element.

The excavation of Areni-1 is only partially complete and members of the Areni expedition are cataloging and analyzing hundreds of new finds every season. These woven artifacts and the tools used to make them will help researchers gain a better understanding of technologies used during the Chalcolithic period in the Arpa River Valley and in the greater region of the southern Caucusus.

References

Adovasio, J. (1977) *Basketry Technology: A Guide to Identification and Analysis*. Chicago: Aldine Publishing Company.

Areshian, G.E., Gasparyan, B., Avetisyan, P.S., Pinhasi, R., Wilkinson, K.N., Smith, A., Hovsepyan, R. and Zardaryan, D. (2012) The Chalcolithic of the Near East and south-eastern Europe: discoveries and new perspectives from the cave complex Areni-1, Armenia. *Antiquity* 86, pp. 115–130.

Barber, E.J.W. (1991) *Prehistoric Textiles: The Development of Cloth in the Neolithic and Bronze Ages*. Princeton: Princeton University Press.

Barnard, H., Dooley, A.N., Areshian, G.E., Gasparyan, B. and Faull, K.F. (2010) Chemical evidence for wine production around 4000 BCE in the Late Chalcolithic Near Eastern highlands. *Journal of Archaeological Science* 38 (5), pp. 977–984.

Baxter, M.J., Cool, H.E.M. and Anderson, M.A. (2010) Statistical Analysis of Some Loomweights from Pompeii: A Postscript. *Archeologica e Calcolatori* 21, pp. 185–200.

Burnham, H.B. (1965) Çatal Hüyük: The Textiles and Twined Fabrics. *Anatolian Studies* 15, pp. 169–174.

Carroll, D.L. (1983) Warping the Greek Loom: A Second Method. *American Journal of Archaeology* 87 (1), pp. 96–99.

Crowfoot, G.M. (1954) Textiles, Basketry, and Mats. In: Singer, C., Holmyard, E.J. and Hall, A.R. (eds.), *A History of Technology*. Oxford: Clarendon Press, pp. 413–447.

Elster, E.S. (2003) Chapter 6. Tools of the Spinner, Weaver, and Mat Maker. In: Elster, E.S. and Renfrew, C. (eds.), *Prehistoric Sitagroi: Excavations in Northeast Greece, 1968-1970 Volume 2: The Final Report*. Los Angeles: Cotsen Institute of Archaeology at UCLA, pp. 229–282.

Emery, I. (1994) *The Primary Structures of Fabrics: An Illustrated Classification*. New York: Watson-Guptil Publications.

Gleba, M. and Mannering, U. (2012) Introduction: Textile Preservation, Analysis and Technology. In: Gleba, M. and Mannering, U. (eds.), *Textiles and Textile Production in Europe: From Prehistory to AD 400*. England: Oxbow Books, pp. 1–24.

Good, I. (1999) The Ecology of Exchange: Textiles from Shahr-I Sokhta. In: *Anthropology*. Philadelphia: University of Pennsylvania, p. 826.

Gostenčnik, K. (2012) Austria: Roman Period. In: Gleba, M. and Mannering, U. (eds.), *Textiles and Textile Production in Europe: From Prehistory to AD 400*. England: Oxbow Books, pp. 65–88.

Grömer, K. (2012) Austria: Bronze and Iron Ages. In: Gleba, M. and Mannering, U. (eds.). *Textiles and Textile Production in Europe: From Prehistory to AD 400*. England: Oxbow Books, pp. 26–64.

Knudsen, L.R. (2012) Case Study: The Tablet-woven Borders of Verucchio. In: Gleba, M. and Mannering, U. (eds.), *Textiles and Textile Production in Europe: From Prehistory to AD 400*. England: Oxbow Books, pp. 254–263.

Mårtensson, L., Nosch, M.-L. and Andersson Strand, E. (2009) Shape of Things: Understanding a Loom Weight. *Oxford Journal of Archaeology* 28 (4), pp. 373–398.

Seiler-Baldinger, A. (1994) *Textiles: A Classification of Techniques*. Bathurst: Crawford House Press.

Shishlina, N.I., Orfinskaya, O.V. and Golikov, V. P. (2003) Bronze Age Textiles from the North Caucasus: New Evidence of Fourth Millennium BC Fibres and Fabrics. *Oxford Journal of Archaeology* 22 (4), pp. 331–344.

Wendrich, W. (1999) *The World According to Basketry: An Ethno-archaeological Interpretation of Basketry Production in Egypt*. Leiden: Research School of Asian, African, and Amerindian Studies (CNWS).

Wilkinson, K.N., Gasparian, B., Avetisyan, P., Hovsepyan, R., Zardaryan, D., Areshian, G.E., Bar-Oz, G., and Smith, A. (2012) Areni-1 Cave, Armenia: A Chalcolithic-Early Bronze Age settlement and ritual site in the southern Caucasus. *Journal of Field Archaeology* 37/1, pp. 20–33.

Figure 1
Linen textile fragment from Areni-1 (001.2010.013).

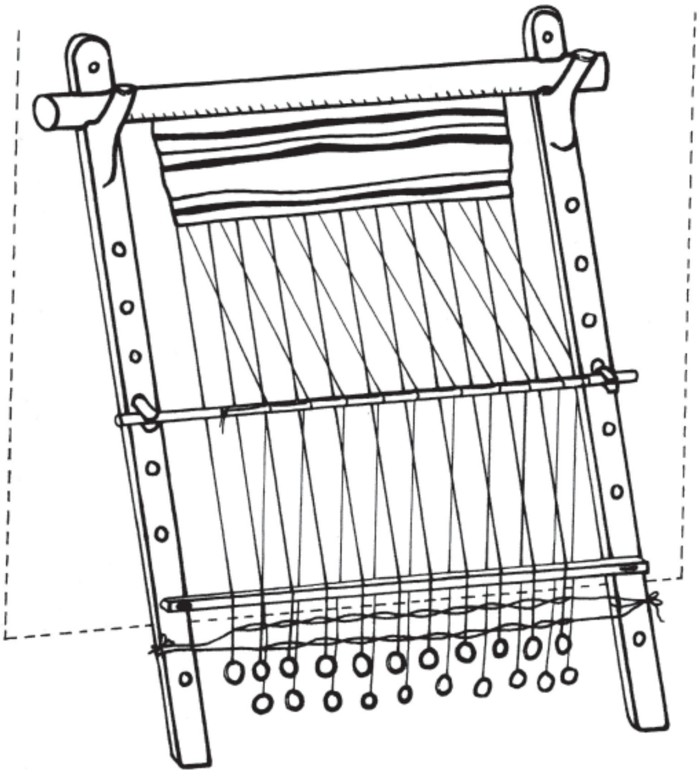


Figure 2
Warp weighted loom with loom weights. From Gleba and Manning 2012, p. 15. Drawing courtesy Eva Andersson.

Figure 3
Detail of header row on 001.2010.013.

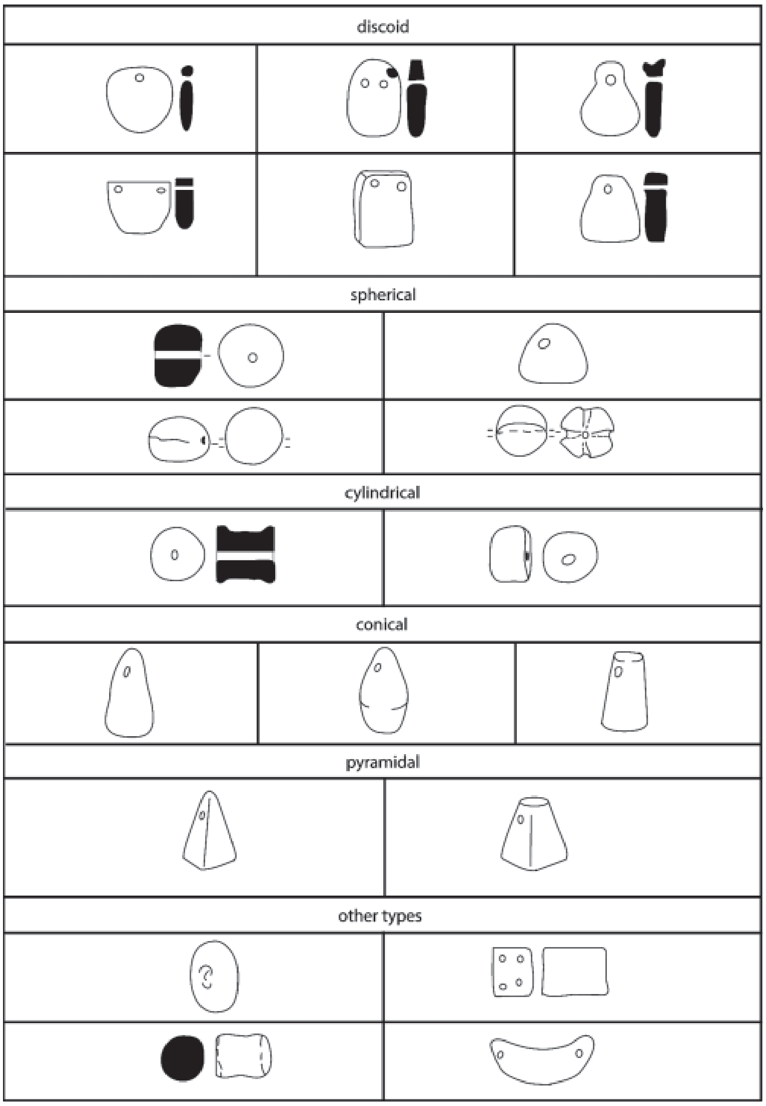


Figure 4
Examples of loom weight types from the Aegean Bronze Age. From Mårtensson *et al*. 2009, p. 375. Drawings after Evely 1993-2000; Dabney 1996; Stærmose Nielsen 1999.

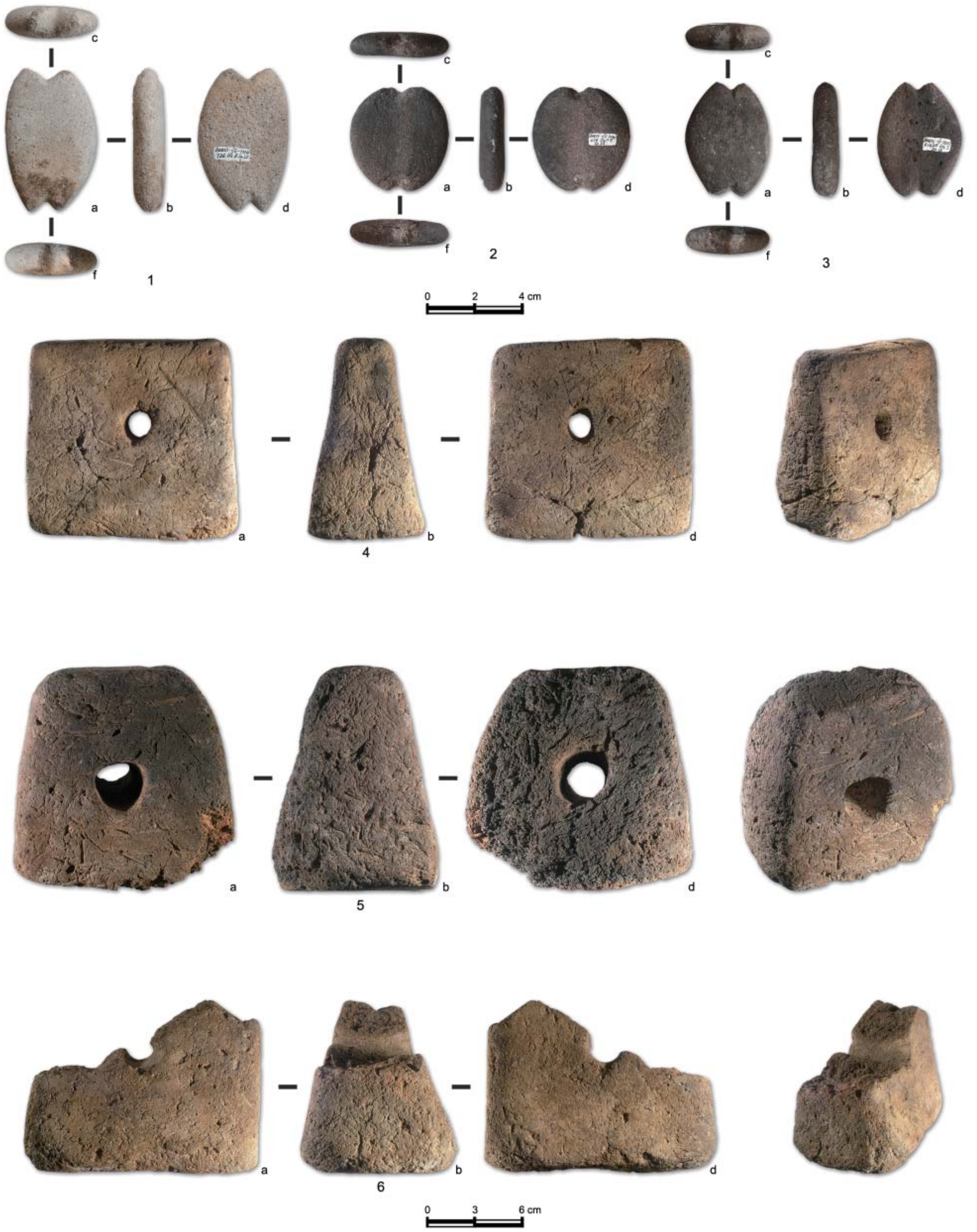


Figure 5

Areni-1 cave. 1-3. Small ovoid stone weights from Trench 2 (Horizon II: 4,000–3,800 Cal BC); 4-6. Large clay weights from Trench 3 (Horizon I: 3,700–3,400 Cal BC).

Figure 6
Areni-1 cave. Group of cylindrical clay weights from Trench 3 (Horizon I: 3,700–3,400 Cal BC).

Figure 7
Areni-1 cave. Bone awls from different Chalcolithic Horizons.
1, 3. Horizon III (4,300–4,000 Cal BC); 2. Horizon I (3,700–3,400 Cal BC); 4. Horizon II (4,000–3,800 Cal BC).

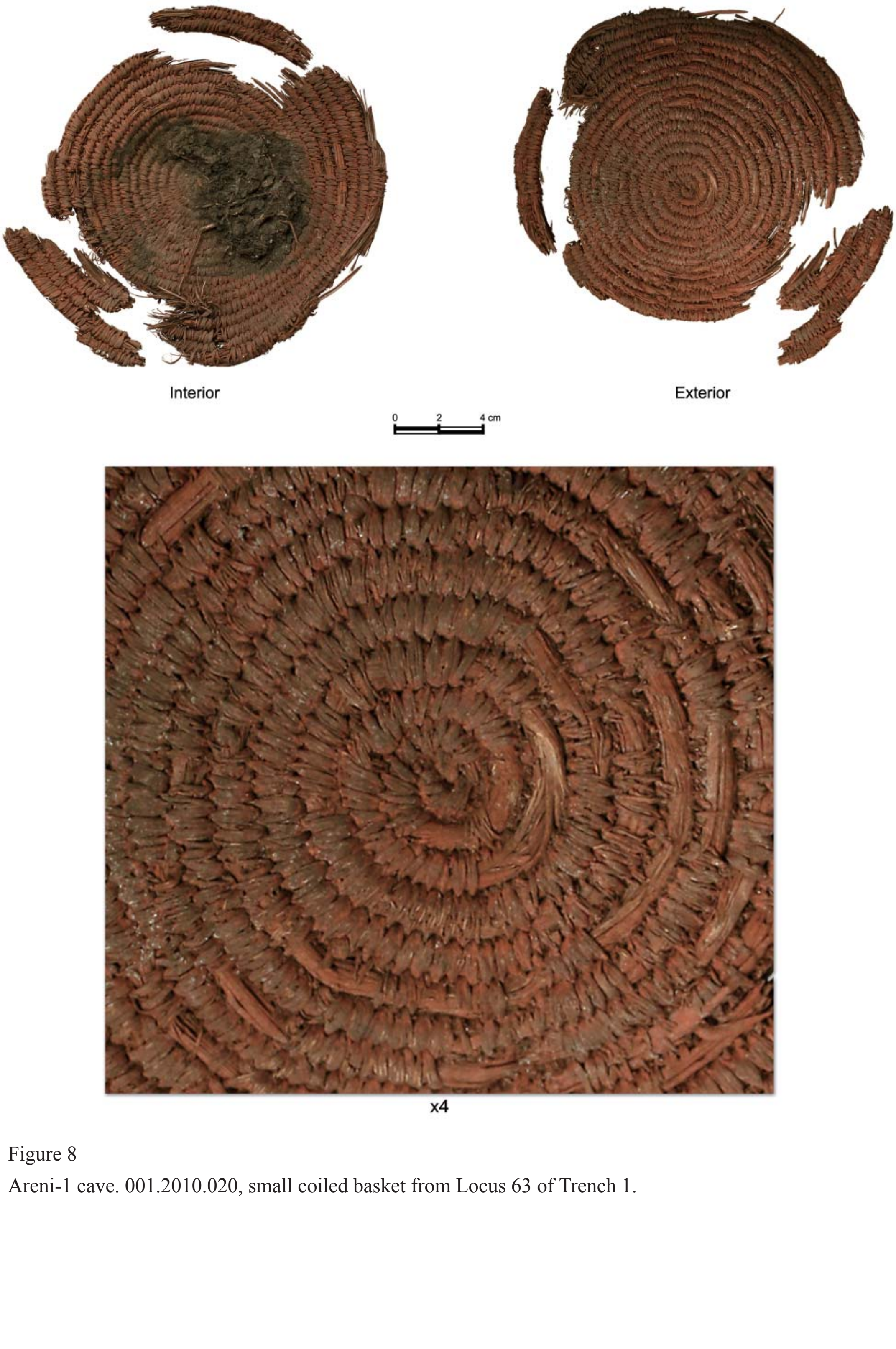


Figure 8
Areni-1 cave. 001.2010.020, small coiled basket from Locus 63 of Trench 1.

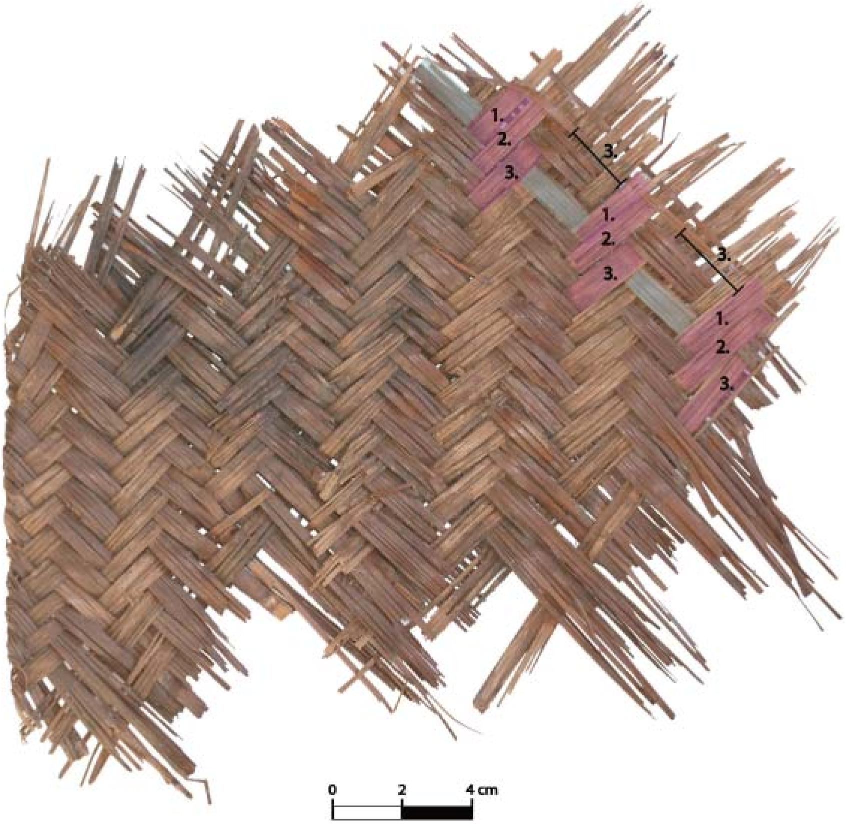


Figure 9
Areni-1 cave. 001.2010.003, twill woven mat fragment from Locus 63 of Trench 1.

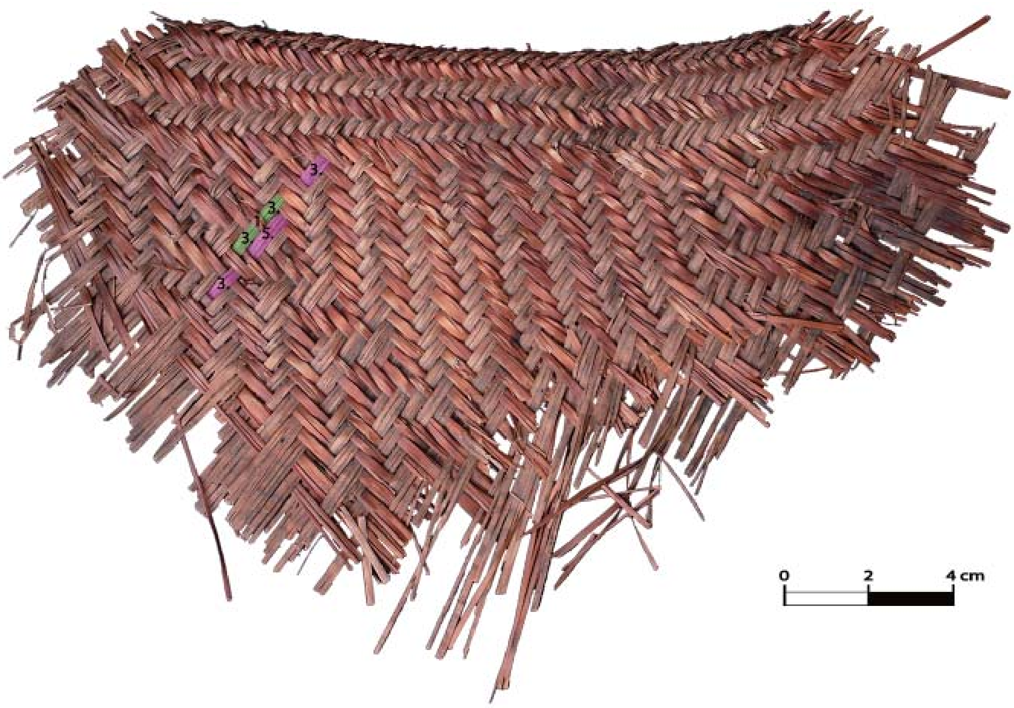


Figure 10
Areni-1 cave. 001.2010.001, twill woven mat fragment from Locus 40 of Trench 1.

Late Chalcolithic and Medieval Archaeobotanical Remains from Areni-1 (Birds' Cave), Armenia

Alexia Smith, Tamara Bagoyan, Ivan Gabrielyan, Ron Pinhasi and Boris Gasparyan

1. Introduction

Areni-1 (also known as Birds' Cave) is a three-chambered karstic cave located on the left-hand side of the Arpa River basin, a tributary of the River Araxes, within the eastern portion of the modern village of Areni in the Vayots Dzor Region of southern Armenia (Figure 1). Excavations at the site began in 2007 and were directed by Boris Gasparyan (Institute of Archaeology and Ethnography, National Academy of Sciences, Armenia) and co-directed by Ron Pinhasi (School of Archaeology, University College Dublin, Ireland) and Gregory E. Areshian (Cotsen Institute of Archaeology at UCLA, USA). The major significance of the site was abundantly clear during the initial excavations when very well preserved Chalcolithic (4,300–3,400 Cal BC) and Medieval (4th–18th centuries AD) occupations were exposed (Areshian *et al*. 2012; Pinhasi *et al*. 2010; Wilkinson *et al*. 2012). Chalcolithic finds within the first gallery of the cave include numerous large storage vessels, some of which contain human skulls of adolescent females. Grape remains and vessels typical of wine storage, associated with chemical analyses of the contents of the vessels, point to Chalcolithic wine production at the site (Barnard *et al*. 2011). It appears that from the end of the 5th millennium BC onwards, people used the cave for different purposes—as a habitation, for keeping animals and storing plant foods, for the production of wine, as well as for ritual purposes. The data from the cave demonstrate clear evidence for incipient social complexity. The workshops, wine producing complex, and the funerary features or "burials" represent a common ritual and production oriented complex.

Medieval finds in the cave span the entire Medieval period from the 4th to the 18th centuries AD. Remains of a well preserved circular dwelling span the 7th to 9th centuries AD. Later finds dating to the 11th to 14th centuries AD include structures, a fragment of an Armenian manuscript, two well-preserved ovens, a wine-storage jar, associated pottery, fragments of glass, and other small finds (Areshian *et al*. 2012; Pinhasi *et al*. 2010; Wilkinson *et al*. 2012). A group of limited small finds dated via 14C dating document early usage of the cave between the 4th and the 7th centuries AD as well as later during the 15th to 18th centuries AD.

Very limited, and what appear to be short-lived, Middle and Late Bronze Age and Iron Age occupations are also evident at Areni-1. Roughly a dozen artifacts dating to these time periods (ceramic sherds, a bronze axe, and jewelry fragments) were recovered from Trenches 1 to 5. A lack of associated architecture and an overall scarcity of finds underscores the brevity of these occupations.

Minimal temperature oscillations and constant levels of low humidity within the cave have provided an ideal environment for preservation of organic remains. As a consequence of this constant microclimate, Areni-1 has yielded large quantities of exceptionally well-preserved organic remains including the world's oldest leather shoe (Pinhasi *et al*. 2010) along with basketry and clothing (Stapleton *et al*. this volume). Large volumes of Late Chalcolithic and Medieval desiccated plant remains have also been preserved, presenting a rare opportunity to better understand plant use in Armenia during a period of increasing social complexity. The main goals of archaeobotanical research at the site are to: 1) determine the range of species and plant parts present within the cave and assess their economic importance to the inhabitants of the site; 2) consider the range of plant husbandry techniques used; 3) assess the domestication status of a number of fruit crops and better understand the nature and timing of domestication events at a regional level; and 4) explore the ritual use of plants within the cave. Owing to the volume of plant material at Areni-1, the analysis and identification of plant remains is a tremendous task and research is ongoing. This report provides preliminary results of the study of Chalcolithic and Medieval plant use at Areni-1 and presents the main genera identified to date.

2. Stratigraphy of the site

Six trenches are currently being excavated at Areni-1 (Figure 2). Trench 1 is located in the main or first gallery inside the cave and contains artifacts and features that clearly relate to funerary ritual, including human remains, as well as wine making paraphernalia dating to 4,000–3,800 Cal BC

(Figure 3). Trench 2, within the same gallery as Trench 1, has yielded pots containing cremations, as well as isolated human remains recovered from loci between the pots (Figure 4: 1). Trench 3 is located under the overhang of the cave on the outer edge at the main entrance to the first gallery (Figure 5: 1). This trench contains Medieval dwellings cutting into at least three Late Chalcolithic occupational phases designated as Chalcolithic Horizons I–III (4,300–3,400 Cal BC). Of the three horizons, the first uppermost horizon tends to be most truncated; it is present only in Trench 3 and the slope at the entrance of the cave complex. Within Trench 3, Horizon I was damaged by the construction of an Early Medieval (7th to 9th centuries AD) house or hut and by later Medieval (11th to 14th centuries AD) storage pits and ovens. Horizon I is represented by hard packed and repeatedly rebuilt dirt floors atop household pits and jar burials and dates to the final phase of the Late Chalcolithic (3,700–3,400 Cal BC). Chalcolithic Horizon II underlies Horizon I but is separated from it by a layer of zoogenic humus (dung layer). Horizon II occupies a more extensive area beginning in Trench 3, outside the entrance to the first gallery and extends into the cave, to the rear part of the first gallery spanning Trenches 1 and 2. It also reaches into Trench 3, where it is characterized by hard packed and repeatedly finished floors and wooden constructions or buildings and large, unfired bins. Radiocarbon dates from Horizon II yield a date range of 4,000–3,800 Cal BC, which places it in the middle phase of the Late Chalcolithic. The third Chalcolithic Horizon encompasses a rather small area and appears in multiple areas beneath Horizon II. Horizon III is separated from Horizon II by a layer of zoogenic humus in Trench 3 and inside the first gallery, where it spans Trenches 1 and 2. Traces of very high quality plastered floors and partially destroyed stone constructions (damaged by intrusive bins dug during Horizon II) are recorded in Trench 3. Dates for this Horizon range between 4,300–4,000 Cal BC placing the Horizon III occupation in the early phase of the Late Chalcolithic.

Towards the front of the cave on the slope (Trenches 4, 5 and 6), the stratigraphy is highly complex and while discrete Late Chalcolithic and Medieval strata exist, certain layers exhibit considerable mixing. In Trench 4 Chalcolithic Horizon I is washed and mixed with the colluvial deposits (Figure 6: 1). A Chalcolithic garbage layer partly exposed in Trench 4 most probably belongs to Horizon II. One of the Chalcolithic Horizons partly opened in the section of Trench 4, extending above the bedrock is dated to 5,260–4,960 Cal BC (OxA-23169) and most likely belongs to the Early Chalcolithic (Figure 6: 2). In Trench 5, portions of a hard packed and repeatedly rebuilt dirt floor with a household pit were discovered (Figure 7). Scant remains of other stone structures are visible. Most of the finds are washed and redeposited because of a strong erosion process existing at the slope in front of the cave. Trench 6 was recently opened, exposing part of a Chalcolithic horizon beneath thick colluvial deposits. Judging from the pottery sherds, this occupation is associated with Horizon III.

Plant remains are distributed unevenly throughout the site. Throughout the cave, large concentrations of plant remains have been recovered from ceramic vessels and associated contexts in Trenches 1, 2, 3 and 4 (Figures 3: 2, 4: 2 and 5: 2).

3. Methods

A comprehensive sampling strategy was adopted at Areni-1, and archaeobotanical samples were collected from every archaeological context. Each sample consisted of 5 L of sediment. Since the plant remains are desiccated, and contact with water results in their disintegration, dry sieving was used to recover the archaeobotanical remains. All sediment samples were sieved using a 1 mm sieve and material <1 mm was discarded. It is likely that small weed seeds and plant parts are lost as a result of this strategy, but since recovering desiccated plant remains by dry sieving is such a labor intensive process, and emphasis was placed on examining economic species from each context, it was deemed a necessary compromise. Similar compromises have been reached at other sites where copious amounts of desiccated plant remains have been preserved (e.g. Van der Veen 2011, pp. 15-17). Of the sieved material in the >1 mm fraction, 1 L of filtered soil was collected for investigation and the remaining filtered soil was placed in a labeled bag and stored within the cave for future generations to examine. The 1 L bag of filtered soil was then subject to detailed analysis and all plant remains, bones, pottery fragments, etc., were separated via hand-picking and labeled appropriately.

All plant remains were examined using a binocular microscope and identified using the Armenian Archaeobotanical Reference Collection, which has been collected in triplicate. Collections are housed at the Institute of Archaeology and Ethnography and the Institute of Botany in Yerevan, as well as the Department of Anthropology at the University of Connecticut. The botanical terminology used within this report follows the Flora of Armenia (Takhtajan 1954-1987; 1995; 2001-2010) and the *Vascular Plants of Russia and Adjacent States* (Cherepanov 1995). Since analysis of samples is ongoing, this report does not include final seed and plant part counts: these data will be provided in an upcoming report.

4. Plant remains from Areni-1

Plant remains recovered from Areni-1 include vast quantities of well-preserved seeds, fruits, stones or endocarps, and stems of both wild and cultivated plants as well as desiccated flowers, blossoms, leaves, wood, and vine branches. A list of the genera identified to date from Late Chalcolithic, Medieval, and mixed contexts is provided in Table 1. A diverse range of taxa have been identified, documenting the richness of plant use in antiquity at Areni-1. While distinct differences are evident between the Late Chalcolithic and the Medieval strata, continuity in plant use is also evident; many of the species observed in the cave continue to be used in the village of Areni today. The following discussion outlines the range of food plants recovered, including fruits, cereals, and legumes, as well as plants used for their fibers and other purposes.

4.1. Fruits

Numerous fruits remains have been recovered from Areni-1 (Figures 8, 9 and 10). Large numbers of well-preserved endocarps or stones from fruit trees document the presence and intensive use of *Prunus* L. (plum), *Armeniaca* Mill. (apricot), *Persica* Mill. (peach), *Amygdalus* L. (almond), and *Cerasus* Mill. (cherry) during the Medieval period. *Prunus* endocarps were also very common within the Late Chalcolithic strata. Other tree, shrub, or vine fruits present at Areni-1 during the Medieval period include *Juglans* L. (walnut), *Pyrus* L. (pear), *Cornus* L. (Cornelian cherry/ dogwood), *Rubus* L. (blackberry/raspberry), and *Vitis* L. (grape), all of which continue to be heavily used in the area today (Table 1). *Juniperus* sp. (juniper) fruit were also recovered from Medieval levels. Sturtevant (Hedrick 1919) reports the fruit of a variety of *Juniperus* species as being edible and highly valued in many parts of the world, but their use at Areni-1 is unclear.

Celtis L. (hackberry) endocarps were also found in great abundance within both Late Chalcolithic and Medieval levels and *Celtis glabrata* Stev. ex Planch. trees are frequently encountered in the Arpa River basin and its tributaries today (Figure 8: 1-3). Sturtevant (Hedrick 1919) lists a variety of *Celtis* species and notes that they possess a sweet and edible fruit. This sentiment is repeated by Medieval Armenian medic Amirdovlat Amasiatsi, who notes in his encyclopedic dictionary that the fruits of the hackberry tree are sweet and delicious. The fruits and other parts of the plant have historically been used for medical purposes and as a hair dye (Vardanyan 1990, pp. 291-292). In addition, ethnographic reports from the villagers at Areni-1 indicate that *Celtis* fruits are ground into a powder and used in conjunction with flour to enhance the flavor of bread.

Given the vast number of *Celtis* finds, it is clear that hackberry fruits were intentionally collected at Areni. While reports of *Celtis* from other sites are not widespread, they do exist. Simchoni and Kislev (2011), for example, report the discovery of approximately 300 *Celtis* *australis* stones from Iron Age Tel Rehov in Israel. *Celtis* finds have also been reported from Epipalaeolithic levels at Öküzini (Martinoli and Jacomet 2004) and Neolithic Çatalhöyük (Fairbairn *et al*. 2002) in Anatolia. Fairbairn *et al*. (2002) also report small frequencies of *Juniperus* sp. at Çatalhöyük in association with higher frequencies of *Celtis* sp., the latter of which they report was "used as wine in later time periods" (Fairbairn *et al*. 2002, p. 42). *Celtis* seeds were recovered from the wine fermentation tank of the producing installation at Areni-1, so it is possible that in addition to grapes, *Celtis* was also used to produce wine.

Remains of *Elaeagnus* L. (oleaster) were also recovered from Medieval strata at Areni-1. Sturtevant (Hedrick 1919) reports the consumption of *Elaeagnus angusifolia* fruit, which is dry and mealy, yet sweet, across Europe and northern Asia. Within Armenia, both *E. angustifolia* L. and *E. orientalis* L. occur within the Arpa River valley today (Gabrielian and Zohary 2004, Fig. 88). Gabrielian and Zohary (2004) note that in addition to being cultivated for its fruit, roughly 50 distinct cultivars are currently valued for their ornamental qualities and their attractiveness to honey bees. Archaeologically, *Elaeagnus* sp. has been reported at Neolithic Aknashen in the Ararat valley in Armenia (Hovsepyan and Willcox 2008) and Early Bronze Age Sarazm located in northwestern Tajikistan where Spengler and Willcox (2013) suggest that it was intentionally gathered for consumption.

Together, these remains document gathering of wild fruits and hint strongly towards the intentional cultivation of other fruits. Much of the existing research regarding the nature and timing of tree fruit domestication points towards the southern Caucasus as a likely origin (Zohary *et al*. 2012). The ongoing study of plant remains from Areni-1 will undoubtedly provide a wealth of information relevant to discussions of domestication of several fruits. Detailed morphometric studies of the following fruits: apricot (*Armeniaca vulgaris* Lam.), plum (*Prunus* L.), grape (*Vitis* L.), are ongoing.

A large number of apricot (*Armeniaca vulgaris* Lam., synonymous with *Prunus armeniaca* L.) endocarps have been recovered from Medieval levels at Areni-1 (Figure 8: 4). Owing to the excellent preservation conditions, mesocarp (pulp) has also preserved in some instances. Today, Armenia is famed for cultivating apricots, but the origin of domesticated apricot is still poorly understood. While some believe that apricot originated in China, others argue that evidence for this is scanty and that domestication may have taken place in Armenia (Agulyan and Asatryan 1981, p. 13; Gladkova 1981, p. 186; Stepanyan and Stepanyan 2011, p. 190). Wild forms of apricot are well documented from the Tien Shan Range of Central Asia, Northeastern China, Korea, and eastern Siberia, but smaller stands also exist within Dagestan and Armenia (Gabrielian and Zohary 2004,

p. 62; Zohary *et al*. 2012, p. 144). The *Flora of Armenia* (Takhtajan 1958, p. 308) notes that many forms of apricot exist within Armenia, but only cultivated species are listed. Since the publication of the third volume of the *Flora of Armenia* in 1958, isolated stands of wild apricot have been reported within the Aragats, Zangezur, and Daralagyaz floristic regions, the latter of which spans the Arpa River valley where Areni-1 lies (Gabrielian and Zohary 2004, Fig. 84). Consequently, wild stands of apricot would most likely have been available to occupants of the cave in antiquity.

Zohary *et al*. (2012, p. 144) report the cultivation of apricot in China around 3,000 years ago and list several early finds of apricot in Ukraine dating to ca. 6,000–4,750 Cal BP. Within Armenia, apricot endocarps have been recovered from Early Bronze Age Garni (see Arakelyan 1951 cited in Gabrielian and Zohary 2004), further documenting an early presence in the region. The endocarp remains from Areni-1 are currently undergoing detailed morphometric analysis so it is premature to discuss their morphology in detail. It is clear, however, that variety exists within the assemblage. Given that *Armeniaca vulgaris* finds are not well reported, and that the origin of apricot domestication is uncertain, the recovery of apricot remains from Areni-1 holds great potential to enhance knowledge of the origin and spread of domesticated apricot.

A very large number of *Prunus* sp. endocarps have been recovered from both Late Chalcolithic and Medieval levels at Areni-1 (Figure 8: 5-6). Within the third volume of the *Flora of Armenia* (Takhtajan 1958, pp. 304-307), four species of *Prunus* (plum) are reported: *P. spinosa* L. and *P. divaricata* L. db., both of which are wild forms; *P. domestica* L., which is a cultivated form; and *P. insititia* Julsen, which may be considered a wild form or a semi-domesticated form when referred to as *P. domestica* subsp. *insititia* (L.) C.K. Schneid. According to Gladkova (1981, p. 186) *P. domestica* subsp. *insititia* represents a very large group that contains an enormously diverse range of varieties. She notes that *Prunus domestica* resulted from the hybridization of black thorny (*P. spinosa*) and cherry-plum (*P. divaricata*). The morphological diversity of *Prunus* endocarps from Areni-1 strongly suggests that a number of species are present at the site. Consequently, it may be possible to document *Prunus* domestication at Areni-1. Assigning species to the archaeological remains and confirming this, however, is currently constrained by a lack of reliable criteria to morphologically distinguish between the endocarps. A detailed morphometric study of modern endocarps collected in Armenia from each of the four *Prunus* species is currently underway in order to develop the criteria needed to reliably distinguish between the archaeological remains.

Very early finds of *Prunus* exist within the archaeobotanical literature. Martinoli and Jacoment (2004), for example, identified *Prunus* endocarp fragments from Epipalaeolithic levels at Özükini in southwestern Anatolia. *Prunus* endocarps have also been recovered from Neolithic and Bronze Age sites across Europe (Zohary *et al*. 2012 provide a useful synthesis of finds). It is not until Roman times, however, that undisputed evidence for the domesticated form, *Prunus domestica*, is found across Europe with repeated finds of *domestica*-type endocarps across Germany and well-preserved wall paintings of the tree at Pompeii in Italy (Zohary *et al*. 2012). Given the abundance of wild *Prunus* types in Armenia, the likelihood of domestication taking place in the Caucasus is high. The ongoing study of *Prunus* remains from Areni-1 will undoubtedly contribute greatly to ongoing considerations of *Prunus* domestication.

A diverse range of *Vitis* sp. remains have been recovered from Areni-1 (Figures 9 and 10). Remains dating to the Late Chalcolithic, Middle Bronze Age and Medieval occupations include grape pips, intact desiccated berries with skin preserved, rachises and pedicels, as well as cut segments of vine wood (Table 2). Strong evidence exists for wine production during the Late Chalcolithic at Areni-1. Within the central gallery of the cave, numerous storage jars associated with a packed clay platform that slopes towards a large ceramic jar were exposed in Trench 1. These remains date to 4,230–3,790 Cal BC (OxA-18197, UCIAMS-40184) and have collectively been interpreted as a grape pressing installation used for wine production. Barnard *et al*. (2011) detected the presence of anthocyanin malvidin, a pigment that gives red wine its color, on ceramic sherds from the installation, providing additional support for wine production at Areni-1 around 4000 BC. While wine is known to have been produced much earlier, around the mid-sixth millennium BC (Miller 2008), Areni-1 is believed to be the oldest wine-making centre in the world. The area surrounding the site continues to be known for wine production today.

Breath (B) and length (L) measurements taken from 12 Late Chalcolithic grape pips from Areni-1 were used to calculate the Stummer's Index (B/L × 100) (Stummer 1911 cited in Jacquat and Martinoli 1999). The Stummer's Index for 12 pips vary between 54.4 and 71.7, placing the remains firmly within the intermediary category (according to the Stummer's Index, wild specimens = 76–83 and domesticated species = 44–53). A more detailed study is underway using a larger sample size to compare the Areni-1 grape pips to modern comparative material from wild and domesticated grape varieties from Armenia.

4.2. Cereals

In addition to a wide variety of fruit, cereals were also recovered from both Late Chalcolithic and Medieval occupations (Figure 11). Cereals would have served as important staple crops during both of these periods and, indeed, have a long history of use within Armenia. Hovsepyan and

Willcox (2008), for example, report Neolithic finds of *Triticum monococcum* (einkorn), *T. dicoccum* (emmer), free-threshing forms of wheat, and *Hordeum vulgare* (barley) and *H. vulgare* var. *coeleste* dating to the 6th millennium Cal BC at Aratashen and Aknashen in the Ararat Valley of Armenia. At Areni-1, both wheat and barley have been recovered (Figure 11: 5-6). Free-threshing wheat has been recovered from Chalcolithic and Medieval levels along with grains that strongly resemble *T. dicoccum* (emmer). While cereals would have been widely consumed at Areni-1, their use was not restricted to subsistence. Intact cereal spikes were used to impress and decorate ceramic vessels. Examination of a number of pottery vessels from Areni-1 has also demonstrated that straw was used to temper clay.

By the Medieval period, millet (*Panicum* sp.) and sorghum (*Sorghum* sp.) are also present at Areni-1 documenting their introduction into the area (Figure 11: 2, 7-8). The location and timing of *Panicum miliaceum* L. (broomcorn millet) domestication is currently poorly understood and investigations are complicated by the morphological similarity between *P. miliaceum* and *Setaria italica* (L.) P. Beauv. (foxtail millet) grain. In an archaeobotanical study of early *P. miliaceum* and *S. italica* finds in the Old World, Hunt *et al*. (2008) note the presence of both species in northern China prior to 5,000 Cal BC along with contemporary finds across Eurasia. The remains from Areni-1 certainly provide support for intensive cultivation of *Panicum* sp. in the Caucasus by the Medieval period.

Our understanding of sorghum domestication suffers from lack of clarity, but is marginally better understood than millet. Today sorghum is grown extensively in Africa, Southwest Asia, and the Indian subcontinent (Zohary *et al*. 2012). Given that the wild progenitors of *Sorghum bicolor* (L.) Moench are restricted to sub-Saharan Africa and Yemen, domestication is thought to have occurred in Africa rather than in Asia, although much more work needs to be done in sub-Saharan Africa to confirm this. If domesticated sorghum did migrate out of Africa northwards, its presence at Areni-1 during Medieval times is very interesting, since sorghum has not yet been recovered from Medieval sites in Syria and is rarely encountered in the Mediterranean during Roman times (Zohary *et al*. 2012, p. 73), suggesting that the crop would have somehow bypassed these regions. Research in India indicates that sorghum was present in South Asia by 2,000 BC (Nesbitt 2005, p. 57). The forms of sorghum grown in Southwest Asia, India and Pakistan today are dominated by the free-threshing *durra* type. Since the *durra* form is not prevalent in Africa, and is restricted largely to Ethiopia, Harlan and Stemler (1976, p. 474) speculated some time ago that primitive *bicolor* plants were introduced to India where they evolved into the *durra* form. They further speculate that the *durra* form was then introduced to areas to the west of India. The presence of *Sorghum* during

Medieval times at Areni-1 along with other crops that were introduced from the east would lend support to this assertion.

4.3. Other food crops

Other food crops recovered from Areni-1 include *Lens* sp. (lentil), *Rubus* sp. (blackberry/raspberry), *Citrullus* sp. (water melon), *Melo* sp. (melon), *Cucurbit* sp. (cucurbit), *Capparis* sp. (caper), *Coriandrum* sp. (coriander) and large amounts of *Beta* sp. (beet) seeds. A remarkable, well-preserved Medieval fabric bundle was recovered from Areni-1 containing large numbers of *Beta* sp. seeds together with smaller amounts of *Coriandrum* sp., *Linum* sp., *Gossypium* sp., *Medicago* sp. (medick), *Triticum* sp. (wheat), *Hordeum* sp. (barley), *Panicum* sp. (millet), *Thlaspi* sp. (pennycress), *Alyssum* sp. (alyssum) seeds, and a diverse range of weeds seeds. Many of the species within the bundle were important field crops during the Medieval period and would have served as staple foods for the local population. It is possible that the contents of the bundle were kept as seed stock for future plantings.

4.4. Fiber plants

Fiber crops recovered from Areni-1 include *Gossypium* sp. (cotton) and *Linum* sp. (flax), both of which occur in Medieval layers (Figures 5: 2 and 12). The preservation of cotton is exceptional and includes seeds, opened bolls, cotton fibers, as well as woven textiles (Figure 12: 3-4). It is not known precisely when cotton was introduced to the Caucasus from the Indian subcontinent, but excavations at Kara-tepe in northwestern Uzbekistan have yielded evidence for cotton dating to ca. 300–500 AD (Brite and Marston 2013). Further analysis and dating of the cotton remains from Areni-1 will undoubtedly contribute much to the discussion of the diffusion of cotton cultivation across Asia.

Late Chalcolithic textiles and basketry have also been recovered from Areni-1. A textile fragment excavated from Chalcolithic Horizon II in Trench 1 was woven from spun linen (*Linum usitatissimum* L.). Intact basket fragments have been recovered from both Late Chalcolithic and Medieval levels at Areni-1 (Stapleton *et al*. this volume, Figure 12: 2). The baskets tend to be created from plant fibers that are thicker and more resilient than textile fibers. Poaceae plant stems were widely exploited across the site. Large quantities of *Phragmites* sp. (reed) stems have been recovered from various parts of the excavations and it would appear that the fibers were being processed on site. Creative use was made of the stems and the bright inner and darker outer portions of the stems were differentially woven to create patterns. Interestingly, reed stems were also recovered from inside one of the earthenware wine pots or kareses near the wine pressing installation together with grape trunks (Figure 3: 2). While describing stores in an Armenian village dwelling, the 5th century BC Greek historian Xenophon wrote in his “Anabasis” the following:

> There was also wheat, barley, beans, and barley wine in big bowls. The very grains of the barley were in it, floating level with the brim, and there were reeds lying in it, some of which were longer, others shorter, but without joints. When one was thirsty, he had to take one of these to his mouth and suck. It was quite unmixed (and strong), unless one poured in a bit of water, and the drink was quite pleasant for one who had learned to be familiar with it. (Xenophon 2008, p. 138, Book IV, Chapter V).

It is highly likely that reed stems were used as straws for drinking wine at Areni-1. A similar use of reeds is depicted on several Early Dynastic Mesopotamian seals illustrating communal drinking and feasting and straws have also been recovered from elite burials at Ur (Joffe 1998 provides a brief review). These finds further document the ritual use of the inner part of the cave during the Late Chalcolithic.

Additionally, a leather shoe packed with wild grasses was recovered from the base of a Late Chalcolithic pit within Trench 3. The grasses helped retain the form of the shoe and keep it dry. Leather from the shoe has been radiocarbon dated to 3,627–3,377 Cal BC (OxA-20581, OxA-20582, UCIAMS-65186), and dates for the associated grasses are contemporary (OxA-20583), making this find the world’s oldest leather shoe (Pinhasi *et al*. 2010).

5. Conclusions

The archaeobotanical remains from Areni-1 provide a rich record of plant use during the Late Chalcolithic and Medieval periods. The extraordinary preservation of plant remains allows us to consider various uses of plants that extend beyond traditional studies of subsistence. Well preserved textiles, basketry, and even reed drinking straws used to consume wine attest to the richness of plant use at the site.

While some plants were used during both periods, suggesting continuity of resource exploitation in the area, the archaeobotanical record also documents the introduction of new species from other regions. Free-threshing wheats and barley were cultivated and *Celtis* fruits were gathered in both Late Chalcolithic and Medieval periods. Likewise, *Vitis* and *Prunus* remains are evident in both time periods. It is unclear at present whether grapes and plum were being intentionally cultivated during the Late Chalcolithic and had reached the point of domestication, but both plants were heavily exploited. By the Medieval period, cotton, sorghum, and millet had been introduced to the region and are evident at the site in significant numbers. A much wider range of fruits remains are also present during the Medieval occupation, documenting the intense use of fruit crops in the region. This phenomenon continues today. The archaeobotanical remains from Areni-1 have enormous potential to provide information on the domestication of a variety of fruits. Detailed morphometric studies of *Prunus*, *Armeniaca*, *Cerasus*, *Persica*, *Amygdalus*, *Juglans*, and *Vitis* are currently ongoing and will contribute much needed information on the role that the southern Caucasus played in this process.

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References

Agulyan, S.L. and Asatryan, A.S. (1981) *Frukti Armenii* (Fruits of Armenia). Volume 5. Yerevan: "Hayastan" Publishing House (in Armenian and Russian).

Areshian, G.E., Gasparyan, B., Avetisyan, P.S., Pinhasi, R., Wilkinson, K., Smith, A., Hovsepyan, R. and Zardaryan, D. (2012) The Chalcolithic of the Near East and south-eastern Europe: discoveries and new perspectives from the cave complex Areni-1, Armenia. *Antiquity* 86, pp. 115–130.

Barnard, H., Dooley, A.N., Areshian, G.E., Gasparyan, B. and Faull, K.F. (2011) Chemical evidence for wine production around 4000 BCE in the Late Chalcolithic Near Eastern highlands. *Journal of Archaeological Science* 38, pp. 977–984.

Brite, E.B. and Marston, J.M. (2013) Environmental change, agricultural innovation, and the spread of cotton agriculture in the Old World. *Journal of Anthropological Archaeology* 32, pp. 39–53.

Bronk Ramsey, C. and Lee, S. (2013) Recent and planned developments of the program OxCal. *Radiocarbon* 55, pp. 720–730.

Cherepanov, S.K. (1995) *Sosudistiye rasteniya Rossii i sopredel'nikh gosudarstv* (Vascular plants of Russia and adjacent states). St. Petersburg: "Mir i Sem'ya" Publishing House (in Russian).

Fairbairn, A., Asouti, E., Near, J. and Martinoli, D. (2002) Macro-botanical evidence for plant use at Neolithic Çatalhöyük, south-central Anatolia, Turkey. *Vegetation History and Archaeobotany* 11, pp. 41–54.

Gabrielian, E. and Zohary, D. (2004) Wild relatives of food crops native to Armenia and Nakhichevan. *Flora Mediterranea* 14, pp. 5–80.

Gladkova, V.N. (1981) Semeystvo Rozoviye (Rosaceae) [Rose Family (Rosaceae)]. In: Takhtajan, A.L. (ed.), *Zhizn' rasteniy* (Life of plants). Volume 5 (2). Moscow: "Proshveshchenie" Publishing House, pp. 175–187 (in Russian).

Harlan, J.R. and Stemler, A. (1976) The Races of Sorghum in Africa. In: Harlan, J.R., de Wet, J.M.J. and Stemler, A. (eds.), *Origins of African Plant Domestication*. The Hague: Mouton, pp. 465–478.

Hedrick, U.P. (ed.) (1919) *Sturtevant's Notes on Edible Plants. Report of the New York Agricultural Experiment Station for the Year 1919, II*. Albany: J.B. Lyon Company.

Hovsepyan, R. and Willcox, G. (2008) The earliest finds of cultivated plants in Armenia: evidence from charred remains and crop processing residues in pisé from the Neolithic settlements of Aratashen and Aknashen. *Vegetation History and Archaeobotany* 17 (Supplement 1), pp. 63–71.

Hunt, H.V., Linden, M.V., Xinyi, L., Motuzaite-Matuzeviciute, G., Colledge, S. and Jones, M.K. (2008) Millets across Eurasia: chronology and context of early records of the genera *Panicum* and *Setaria* from archaeological sites in the Old World. *Vegetation History and Archaeobotany* 17 (Supplement 1), pp. S5–S18.

Jacquat, C. and Martinoli, D. (1999) *Vitis vinifera* L.: Wild or Cultivated? Study of Grape Pips found at Petra, Jordan; 150 B.C.–A.D. 40. *Vegetation History and Archaeobotany* 8, pp. 25–30.

Joffe, A.H. (1998) Alcohol and Social Complexity in Ancient Western Asia. *Current Anthropology* 39 (3), pp. 297–322.

Martinoli, D. and Jacomet, S. (2004) Identifying endocarp remains and exploring their use at Epipalaeolithc Öküzini in southwest Anatolia, Turkey. *Vegetation History and Archaeobotany* 13, pp. 45–54.

Miller, N.F. (2008) Sweeter than wine? The use of the grape in early western Asia. *Antiquity* 82, pp. 937–946.

Nesbitt, M. (2005) Grains. In: Prance, G. and Nesbitt, M. (eds.), *The Cultural History of Plants*. New York: Routledge, pp. 46–60.

Pinhasi, R., Gasparian, B., Areshian, G.E., Zardaryan, D., Smith, A., Bar-Oz, G. and Higham, T. (2010) First Direct Evidence of Chalcolithic Footwear from the Near Eastern Highlands. *PLoS ONE* 5 (6) (http://www.plosone.org/article/info:doi/10.1371/journal.pone.0010984).

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Ramsey, C.B., C., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M. and van der Plicht, J. (2013) IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. *Radiocarbon* 55, pp. 1869–1887.

Simchoni, O. and Kislev, M.E. (2011) Early finds of *Celtis australis* in the southern Levant. *Vegetation History and Archaeobotany* 20, pp. 267–271.

Spengler, R.N. and Willcox, G. (2013) Archaeobotanical results from Sarazm, Tajikistan, an Early Bronze Age Settlement on the edge: Agriculture and exchange. *Journal of Environmental Archaeology* 18 (3), pp. 211–221.

Stepanyan, N.P. and Stepanyan, R.A. (2011) Novoe mestonakhozhdenie dikorastushchego abrikosa (*Armeniaca vulgaris* Lam.) v Armenii [Newly discovered locality of wild apricot (*Armeniaca vulgaris* Lam.) in Armenia]. *Takhtajania* Volume 1, pp. 190–191 (in Russian).

Takhtajan, A.L. (ed.) (1954–1987) *Flora of Armenia. Volumes 1–8. Armenian SSR*. Yerevan: Academy of Sciences Press (in Russian).

Takhtajan, A.L. (1958) *Flora of Armenia*. *Volume 3. Platanaceae–Crassulaceae. Armenian SSR*. Yerevan: Academy of Sciences Press (in Russian).

Takhtajan, A.L. (1995) *Flora of Armenia. Volume 9. Campanulaceae–Asteraceae*. Krncirska: Koeltz Scientific Books (in Russian).

Takhtajan, A.L. (2001–2010) *Flora of Armenia. Volumes 10–11*. Lichtenstein, Ruggell: A.R.G. Gantner Verlag (in Russian).

Van der Veen, M. (2011) *Consumption, Trade and Innovation. Exploring the Botanical Remains from the Roman and Islamic Ports at Quseir al-Qadim, Egypt*. Frankfurt: Africa Magna Verlag.

Vardanyan, S.A. (1990) *Nauchnoe nasledie. Tom 13. Amirdovlat Amasatsi. Nenuzhnoe dlya neuchey (perevod s armyanskogo yazika i kommentariy S.A. Vardanyan)* [Scientific Heritage, Vol. 13, Amirdovlat Amasatsi. Useless for Ignoramuses (Translation from the Armenian and comments by S.A. Vardanyan)]. Moscow: "Nauka" Publishing House (in Russian).

Wilkinson, K.N., Gasparian, B., Pinhasi, R., Avetisyan, P., Hovsepyan, R., Zardaryan, D., Areshian, G.E., Bar-Oz, G. and Smith, A. (2012) Areni-1 Cave, Armenia: A Chalcolithic–Early Bronze Age settlement and ritual site in the southern Caucasus. *Journal of Field Archaeology* 37/1, pp. 20–33.

Xenophon (2008) *The Anabasis of Cyrus*. Translated by W. Ambler. Ithaca: Cornell University Press.

Zohary, D., Hopf, M. and Weiss, E. (2012) *Domestication of Plants in the Old World. The Origin and Spread of Cultivated Plants in South-west Asia, Europe and the Mediterranean Basin*. Oxford: Oxford University Press.

Table 1
Plant remains recovered from Chalcolithic and Medieval levels at Areni-1. Nomenclature follows Takhtajan 1954–1987; 1995; 2001–2010 and Cherepanov 1995.

Family	Genus	English common name	Armenian common name	Chalcolithic	Medieval	Mixed
Aceraceae	*Acer* L.	Maple	Tkhki	+	+	
Alliaceae	*Allium* L.	Onion	Sokh			+
Apiaceae	*Coriandrum* L.	Coriander	Hamem		+	
	Heracleum L.	Cow-parsnip	Baldrghan			+
Asteraceae	*Achillea* L.	Yarrow	Hazaraterevuk		+	
Boraginaceae	*Lithospermum* L.	Gromwell/Stoneseed	Kakavkrkut			+
Brassicaceae	*Alyssum* L.	Alyssum	Varvruk			+
	Brassica L./*Sinapis* L.	Brassica/Mustard	Kaghamb/Mananekh			+
	Camelina Crantz.	False flax	Soruk			+
	Thlaspi L.	Pennycress	Shnkotem			+
Capparaceae	*Capparis* L.	Caperbush	Kapar		+	
Chenopodiaceae	*Beta* L.	Beetroot	Bazuk		+	
Cornaceae	*Cornus* L	Cornelian cherry/ Dogwood	Hon			+
Cucurbitaceae	*Citrullus* Forsk.	Water melon	Dzmeruk		+	
	Cucurbita L.	Cucurbit	Ddum		+	
	Melo Adans.	Melon	Sekh		+	
Cupressaceae	*Juniperus* L.	Juniper	Gihi		+	
Elaeagnaceae	*Elaeagnus* L.	Oleaster	Pshateni		+	
Fabaceae	*Lathyrus* L.	Vetchling	Tapvolor			+
	Lens Adans.	Lentil	Vosp			+
	Medicago L.	Medick	Arvuyt			+
Juglandaceae	*Juglans* L.	Walnut	Ynkuzeni		+	
Lamiaceae	*Leonurus* L.	Motherwort	Aryutsagi			+
Linaceae	*Linum* L.	Flax	Ktavat		+	
Malvaceae	*Gossypium* L.	Cotton	Bambak		+	
Oleaceae	*Fraxinus* L.	Ash tree	Hatseni		+	
Papaveraceae	*Glaucium* Adans.	Horned poppy	Tsaghkakakach			+
	Papaver L.	Poppy	Kakach		+	
Poaceae	*Agropyron* Gaertn.	Crested-wheat grass	Sez		+	
	Hordeum L.	Barley	Gari	+	+	
	Oryza L.	Rice	Brindz			+
	Panicum L.	Millet	Korek			+
	Phragmites Adans.	Reed	Yegheg	+	+	
	Sorghum Moench	Sorghum	Sorgo		+	
	Triticum L.	Wheat	Tsoren	+	+	
Polygonaceae	*Polygonum* L.	Knotweed	Matitegh			+
Ranunculaceae	*Delphinium* L.	Larkspur	Vojlakhot			+
	Ranunculus L.	Buttercup	Gortnuk			+
Rosaceae	*Amygdalus* L.	Almond	Nsheni		+	
	Armeniaca Mill.	Apricot	Tsiraneni		+	
	Cerasus Juss.	Cherry	Baleni		+	
	Crataegus L.	Hawthorn	Szni, Alotch			+
	Persica Mill.	Peach	Deghdzeni		+	
	Prunus Mill.	Plum	Saloreni, Dambul	+	+	
	Pyrus L.	Pear	Tandzeni		+	
	Rosa L.	Rose	Masreni		+	
	Rubus L.	Raspberry/Blackberry	Aznvamori/Mosheni			+
Rubiaceae	*Galium* L.	Bedstraw	Makardakhot			+
	Rubia L.	Madder	Toron			+
Solanaceae	*Hyoscyamus* L.	Henbane	Bangi		+	
Tamaricaceae	*Tamarix* L.	Tamarisk	Karmran	+		
Ulmaceae	*Celtis* L.	Hackberry	Prshni	+	+	
Valerianaceae	*Valeriana* L.	Valerian	Katvakhot			+
Vitaceae	*Vitis* L.	Grape	Khaghogh	+	+	

Table 2
AMS 14C determinations for the grapes from Areni-1 (calibrated using OxCal Ver. 3.5 based on the last atmospheric dataset OxCal v.3.10 (Bronk Ramsey and Lee 2013) and IntCal13 (Reimer *et al*. 2013).

N	Lab number	Context	Dated object	Date	Calibrated age range (68.2% probability)	Calibrated age range (95.4% probability)
1	UCIAMS-40184	Trench 1, Unit 1002, Locus 11	*Vitis* sp., trunk	5240±20 BP	4050–3990 BC	4230–3970 BC
2	AA-95788	Trench 1, Unit 3, Sq.R19/20, Locus 2, Spits 6–7	*Vitis* sp., trunk	5096±41 BP	3960–3800 BC	3980–3790 BC
3	AA-95789	Trench 3, Sq.J26, Spit 11	*Vitis* sp., trunk	5055±47 BP	3950–3790 BC	3970–3710 BC
4	AA-95788	Trench 1, Unit 3, Square R18, Locus 19, Spit 3	*Vitis* sp., trunk	3694±41 BP	2140–1980 BC	2200–1950 BC
5	AA-103199	Trench 1, Unit 3, Sq.N17, Locus 27	*Vitis* sp., trunk	1567±32 BP	435–535 AD	410–600 AD
6	AA-103198	Trench 3, Sq.I23/J24, Sp.6	*Vitis* sp., trunk	1132±40 BP	885–985 AD	780–1000 AD
7	OxA-24177	Trench 1, Unit 3, Sq.L18, Pit 1, Spits 8–25	*Vitis* sp., trunk	841±24 BP	1160–1245 AD	1150–1270 AD
8	AA-103200	Trench 1, Unit 3, Sq.N16, Locus 76a	*Vitis* sp., trunk	840±32 BP	1160–1255 AD	1060–1280 AD
9	OxA-24048	Trench 1, Unit 3, Sq.N16, Locus 29	*Vitis* sp., trunk	831±24 BP	1190–1260 AD	1160–1270 AD
10	OxA-24178	Trench 1, Unit 3, Sq.L18, Pit 1, Spits 8–25	*Vitis* sp., trunk	817±24 BP	1215–1259 AD	1185–1280 AD

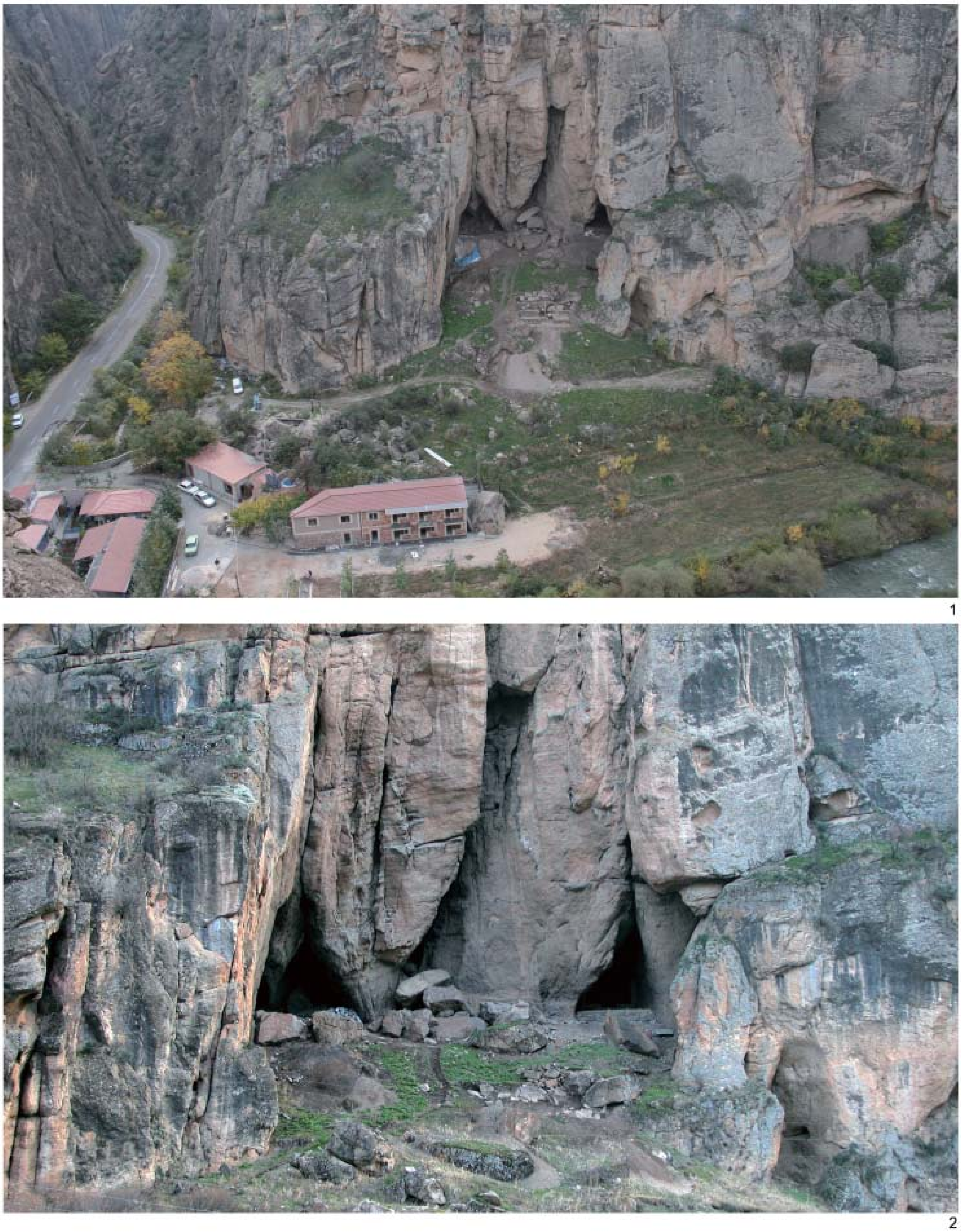


Figure 1

1. Photograph showing the Arpa River canyon and the junction with the Gnishik tributary in the foreground and Areni-1 cave in the background; 2. Photograph showing the main view of the entrance of the cave.

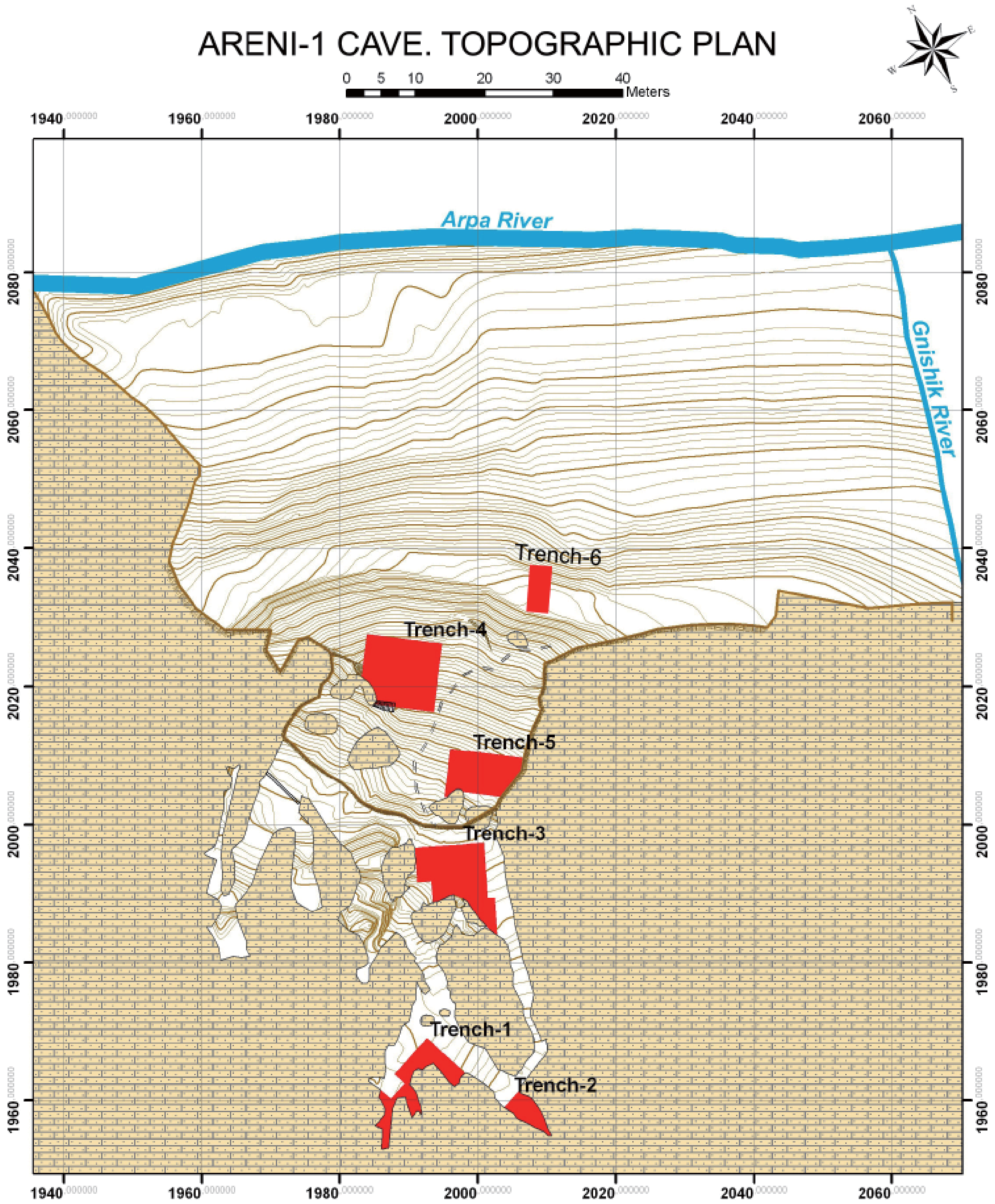


Figure 2
Topographic plan of the cave highlighting the location of Trenches 1–6.

1

2

Figure 3

1. Photograph of the grape pressing installation used for wine production in Trench 1; 2. Photograph showing earthenware pots (karases) used for storing wine near the pressing installation. Grape wood and reed stems are preserved in one of them (Locus 11).

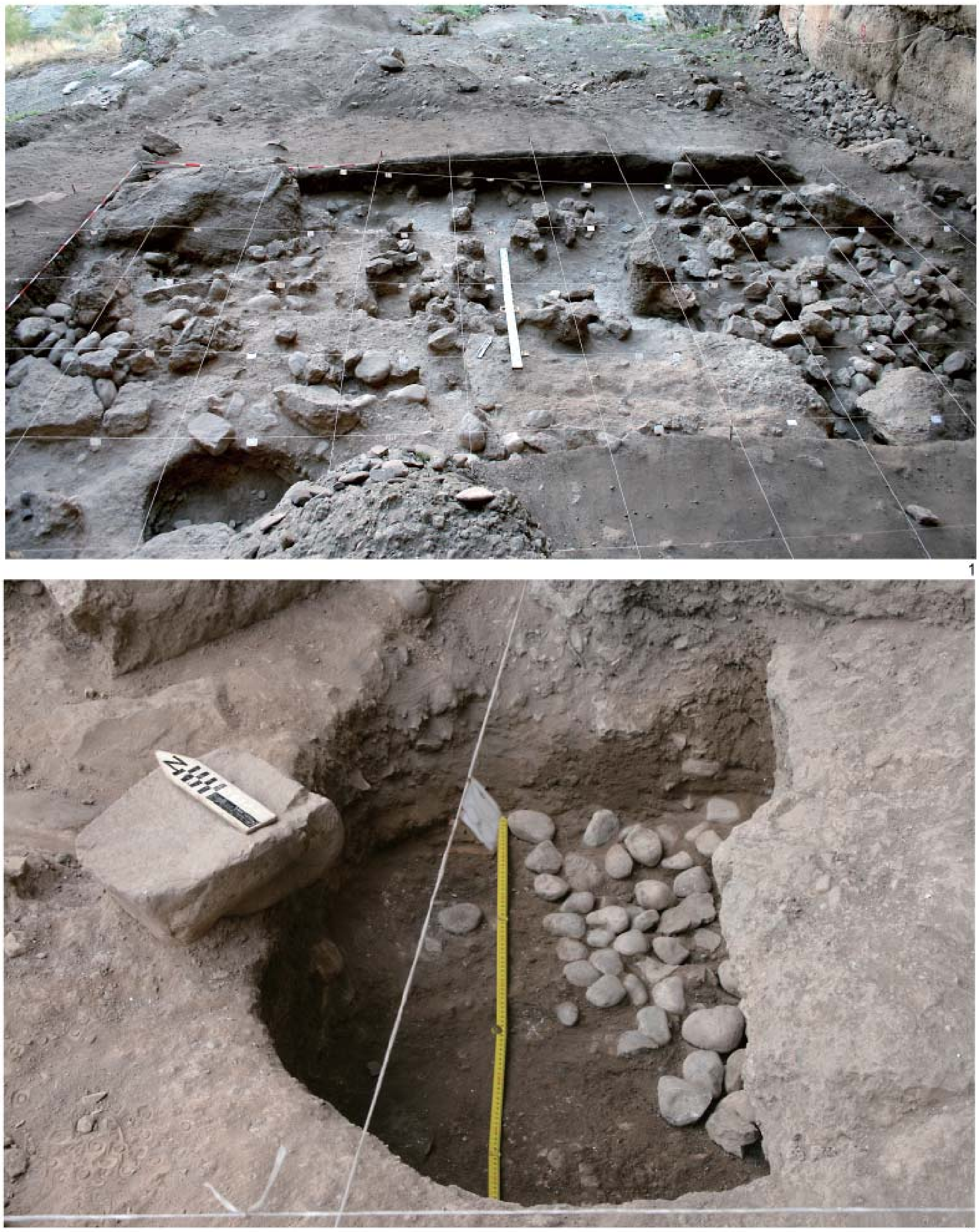
Figure 4

1. Photograph showing the main view of Trench 2; 2. Two-handled vessel discovered within Trench 2 filled with desiccated plant remains.

Figure 5
1. Photograph showing the main view of Trench 3; 2. Photograph showing a concentration of cotton seeds in Trench 3 (Square L35).

Figure 6

1. Photograph showing main view of Trench 4; 2. Photograph showing transverse section in Trench 4.



1

2

Figure 7
1. Photograph showing main view of Trench 5; 2. Photograph showing the Chalcolithic household pit excavated in Trench 5.

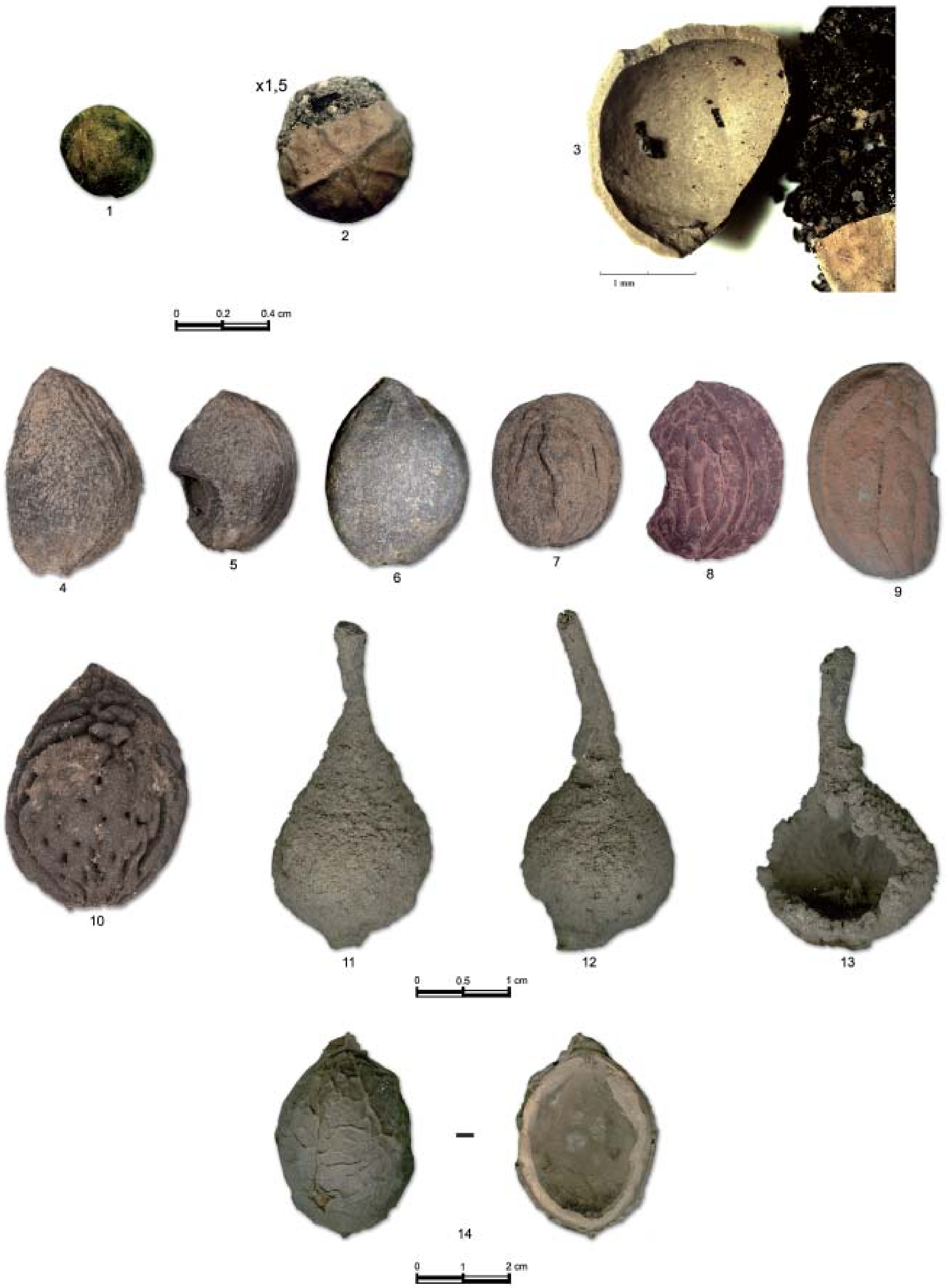


Figure 8

Photographs of plant remains. 1. *Celtis* sp. stone; 2. *Celtis* sp. stone; 3. Broken *Celtis* sp. stone and contents; 4. *Armeniaca* sp. endocarp; 5. *Prunus* sp. endocarp; 6. *Prunus* sp. endocarp; 7. *Amygdalus* sp. endocarp; 8. *Amygdalus* sp. endocarp; 9. *Amygdalus* sp. endocarp; 10. *Persica* sp. endocarp; 11. Desiccated *Pyrus* sp. fruit; 12. Desiccated *Pyrus* sp. fruit; 13. Desiccated *Pyrus* sp. fruit; 14. *Juglans* sp. endocarp.

Figure 9

Photographs of plant remains. *Vitis* sp. 1–4. Stems; 5. Bark; 6. Pedicels.

Figure 10
Photographs of plant remains. *Vitis* sp. 1–13. Pips.

Figure 11

Photographs of grass (Poaceae) remains. 1. *Panicum* sp. panicle; 2. *Sorghum* sp. panicle; 3. Free-threshing *Triticum* sp. culm and rachis segments; 4. *Triticum* sp. ear; 5. *Triticum* sp. caryopsis; 6. *Hordeum vulgare* L. caryopsis; 7. *Panicum* sp. caryposis; 8. *Panicum* sp. spikelet; 9. *Oryza* L. spikelet.

Figure 12
Photographs of fiber-related remains. 1. *Phragmites* sp.; 2. Chalcolithic period basketry fragment; 3. *Gossypium* sp. boll; 4. Medieval cotton textile fragment; 5. Fragment of a Chalcolithic linen fishing net.

Forest Exploitation during the Holocene in the Aghstev Valley, Northeast Armenia

Makoto Arimura, Boris Gasparyan, Samvel Nahapetyan and Ron Pinhasi

1. Introduction

The territory of the Republic of Armenia is characterized by a diverse landscape. It was formed by complex landforms, including folded ranges, volcanic massifs, deep valleys, high mountainous plateaus, and intermountain depressions (Gasparian 2010, p. 162). The Lesser Caucasus, which is oriented south-east to north-west, was formed by a continental collision between the Arabian and the Eurasian plates. It comprises mountain chains and numerous river gorges. Mountains of the Lesser Caucasus form the watershed of the Kura basin, the largest alluvial plain in the southern Caucasus.

The Aghstev River is located in the Tavush region, in north-east Armenia. Its source is in the Lesser Caucasus, and it flows into the Kura River. The length of the river is 130 km, and its basin covers ca. 2500 km^2. In the territory of the Republic of Armenia, most parts of the Aghstev River flow through narrow and sharp valleys - with a river basin less than 2 km wide. Based on its current large drainage area, the Aghstev Valley must have served as an important route between the Lesser Caucasus, the Kura basin, and the volcanic landscapes of the Armenian Highlands during prehistoric times. Hence, the discovery of numerous prehistoric sites along the basin comes as no surprise.

This paper provides an overview of the records of archaeological sites in the Aghstev Valley, spanning epochs from the Late Pleistocene to the Middle Holocene.

2. Prehistoric sites in the Aghstev Valley and its surrounding areas

During the last decade, different teams, including the present authors, have investigated the sites mentioned here, by means of excavations and surveys. Some of the sites were test-excavated in order to provide a preliminary stratigraphic cultural sequence. In the following discussion – except for several radiocarbon dates obtained from well-defined contexts of some of the sites – all chronological determinations are relative, and are based on the typological and technological attributes of artifacts (mainly lithics). Thus, the attributed chronological framework provided below should be regarded as preliminary, and may be subject to future changes and modifications.

2.1. Barepat-1

Barepat-1 is a small mountainous cave site situated on the left side of the Barepat River (tributary of the Getik River), north of Lake Sevan, 1700 m asl. (Cherkinsky and Chataigner 2010). A test excavation was carried out in 2007 by an Armenian-French team (Directors: Boris Gasparyan and Christine Chataigner), and was followed by longer fieldwork in 2008–2009 by a team from the Institute of Archaeology and Ethnography studying the Stone Age sites of the Aghstev River basin (Figure 1). Excavations revealed 1 m depth of cultural deposits in the cave containing some potsherds, ground stones, obsidian artifacts, bone tools, and faunal remains (Figure 2). One bone sample from the test trench was dated to the range of 4,273–4,146 Cal BC (UGAMS-2818, 5360 ± 40 BP).

Obsidian artifacts are relatively abundant, and include regular blade tools (produced by using a pressure-flaking technique), a massive core, and flake tools (Figure 3). Additionally, a diagnostic obsidian tool – a semi-circular microlith (lunate) – was discovered (Figure 3: 8). The back of this tool is formed by bidirectional retouch. This type of microlith is known from Chalcolithic sites such as the Tsaghkahovit-1 rock-shelter located on the Aragats Mountain (Arimura *et al*. 2012). The radiocarbon dates from Berepat-1 and Tsaghkahovit-1 all fall in the fourth quarter of the 5th millennium BC, Late Chalcolithic period.

2.2. Hovk rock-shelters

An aggregate of Stone Age caves and rock-shelter sites in the Aghstev Valley was discovered by an Armenian-British-Irish joint team (Directors: Boris Gasparyan and Ron Pinhasi), north-west from the modern village of Hovk, 20 km east of Dilijan, on the south-eastern side of the Ijevan Mountain Range (Pinhasi *et al*. 2006). These sites are located at a relatively high altitude, circ, 1800–2000 m asl. One of the sites in the area, Hovk-1 cave excavated between 2005 and 2009, provided novel information about the Middle Paleolithic human occupation and activity in the high elevation regions in the southern Caucasus (Pinhasi *et al*. 2011).

Among discovered sites, Hovk-1 and Hovk-3 rock-shelters were test-excavated (Figures 4-6). The excavations at Hovk-1 rock-shelter showed human occupations of various prehistoric periods – from the Chalcolithic to the Bronze Age (5th to 2nd millennia BC) and Middle Age (10th–11th centuries AD) – represented by more than 1 m of deposits, containing some potsherds, obsidian artifacts, beads, coins, a little faunal remains, and lenticular ash sediments (fire places?). This indicates that the high elevation area was continuously visited by people for a long time, probably for hunting, and in later periods for transhumance.

There are not many artifacts which are unique to specific periods, and so would enable us to accurately define the relative chronology of occupation in Hovk-1 and Hovk-3 rock-shelters prior to the Bronze Age. Among the obsidian artifacts from Hovk-1 and Hovk-3, there are a few diagonostic pieces which can be attributed to certain period (Figures 7-8). However, the presence of lunates in these sites is significant (Figure 8: 7-8, 11) and, as noted above, this type is used as arrowhead components in the Chalcolithic. The presence of lunates could indicate that both Hovk-1 and Hovk-3 rock-shelters were probably occupied during the same period, the Late Chalcolithic.

An open-air site, "Hovk-1 settlement", was discovered on an old terrace of the Aghstev River (Figure 9: 1). The terrace is bisected by a modern highway, and was discovered when some obsidian artifacts were detected in a paleosol layer. A small section-cleaning was conducted (Figure 9: 2), and it produced some obsidian and flint artifacts, very limited and badly preserved faunal remains, and some wood charcoal. Obsidian artifacts included a conical core, blade-like flakes, regular blades, and pressure-retouched blade tools (Figure 10). These pieces, together with the stratigraphic position of the finds, indicate that the site was occupied during the Early to Middle Holocene. It is not clear, however, whether this site was occupied during a single or multiple periods, although one radiocarbon date from charcoal samples taken from the excavations gave a date falling at the first quarter of the 5th millennium BC (4,894–4,888 Cal BC: UGAMS-2288, 5880 ± 50 BP), which corresponds to the Early Chalcolithic.

2.3. Yenokavan-1 and -2 caves

Two caves, Yenokavan-1 and -2, are located on relatively lower elevations (1200 m asl.) in a deep canyon of the Khachaghbyur River, a tributary of Aghstev River, which passes through limestone formations of the Ijevan Mountain Range near the Yenokavan and Getahovit villages. These two karst caves were test-excavated by the Armenian-British team (Directors: Boris Gasparyan and Ron Pinhasi, Figures 11 and 13). Soundings were conducted at both sites in 2007–2008. Trenches at both caves produced archaeological materials from different occupational phases (Figures 12 and 14), especially in the larger cave, at Yenokavan-2, archaeological layers are better preserved and are represented by more than 2.5 m of cultural deposits, including a hearth with ash layers and burials (Figure 13: 2). They are divided into the Middle Age, the Iron Age, the Late Bronze Age, the Early Bronze Age, and earlier occupation. The most impressive layer is that of the Early Bronze Age, which is >1 m thick, with dense finds of pottery fragments, faunal remains and a tool made from a deer antler[1]. Pits and hearths made by the Early Bronze Age inhabitants of the cave partly damaged the earlier cultural layer, which was exposed in limited squares at the end of the 2008 season. This layer has provided approximately 30 lithic implements made from obsidian and local flint (Figure 14), as well as faunal remains. Among them, the presence of the so-called “Kmlo tool”, made from obsidian (Figure 14: 7), is quite important since this piece could be of the Early Holocene. Early Holocene sites in the southern Caucasus, and especially in Armenia, are usually found in volcanic environments with very limited faunal remains, and are poorly known. Further investigation is needed in the Yenokavan-2 cave, where faunal preservation will allow accurate dating of this cultural phenomenon.

Excavations at Yenokavan-1 yielded some obsidian and flint artifacts including a small number of pottery fragments, and some faunal remains, from Holocene deposits. These belonged to different periods, and are from a mixed stratigraphic context, due to the natural sloping of the cave deposits. A bladelet core from local flint, obsidian and flint bladelets and tools (of which an obsidian rounded scraper is the most significant), seems, on the basis of typological classification, to belong to the Chalcolithic period (Figure 12: 16).

3. Discussion and concluding remarks

All cave and rock-shelter sites mentioned in this article are small, and they were probably short-stay camps. Except for the Hovk sites, all of them are located in the forested area, 900–2000 m asl. (Figure 15). It should be noted that these sites are located on the lower slopes of mountains, where one can have a good view of the bottom of the valley. Such locations could imply that hunters were the primary occupants of these cave/rock-shelter sites. The finding of lunates, one type of a composite

1. The artifact is dated OxA-21229, 3895 ± 26 BP, 2,470–2,290 Cal BC (2 sigma range).

hunting weapon, supports this hypothesis.

On the other hand, we will not exclude the possibility of other functions being conducted at some of these sites: collecting organic resources like plants, trees, fruits, and minerals was probably part of the forest resource exploitation practiced by the ancient people. For example, flint outcrops were found near Yenokavan village. Karst Mountains in the Aghstev Valley have many flint sources, which were attractive for prehistoric stone knappers.

The presence of human occupations at Hovk cave, and rock-shelters at an elevation of >2000 m asl. indicates that the area above the forest line was also exploited frequently by prehistoric people. The exact purpose of their visits, however, remains elusive. Rich faunal remains, especially large mammals (wild goat and red deer), recovered from the Middle Paleolithic context of Hovk-1 cave, suggest that this high elevation region was an area used for hunting and trapping wild animals (Bar-Oz *et al*. 2012).

As mentioned above, all cave/rock-shelter sites in the Aghstev Valley are relatively small, and they were probably occupied for short periods. The people who occasionally occupied these sites may have come from other regions. Alternatively, further excavations at the Hovk-1 settlement site on the terrace of the Aghstev River may elucidate a relationship between a base-camp site (Hovk-1 settlement) and ephemeral sites (other mountain cave/rock-shelter sites) within the Aghstev Valley itself.

The radiocarbon dates indicate that most sites were occupied during 5th millennium BC (Barepat-1 cave, Hovk-1 settlement). If our assumption regarding the chronological position of lunates is correct, we could add Hovk-1 and -3 rock-shelters as sites with Late Chalcolithic occupations. Additionally, recent excavations at Getahovit-2 conducted by the Armenian-French joint project “Mission Caucasus” (Kalantaryan *et al*. 2012), located in a small valley formed by Khachagbyur River, a tributary of the Aghstev River, also provided similar cave occupation in the late 5th millenium BC. Two obsidian lunates were also recovered from the site. One emerging question in regard to Getahovit-2 concerns the types of human groups that occupied this site. These may have been hunter-gatherers, or pastoral nomads (day-trip herding or transhumance). Getahovit-2 has a rich of archaeological record, and future studies of the cave will provide more information about human activities in this mountainous area during the Chalcolithic period.

In sum, we infer that people exploited the forested areas of the Aghstev Valley intensively during the Chalcolithic period. As noted above, the presence of the Yenokavan-2 material may imply earlier human occupation at this site (the Early Holocene). As the evidence from Hovk-

1 cave in the Middle Paleolithic has shown, the forested area, even including the high-elevation zone >2000 m, had already been exploited at the beginning of the Upper Pleistocene, and it is not surprising that this area was continuously used by different groups during the Early to Middle Holocene.

The farming economy was established in the lowlands (Kura basin, Ararat plain) of the southern Caucasus for the first time in the 6th millennium BC (the Neolithic). It therefore remains to be investigated how and when the spread of agriculture first influenced mountain regions such as the Aghstev Valley. This important research topic will be further investigated in the coming years.

References

Arimura, M., Gasparyan, B. and Chataigner, C. (2012) Prehistoric sites in northwest Armenia: Kmlo-2 and Tsaghkahovit. In: Matthews, R. and Curtis, J. (eds.), *Proceedings of the 7th International Congress on the Archaeology of the Ancient Near East. Volume 3*.Wiesbaden: Harrassowitz Verlag, pp. 135–149.

Bar-Oz, G., Weissbrod, L., Gasparian, B., Nahapetyan, S., Wilkinson, K. and Pinhasi, R. (2012) Taphonomy and zooarchaeology of a high-altitude Upper Pleistocene faunal sequence from Hovk-1 cave, Armenia. *Journal of Archaeological Science* 39, pp. 2452–2463.

Chataigner, C. (ed.) (2013) Mission Caucase, rapport scientifique 2013.

Cherkinsky, A. and Chataigner, C. (2010) 14C ages of bone fractions from Armenian prehistoric sites. *Radiocarbon* 52/2, pp. 569–577.

Gasparian, B. (2010) Landscape organization and resource management in the Lower Palaeolithic of Armenia. *TÜBA-AR* 13, pp. 159–183.

Kalantaryan, I., Arimura, M., Hovsepyan, R. and Chataigner, C. (2012) The Archaeological Investigations of Getahovit-2 cave (Armenia) in 2011–2012: The Preliminary Results. *Aramzd* 7 (1), pp. 7–23.

Pinhasi, R., Gasparian, B., Wilkinson, K., Schreve, D., Branch, N. and Nahapetyan, S. (2006) The archaeology of Hovk, north-east Armenia: A preliminary report. Project Gallery, *Antiquity* 80 (308), (http://antiquity.ac.uk/projgall/pinhasi308/, 09/02/2014 accessed).

Pinhasi, R., Gasparian, B., Nahapetyan, S., Bar-Oz, G., Weissbrod, L., Bruch, A.A., Hovsepyan, R. and Wilkinson, K. (2011) Middle Palaeolithic human occupation of the high altitude region of Hovk-1, Armenia. *Quaternary Science Reviews* 30, pp. 3846–3857.

Figure 1

1. Main view of the Barepat-1 cave from north-east;
2. Trench opened in Barepat-1 cave by the end of 2009 excavations.

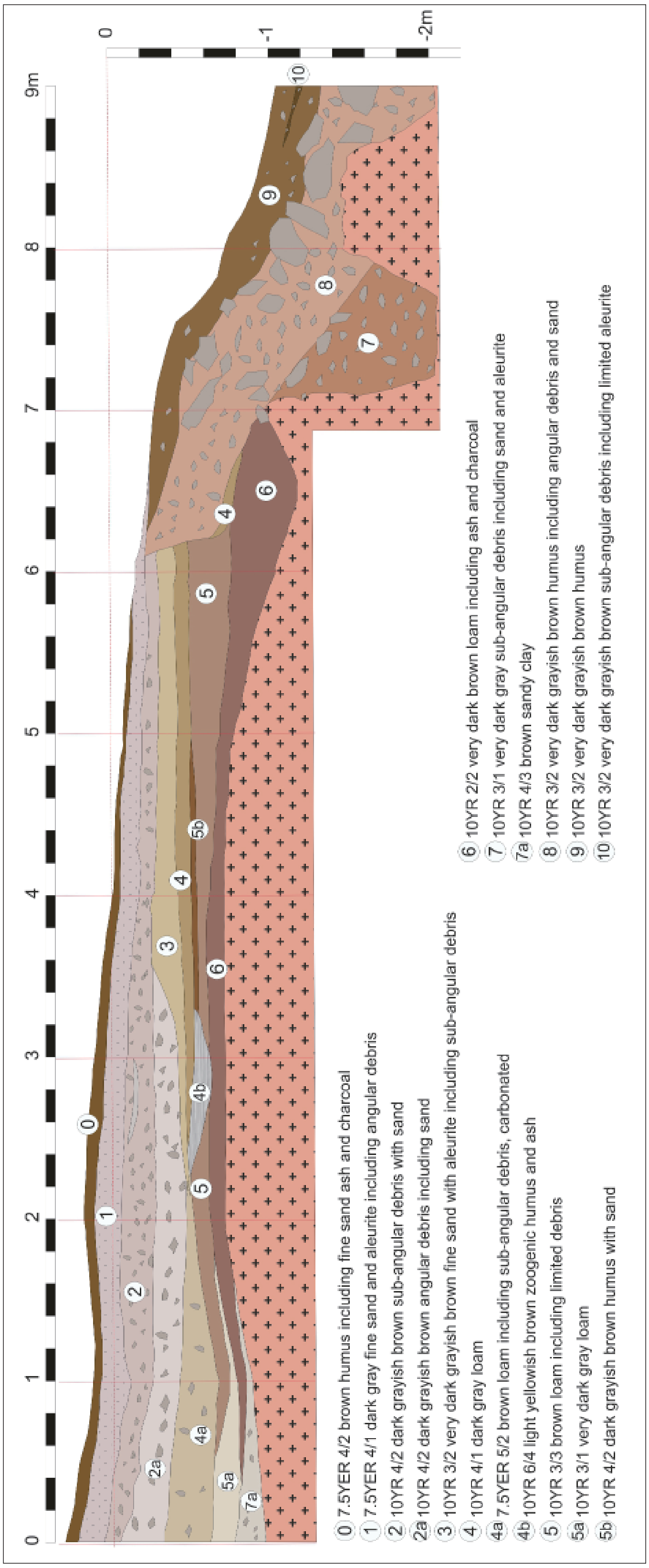


Figure 2
Barepat-1 cave. Profile drawing of the eastern wall of the trench in the 2008 excavation.

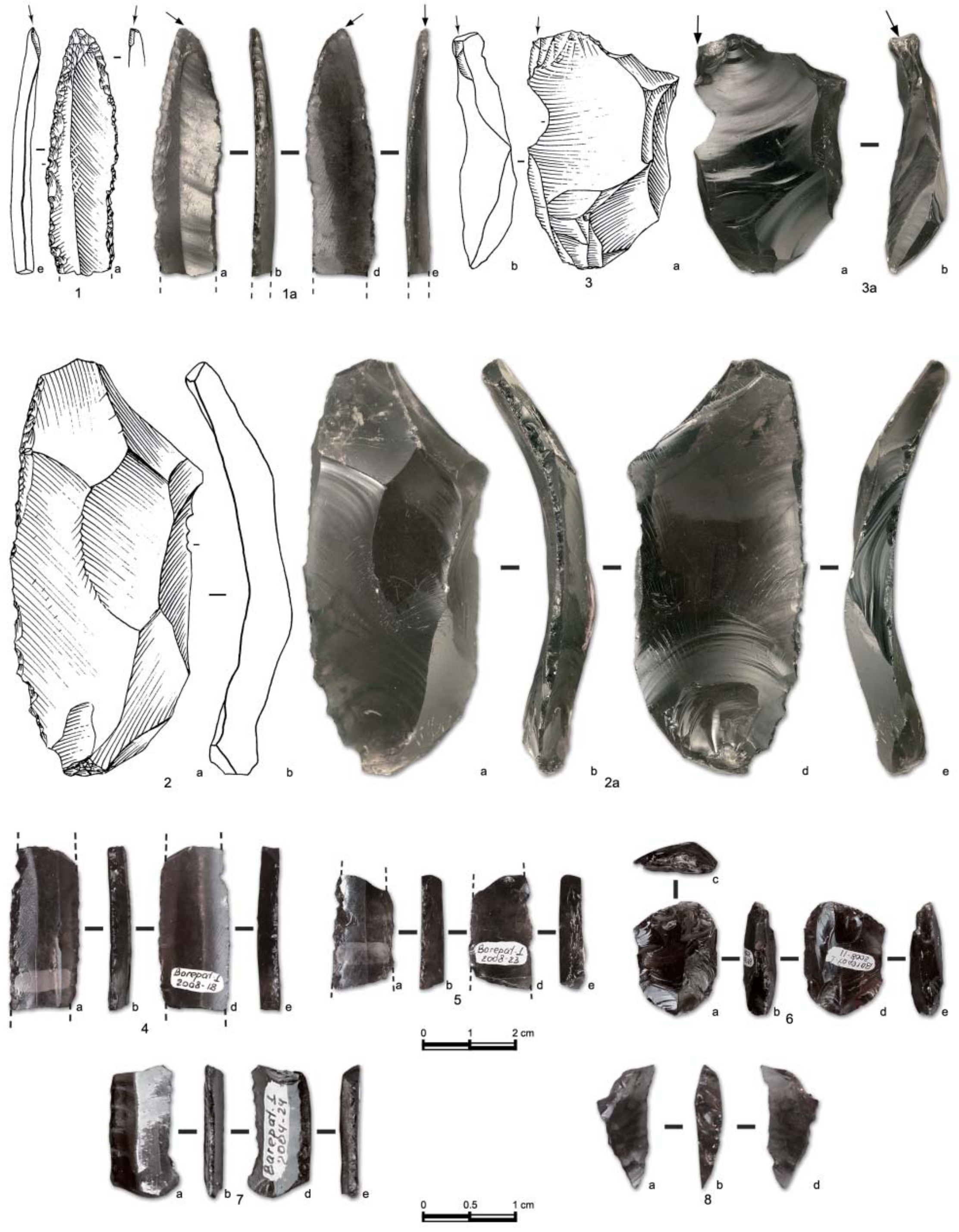


Figure 3
Late Chalcolithic selected obsidian artifacts from the excavations of Barepat-1 cave.
1-1a. Point; 2-2a. Side scraper; 3-3a. Burin; 4-5. Retouched blades; 6. Chisel or *pièce esquillée*; 7. Backed bladelet; 8. Lunate.

Figure 4

1. Main view of the Hovk-1 rock-shelter from east;

2. Trench opened in Hovk-1 rock-shelter by the end of 2009 excavations.

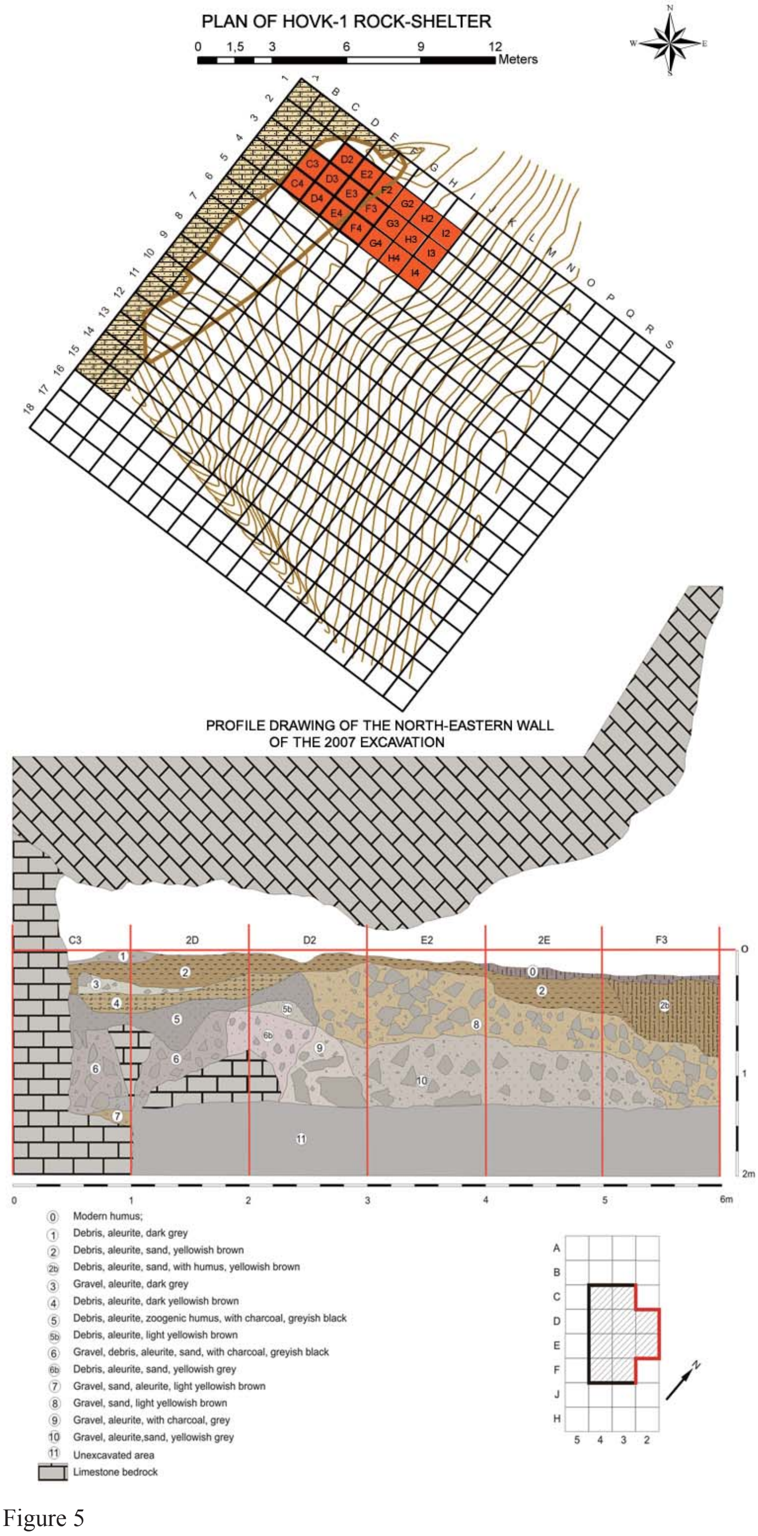


Figure 5

1. Plan of Hovk-1 rock-shelter. Red color is marking the excavated squares;

2. Profile drawing of the north-eastern wall of the trench from 2007 excavations.


1


2

Figure 6
1. Main view of the Hovk-3 rock-shelter from north-east;
2. Test sounding at the Hovk-3 rock-shelter from 2008 excavations.

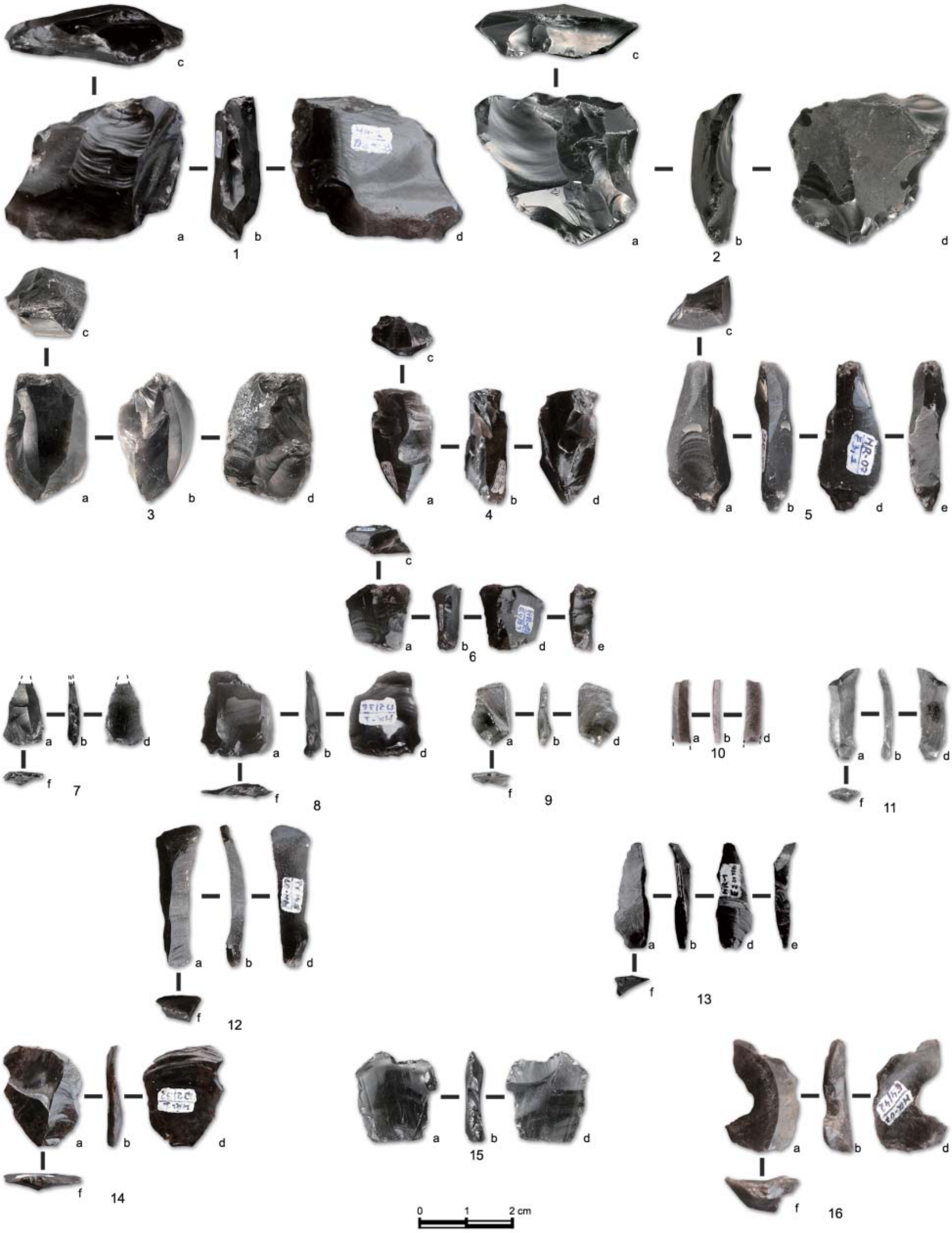


Figure 7
Late Chalcolithic selected obsidian artifacts from the excavations of Hovk-1 rock-shelter.
1-6. Small cores; 7-9. Small flakes; 10-11. Bladelets; 12-13. Retouched bladelets; 14-16. Notched tools.

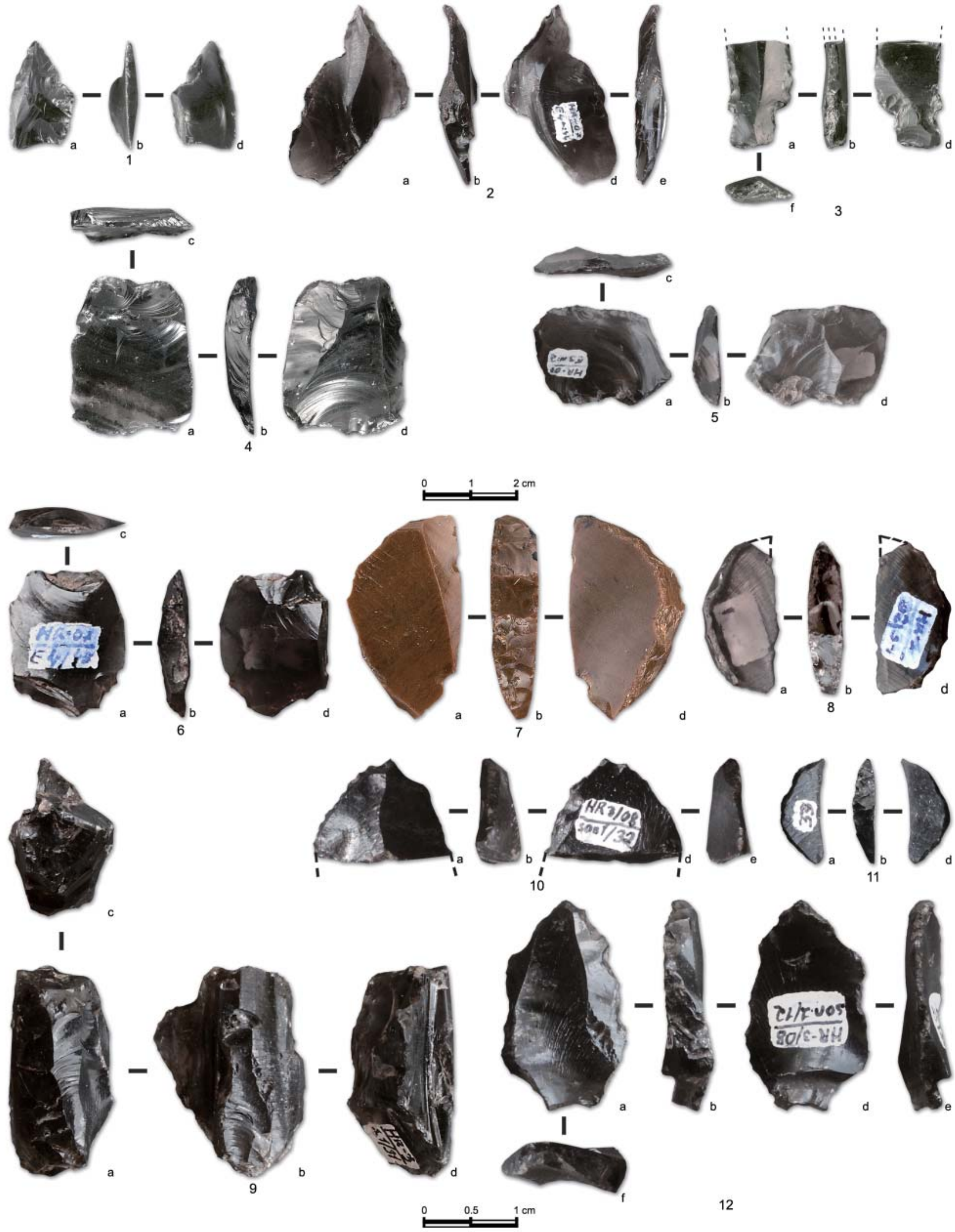


Figure 8
Late Chalcolithic selected obsidian artifacts from the excavations of Hovk-1 (1-8) and Hovk-3 (9-12) rock-shelters. 1-2, 10. Points; 3, 12. Arrowheads; 4-6. Chisels or *pièce esquillées*; 7-8, 11. Lunates; 9. Small prismatic core.

1

2

Figure 9

1. Section of Hovk-1 settlement opened by the highway construction (view from east);

2. Section of 2006 test trench at Hovk-1 settlement.

Figure 10
Selected Early Chalcolithic obsidian artifacts from Hovk-1 settlement. 1. Conical core (refitting); 2. Bladelet core on flake; 3-4. Retouched blades; 5. Point; 6. Endscraper; 7-8. Chisels or *pièce esquillées*; 9. Arrowhead; 10. Transverse arrowhead.

1

2

Figure 11

1. The entrance of Yenokavan-1 cave from west;
2. Test sounding at Yenokavan-1 cave from 2008 excavations.

Figure 12
Selected artifacts from the excavations of Yenokavan-1 cave.
1. Prismatic core (flint); 2-3. Small flakes (flint); 4, 7. Blades (4: flint, 7: obsidian); 5, 8. Retouched flakes (5: flint, 8: obsidian); 6. Retouched bladelet (flint); 9. Sickle element (obsidian); 10. Double scraper (flint); 11. Partial scraper (flint); 12. Scraper-burin (green chalcedony); 13-15. Chisels or *pièce esquillées* (obsidian); 16. Rounded scraper (obsidian).

1

2

Figure 13

1. Main view of Yenokavan-2 cave from south;
2. Trench opened inside of the Yenokavan-2 cave by the end of 2008 excavations.

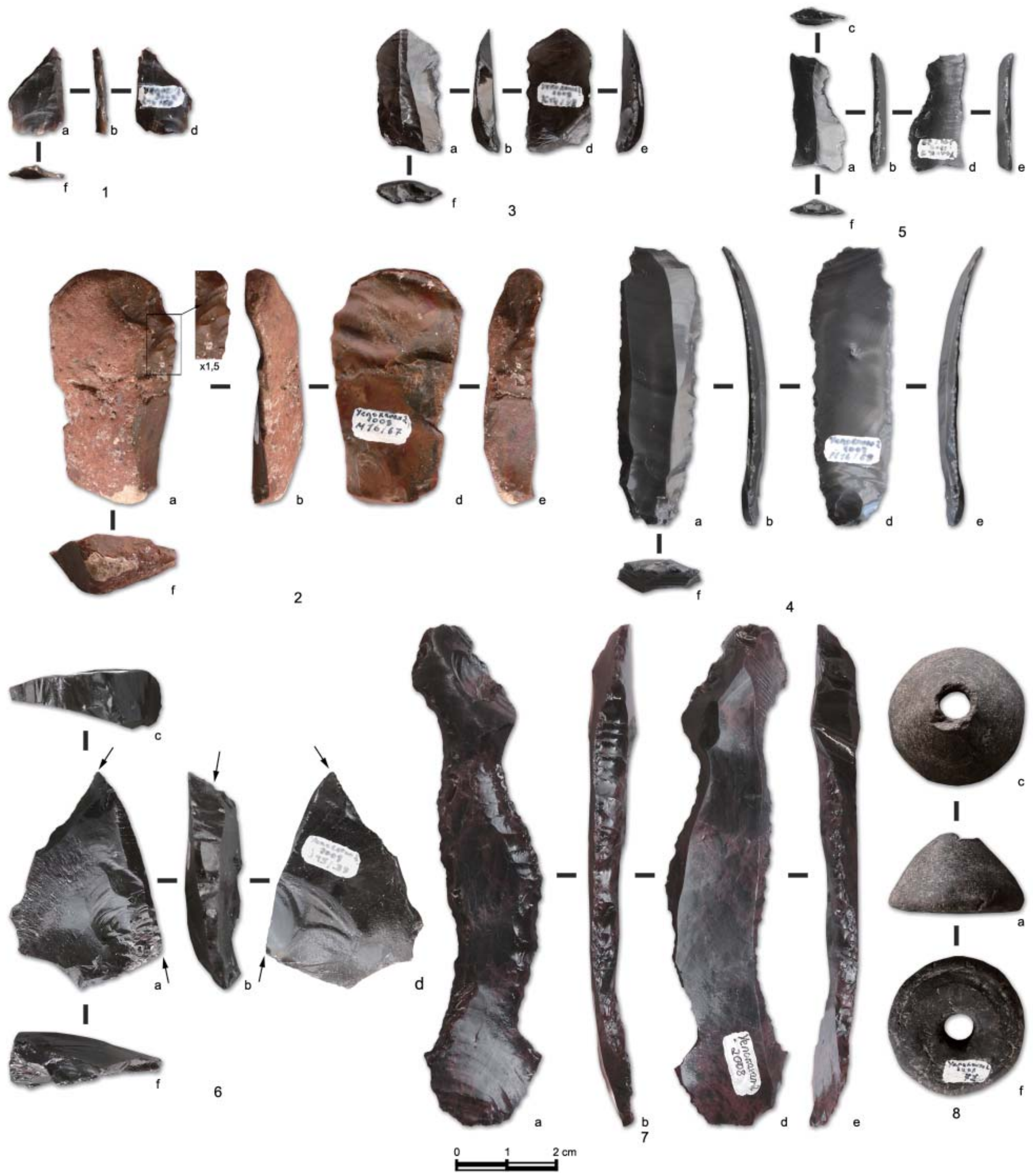


Figure 14

Selected Early Holocene (1-7) and Early Bronze Age (8) artifacts from Yenokavan-2 cave.

1. Small flake (flint); 2. Retouched flake (flint); 3-5. Retouched blades (obsidian); 6. Burin (obsidian); 7. “Kmlo tool” (obsidian); 8. Spindle whorl (clay, 2,400–2,200 Cal BC).

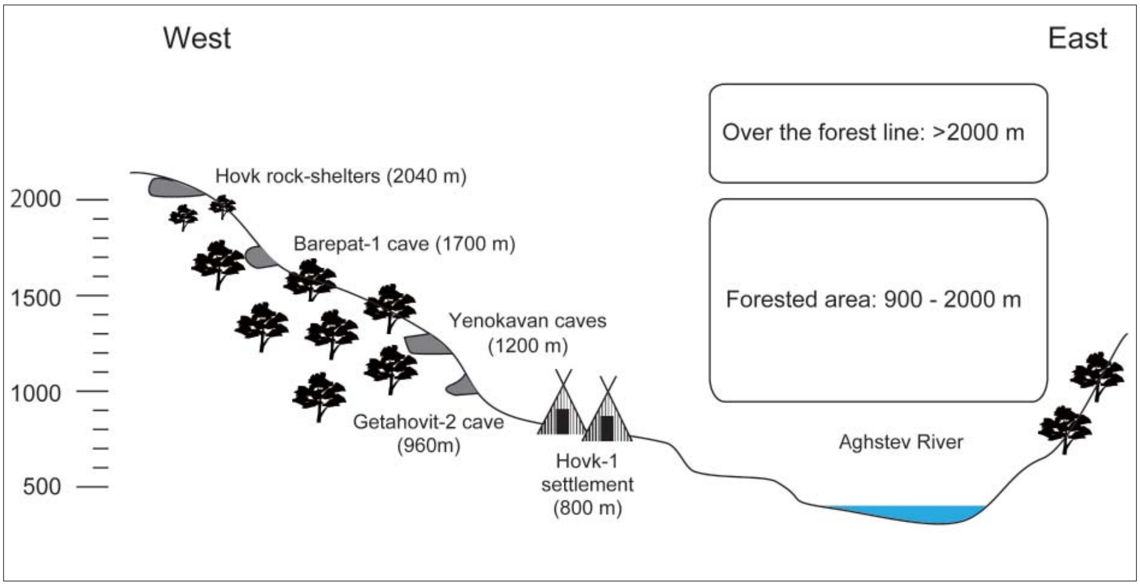


Figure 15
Schematic diagram for locations of sites mentioned in the text.

Transition to Extractive Metallurgy and Social Transformation in Armenia at the End of the Stone Age

Arsen Bobokhyan, Khachatur Meliksetian, Boris Gasparyan, Pavel Avetisyan, Christine Chataigner and Ernst Pernicka

1. Introduction

Recent archaeological work in the South Caucasian region in general and in Armenia in particular, accompanied by a great quantity of new C14 data, have fundamentally changed our reconstructions of the development of the Neolithic and Chalcolithic in the region. In particular, we now know that the southern Caucasus was part of a greater Near Eastern network linked by common technological practices and structural transformations. One of the most important of these transformations was the first use of metal, the appearance of which at the end of the Stone Age had a great impact on various spheres of human society and resulted in an increase in productivity, the accumulation and redistribution of wealth, the growth of social stratification, status, and power, the functional differentiation of society, and the development of long distance trade. It is widely accepted that the earliest evidence of copper smelting, frequently defined as the “first technological revolution” (around 5,000 BC), is limited to regions of the Near East, southeastern Europe, the Iranian Plateau, and the southern Caucasus. The early appearance of metallurgy in the southern Caucasus and the abundance of copper and polymetallic ores make this region particularly important for archaeometallurgical studies. In spite of this, our knowledge about the earliest metallurgy in the region remains limited, and any new discovery such as metal artifacts and metalworking attributes provide an opportunity to study not only the earliest stages of metal production but to understand technology and artifact provenance. During last decade, important evidence of early metalworking has been recovered in Armenia at number of Chalcolithic sites such as Areni-1 cave and the settlements of Nerkin Godedzor and Mushakan-4. This paper provides an introduction to recent archaeological and archaeometallurgical investigations and attempts to summarise the earliest evidence of copper based metal production in Armenia.

2. Armenia at the End of the Stone Age

According to new data based on recent stratigraphic observations and C14 chronology, we can reconstruct the following sequence of archaeological traditions in Armenia at the end of the Stone Age:

The Early Holocene (Mesolithic/Proto-Neolithic, ca. 10,000–7,500 Cal BC) is represented by sites of Apnagyugh/Kmlo tradition like Apnagyugh-8/Kmlo-2 cave, Kuchak-1 rock-shelter, and the open-air site of Gegharot-1, among others. This period is characterized by a society at the gateway of a food-producing life style, yet continues to live much like the hunters and gatherers of the preceding Pleistocene. Early Neolithic sites (ca. 7,500–6,000 Cal BC) that evidence the beginnings of a food-producing economy have not yet been recorded in Armenia nor in the southern Caucasus as a whole.

The Late Neolithic (ca. 6,000–5,200 Cal BC) is represented by sites of the "Aratashen-Shulaveri-Shomutepe" tradition like Aratashen (Horizons I-II), Aknashen/Khatunarkh (Horizons II-V), and Masis Blur. The Armenian sites had links to the Syro-Mesopotamian world (e.g. Samarra and Halaf). Society is characterized by a sedentary economy, the full establishment of a food-producing life style, a more-or-less uniform cultural complex, the beginning of pottery production, and first use of native copper.

The Early/Middle Chalcolithic (ca. 5,200–4,300 Cal BC) is known by the "Adablur" and "Sioni" traditions, with sites such as Aratashen (Horizon 0), Aknashen (Horizon I), Artashat, Adablur, and Mushakan-4. Armenian late Middle Chalcolithic settlements have close connections with sites like Sioni, which developed in the Kura Basin after the disappearance of the "Aratashen-Shulaveri-Shomutepe" tradition. The present data suggest a change in the economy towards more mobility with the shifts towards early extractive copper metallurgy. Society is characterized by its relationship to the Syro-Mesopotamian world (Early Ubaid).

The Late Chalcolithic (ca. 4,300–3,500 Cal BC) is represented by the "Areni" and "Godedzor" traditions, with such sites as Areni-1 cave and the settlements of Teghut and Nerkin Godedzor. Society is characterized by a diversity of cultural complexes, growing complexity, relations to the Syro-Mesopotamian (Late Ubaid, Uruk) and North Caucasian (Early Maikop) worlds, as well as extractive copper metallurgy[1].

1. Cf. Badalyan *et al*. 2004; 2007; 2010; Avetisyan *et al*. 2006; Chataigner *et al*. 2007; Arimura *et al*. 2010; Areshian *et*

3. Early South-Caucasian Metallurgy and the Armenian Evidence

The first metal objects, made from native copper, appear during the Neolithic of Anatolia and Iran in the 8th–6th millennia BC. The 5th millennium is characterized by significant changes in a number of regions of the Old World that ultimately led to copper smelting (Pernicka 1990; Meliksetian *et al*. 2011; Pigott *et al*. 1999). The earliest reliable evidence for copper smelting is dated to the 5th millennium BC and is found at sites related to the late Ubaid period in Mesopotamia (Zwicker 1977; Hauptmann 1982; Seeliger *et al*. 1985) and Late Neolithic and Chalcolithic sites in Iran (Piggot 1999). Contemporary copper based metallurgy is also evident in the Balkan region in southeastern Europe (Radivojević *et al*. 2010; 2013).

In the southern Caucasus, early use of metals dates to the 6th millennium BC and is characterized by the extraction of native metal and cold-working-cum-annealing (Khramis Didi-Gora, Arukhlo and Gargalar Tepesi, represented mainly by beads). Copper smelting appears at late 5th millennium BC (Mentesh Tepe, with a mould find). The evidence of metallurgical activities in the region increases in the early 4th millennium BC and is represented by previously known finds from Kültepe I in Nakhijevan, Alikemektepesi (knife, bead like ornaments, made of pure copper, some with low arsenic) and new finds, particularly in the Middle Kura region, such as pit furnaces, slags (Leylatepe), casting molds (Böyük Kesik, Qarakepektepe), heavy tools like axes or knife/daggers (Ovçular Tepesi, Soyugh Bulagh) with use of arsenical copper (Berikldeebi, Böyük Kesik, Leylatepe), and gold and electrum beads (Soyugh Bulagh)[2].

What, then, is the situation in Armenia? Recent excavations in the Ararat valley and southern Armenia revealed new data on early metallurgy from Late Neolithic horizons as well as early (First Stage) and late (Second Stage) Chalcolithic horizons.

First Stage. Copper beads and their fragments as well as some pieces of copper ore minerals from Ararat valley sites represent the earliest known appearance of copper in the southern Caucasus. The finds of azurite and malachite from Aratashen Horizon IId (5,905–5,711 Cal BC)

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al. 2012; Zardaryan and Gasparyan 2012; Avetisyan and Bobokhyan 2012. For historiography of the question and the southern Caucasian context, cf. Munchayev 1975; 1982; Kiguradze 1976; Korobkova 1987; Chataigner 1995; Areshian and Ghafadaryan 1996; Kushnareva 1997. For correlation of cultural and metallurgical developments, cf. Gevorkyan 1980; Meliksetian *et al*. 2011; Courcier 2014 (with further literature). In all these publications we can trace a wide range of diverse terminologies concerning Neolithic-Chalcolithic "cultures/groups/assemblages/complexes/communities/sites" of the region. We use here the neutral term "tradition" to bridge the former culture-historical approaches to modern ones.

2. For detailed history of research and list of materials, cf. Courcier 2014, as well as Courcier *et al*. 2008; 2012; Lyonnet *et al*. 2007; 2012, p. 109; Marro *et al*. 2011, pp. 69-72; Helwing 2012, pp. 212-213.

and Horizon I (probably mid 6th millennium BC), as well as from the nearby site of Aknashen/ Khatunarkh (first half of the 6th millennium BC)[3] have parallels in the 8th–6th millennia sites of Anatolia and Iran (Hallan Çemi, Çayönü, Aşıklı, Hassuna, Yarim Tepe I and II).

In Aratashen IIb (5,878–5,775 Cal BC) a bracelet about 6 cm in diameter made of 57 partly oxidized copper beads and their fragments made of a foil rolled up around a stem was unearthed *in situ*. They were made of native copper (Meliksetian *et al*. 2011), but the technique and shapes are known from the 8th–6th millennia BC at sites in North Mesopotamia (Yarim Tepe I and II, Chagar Bazar) and others of "Aratashen-Shulaveri-Shomutepe" tradition (Gargalar Tepesi, Chalaghantepe).

A ring, a bracelet fragment with secondary use, a hook, a holed disk (bead?), an awl/ retoucher, and a small piece of copper derive from the Chalcolithic settlement Mushakan-4, which probably dates to the third quarter of the 5th millennium BC (Figure 1). Although all of the metal finds from Mushakan-4 are from the disturbed components of Horizon I and only the holed disk (bead?) was found *in situ* from the Chacloithic context (Figure 1: 1), there is no doubt about their belonging to the same layer since the site has an exceptionally well-preserved Chalcolithic occupation (excavations of B. Gasparyan).

Especially important for reconstructions of metallurgical procedures are a basalt pestle-hammer/grinding stone with traces of crashed oxide copper ore and two ceramic crucibles (Figure 6: 7-8) from the Chalcolithic Horizon of Aknashen/Khatunarkh (more probably dating by mid 5th millennium BC).

Second Stage. The transition to extractive metallurgy between the 5th and 4th millennia BC is also evident in the territory of Armenia. The metal objects from the Chalcolithic settlement of Teghut (4,000–3,700 BC), analyzed in the 1970s, turned out to be made of arsenical copper (3–4.6 % As), among which the knife is particularly noteworthy (Figure 7: 2, after new restoration). A similar knife, though with only 0.69% As, was recently found by an Armenian-German joint expedition during excavations at the settlement of Sotk 2 (Horizon IIa, 3,700–3,400 Cal BC) (Figure 7: 3). Four small awls and a ring (Figure 8: 5-9) originate from the Late Chalcolithic settlement of Nerkin Godedzor (3,700–3,400 Cal BC) excavated by an Armenian-French joint expedition (co-directors P. Avetisyan and C. Chataigner): the composition of the pins is similar to the objects from Teghut, showing an arsenical copper with an arsenic content ranging from 4 to 5%[4].

3. Excavation at Aratashen and Aknashen/Khatunarkh are conducted by Armenian-French joint expedition, co-directors R. Badalyan and C. Chataigner. For detailed history of research and the published materials, cf. Badalyan *et al*. 2004; 2007; 2010.

4. Meliksetian *et al*. 2007, pp. 1-4; 2011, p. 201. For Teghut finds, cf. Torosyan 1976, pp. 60-65; Tedesco 2006, p. 104; for Aratashen, cf. Badalyan *et al*. 2007, pp. 52-53; for Godedzor, cf. Chataigner *et al*. 2010, p. 399; for Sotk, cf. Kunze *et al*.

4. New Data from Areni-1

Excavations of the Areni-1 cave in the Arpa River valley (southern Armenia) open a new stage in our understanding of Chalcolithic societies of the southern Caucasus. Owing to cave's dry conditions, the perishable organic materials have been wonderfully preserved. As a result, stratigraphic observations and a set of secure radiocarbon dates allow the reconstruction of the Late Chalcolithic sequence of Armenia (and the entire Caucasus and Near East) between 4,300–3,400 Cal BC with unparalleled precision. It appears that from the end of the 5th millennium BC onwards, people used the cave for different purposes – as a habitation, for keeping animals and storing plant foods, for the production of wine, as well as for ritual purposes. The data from the cave demonstrated evidence for early social complexity, and connections to contemporary Near Eastern and North Caucasian societies[5].

The excavations of Areni-1 also revealed a very significant group of finds that reflect metallurgical processes, most of which derive from the Chalcolithic Horizons I and II and the garbage layer in front of the cave, the latter of which is contemporary with the Horizons II and III[6].

Horizon I is represented by reinforced and repeatedly rebuilt paved and plastered floors with household pits and jar burials that date to the final phase of the Late Chalcolithic (3,700–3,400 Cal BC). It is spread only within the limits of Trench 3 outside the entrance to the first gallery and the slope at the entrance of the cave complex. Metallurgical data from the context of Trench 3 include crucibles of basalt and clay with traces of fire (Figure 4: 1, Figure 5: 1) and a casting mould (Figure 6: 10).

Horizon II occupies a more extensive area. It begins in Trench 3 (here it underlies Horizon I but is separated from it by a layer of zoogenic humus or dung) and extends into the cave, to the rear part of the first gallery across to the limits of Trenches 1 and 2. The Horizon II of the Trench 3 is also characterized by reinforced and repeatedly finished floors and includes wooden constructions or buildings and large, unfired bins. Trench 1 contains artifacts and features that are clearly related

2013, p. 63; for Aknashen/Khatunarkh, cf. basalt pestle-hammer (Gevorkyan 1980, p. 38; 1981, p. 13), crucibles (excavations of R. Torosyan, Vagharshapat Museum), copper ore (excavations of R. Badalyan, cf. Courcier 2014, p. 592). Materials from Mushakan are published here for the first time. The authors are thankful to Vagharshapat Museum for the permission to publish the materials from Aknashen/Khatunarkh and Teghut.

5. The site was excavated by Armenian-Irish-American joint expedition, director B. Gasparyan (Institute of Archaeology and Ethnography), co-directors R. Pinhasi (University Colleage Cork) and G.E. Areshian (Cotsen Institute of Archaeology, University of California). For preliminary results of Areni excavations, cf. Pinhasi *et al*. 2011; Areshian 2012; Areshian *et al*. 2012; Wilkinson *et al*. 2012; Zardaryan and Gasparyan 2012; Gasparyan 2013.

6. Metallurgical materials from Areni-1 are published here for the first time. For a brief reflection, cf. Areshian *et al*. 2012, p. 127.

to funerary rituals including human remains and a wine producing complex. Trench 2 is adjacent to Trench 1 and has produced pots containing cremations, as well as isolated human remains recovered from loci between the pots. A set of carbon dates from Horizon II produces a time range of 4,000–3,800 Cal BC, which places it in the middle phase of the Late Chalcolithic. It is this horizon that reveals a majority of data on complex metallurgical processes, which is attested in five contexts: the partially excavated workshop at the south-eastern side of Trench 3, the stratified plastered floor (also in Trench 3), in the context of the wine producing complex, inside and nearby the ritual features in Trench 1, and, finally, the garbage layer on the slope at the entrance of the cave complex (Trench 4).

Copper ores (Figure 2: 1-2), basalt pestle-hammer and grinding stones with metal working/crushing traces (Figure 3: 1), ceramic crucibles with traces of fire (Figures 4: 2 and 5: 2), a spouted vessel (Figure 6: 6), a pourer with metal traces (Figure 6: 1), and casting molds (Figure 6: 9-10), the last of which were very probably used for the smelting of such objects as ingots (Figure 8: 4), have been found within the limits of the workshop.

Additional stratified metal finds appeared on the paved and plastered floors around the workshop in Trench 3, including copper ores (Figure 1: 3), a small ceramic crucible (Figure 6: 5), a knife and corresponding fragment (Figure 7: 4 and 6), and an awl (Figure 8: 2).

One of the most interesting finds, a copper ingot originating from the Chalcolithic garbage layer partly opened in Trench 4 on the steep northern slope in front of the cave complex (Figure 7: 1), most probably belongs to Horizon II.

The other archaeometallurgical finds from Horizon I appear in connection with the wine producing complex and the accompanying funerary pots and features (clay constructions) in Trenches 1 and 2. These finds include a pourer (Figure 6: 2), a ventilation pipe with traces of fire (Figure 6: 11), a small knife (Figure 7: 5), an ingot (Figure 8: 3), an adze (Figure 7: 7), a bowl fragment (Figure 7: 8), a bracelet fragment (Figure 8: 10), and a massive pike head (Figure 8: 1).

The majority of the present finds from Horizon II of Areni-1, almost all of which are *in situ* with some light Middle Age disturbances, reconstruct a *châine opératoire* with most stages of the metallurgical process (ore working, smelting, and recycling). The workshop, wine producing complex, and the funerary features or “burials” represent a common ritual and production oriented complex, where a syncretic landscape of human behavior is attested connected mainly with creating and sacrificing procedures. In such a context metal activity is not only a practical but also a sacred/cult/ritualistic action. In this respect some of the metal finds such as the knives and especially the pike head, as their context suggests, can be considered as weapons used during the ritual.

Preliminary investigation of the metal objects from Areni-1 demonstrates that we are dealing with an open mould and additional hammering techniques. Archaeometallurgical analyses of the metal objects from Areni-1 are in process (cf. Table 1)[7].

The materials concerning metallurgical activities from Areni-1 find parallels at Early and Late Chalcolithic sites of the Armenian Highlands as well as in the North Caucasus and Iran. First of all, connections are discernable at previously Armenian sites (cf. azurite of Aratashen and Aknashen/Khatunarkh, basalt pestle-hammer from Aknashen/Khatunarkh, awls from Godedzor, knives of Teghut and Sotk). The awl and the knife from Kültepe I can also be mentioned in this context. Similarities in finds and context are also visible in the settlements of the Middle Kura and Karabakh such as Mentesh Tepe (crushed azurite, crucibles, moulds, awls, rings – Courcier *et al*. 2012, pp. 211-214, fig. 6: 9; Lyonnet *et al*. 2012, pp. 112-114, fig. 155-156); for awls in contemporary Sioni horizon sites of Georgia – Alazani III, Tsiteli Gorebi, Kviriatskhali (cf. Courcier 2014, p. 210), Leylatepe (ingots, a fired clay fragments plashed with pieces of oxidized metal, awls, an adze, knife fragments – Narimanov *et al*. 2007, pp. 62-64; Museyibli 2007a, pp. 142-143; Akhundov and Makhmudova 2008, p. 65), Böyük Kesik (knifes, awls, molds – Museibli 2007, pp. 138-140, 174, Tab. 16: 6-8, XL; Akhundov and Makhmudova 2008, p. 160, Photo 14), and Hantepe near Fizuli (a clay crucible – Museyibli 2007a, p. 142). Worth mentioning also are metal finds from the kurgans of Soyugh Bulagh and Telmankend (flat axe-adzes, awls, knives – Akhundov and Makhmudova 2008, pp. 62-63, 145, 170, Tab. 28: 5, Tab. 30: 3-6, Photo 32).

The knives/daggers, pourers, and ingot molds find parallels at the Maikop sites as well (Chernykh 1992, pp. 75, 82-83, fig. 24: 14, fig. 27: 5-6, fig. 28: 8; Korenevskiy 2004, p. 42, knife subtypes 1-2). Especially noteworthy is a metal vessel fragment from Areni-1; such vessels are also known in the Maikop sites (Chernykh 1992, p. 76, fig. 25; Hansen 2013, p. 154, fig. 25) and the contacts to which can be postulated through finds of Maikop ceramics at Areni-1 (Zardaryan and Gasparyan 2012, p. 48; Areshian *et al*. 2012, p. 128).

Finds similar to the Areni-1 ores, chisels, awls, and crucibles are reported at Arslantepe VII (3,800–3,400 BC) (Di Nocera 2010, pp. 255-256, fig. XIII. 3: 15).

Simliar crucibles, ingot moulds, and knives/daggers are visible also in Chalcolithic Iran, particularly in such sites as Tal i-Iblis, Cheshmeh Ali, Tepe Ghabristan, Qaleh Gusheh, and Arisman (Azarnoush and Helwing 2005, p. 209, fig. 30; Thornton 2009, pp. 310-313, fig. 2-5; Ivanova 2012, p. 11, Abb. 7: 6-8). A chisel/adze like that at Areni-1 is reported from Mersin in the period after ca. 5,000 BC (Hansen 2013, p. 139, fig. 1).

7. Analyses are made in Curt-Engelhorn-Zentrum Archäometrie, GmbH, Mannheim.

Resemblances are also discernable in metal compositions: like at Areni-1, Teghut, Nerkin Godedzor (see above), Mentesh Tepe (Courcier 2014, p. 221, Tab. 3), Leylatepe, Kültepe I, Poylu II (Museyibli 2007a, p. 142; Akhundov and Makhmudova 2008, p. 66) and Arslantepe VII (Di Nocera 2010, p. 255), the main objects are copper based, some of which contain ca. 1 to 4% and, rarely, up to 5%, arsenic.

5. Chemical compositions of Chalcolithic metal finds in the territory of Armenia

As mentioned above, the first evidence of smelted copper in Armenia appear as several Chalcolithic metal objects from the settlement of Teghut (Torosyan 1976), the OES analysis of which revealed the use of arsenical copper (3-4.6% of As) (Gevorkyan 1980). Obviously, these objects were smelted from ores, pointing to a transition from the use of rare native copper to extractive metallurgy. Some of previously mentioned copper based artifacts from Areni-1 cave and Nerkin Godedzor were recently analyzed for chemical composition (XRF) and Pb isotopes (ICP-MS) by Curt-Engelhorn-Zentrum Archäometrie GmbH, Mannheim, Germany. Detailed study of these artifacts is still in progress and here we present some discussion based on preliminary results.

By means of chemical composition, four of the objects from Nerkin Godedzor, two fragments and two pins (MA-082106, MA-070019, MA-071550, MA-071551 respectively) turned out to consist of copper-arsenic alloys with about 5% of As (Table 1). Enrichment of copper with arsenic is a feature typical for Chalcolithic and Early Bronze Age metal production in the region (Gevorkyan 1980; Meliksetian *et al*. 2003; Meliksetian and Pernicka 2010). The chemical composition of the fifth object, another pin (MA-082105), turned out to be quite surprising: it consists of copper (84%) with an admixture of nickel 3,6%, arsenic (6%), and silver (6%). It seems reasonable to assume that such a composition is not an intentional alloying, but is a characteristic of the polymetallic ores that were utilized.

Another interesting geochemical feature of all the objects from Nerkin Godedzor is the extremely low concentration of lead. XRF analysis shows that lead content is below the detection limit of the method (<100 ppm), but attempts to measure lead concentration with more sensitive method such as ICP-MS shows that the lead content is extremely low, around 10 ppb (0.01 ppm). The concentration of lead in these objects is so low, in fact, that it was not possible to perform lead isotope analysis for these artifacts. While this makes provenancing these objects quite complicated, the very low content of lead could also be an important geochemical feature of the ore deposit

Table 1
Chemical composition of metal objects from Areni-1 cave and Nerkin Godedzor settlement. Concentrations of copper are given in weight percents, all other values are in ppm.

	Sample #	Original sample #	Site	Description	Dating	Cu %	Fe	Co	Ni	Zn	Pb	Bi	Sn	As	Sb	Se	Te	Au	Ag
1.	MA-082105	Gd-07-34	Nerkin Godedzor settlement	Pin (Figure 8/5)	Late Chalcolithic	84.0	<200	<100	36000	<2000	<100	<100	<50	61000	250	<50	<50	540	60000
2.	MA-082106	Gd-07-28		Ring-fragment (?). (Figure 8/9)	Late Chalcolithic	95.0	<200	<100	140	<2000	<100	<100	90	52000	<50	<50	<50	<100	230
3.	MA-070019	GD-05-2		fragment	Late Chalcolithic	94.7	200	100	<100	2000	<100	<100	58	51516	15	50	92	100	76
4.	MA-071550	GD-05-03		Pin (Figure 8/6)	Late Chalcolithic	95.1	1248	100	<100	2000	<100	<100	86	45874	381	50	50	200	347
5.	MA-071551	GD-05-04		Pin (Figure 8/7)	Late Chalcolithic	94.8	200	100	111	2000	<100	<100	50	51064	50	50	50	115	143
6.	MA-082097	Areni-1	Areni-1 cave	Pike head (Figure 8/1)	Late Chalcolithic	99.0	<200	<100	<100	<2000	<100	<100	<50	12800	<50	<50	<50	<100	300
7.	MA-082098	Areni-2		knife (Figure 7/5)	Late Chalcolithic	97.0	470	<100	230	<2000	<100	<100	<50	28100	<50	<50	<50	<100	310
8.	MA-082100	Areni-4		knife (Figure 7/4)	Late Chalcolithic	97.0	850	<100	870	<2000	<100	<100	<50	30000	60	<50	<50	<100	160
9.	MA-124777	T3-SP7		Copper ingots (Figure 8/3-4)	Late Chalcolithic	96.0	<200	<100	950	<1000	144	<100	<50	42280	103	<100	<50	<100	397
10.	MA-124778	T2A-SP20			Late Chalcolithic	97.0	<200	<100	2610	<1000	2205	<100	<50	28025	79	<100	<50	<100	366

and thus may be used for locating the origin of these objects. It should be noted that all studied Armenian copper ores and all studied Bronze Age artifacts contain a noticeable amount of lead (Meliksetian and Pernicka 2010). According to Dr. Nima Nezafati[8], some ores with very low lead content are known in the Tarom-Hashtjin region (western Alborz, North-West Iran) but more work and comparison to chemical composition of ores in North-West Iran is necessary. Therefore, our current state of knowledge does not allow the determination of a matching ore source for these objects, but presumably it is outside the southern Caucasus region, perhaps in northwest Iran.

The compositions of the Areni-1 objects are less surprising (Table 1), being made of copper with an admixture of arsenic ranging from 1.3 to 4.2%; comparable arsenic content is typical for tools and weapons of Early Bronze Age Armenia, while for decorative objects the content is usually much higher (Meliksetian and Pernicka 2010; Meliksetian *et al*. 2011). Also noteworthy is the elevated content of Ni in three of Areni-1 samples (870-2600 ppm) and an admixture of lead (about 0.2% in one of the ingots; MA-124778). Figure 9 shows a comparison of Ni and Ag content in the analyzed Chalcolithic artifacts compared with available data from Early Bronze Age artifacts (Meliksetian and Pernicka 2010). With the exception of Cu + (Ni-Ag-As) alloy (MA-082105), most of the artifacts from Areni-1 and Nerkin Godedzor are within the range of Armenian ores and Early Bronze Age artifacts.

For two samples, MA-124777 and MA-124778, lead isotope values are also available (Table 2). Figure 10 shows a comparison of $^{207}Pb/^{206}Pb$ vs. $^{208}Pb/^{206}Pb$ of analyzed Chalcolithic artifacts with the lead isotope compositions of Armenian and regional ores. Interestingly, the artifacts from Areni-1, at least according to their lead isotope signature, lie at the intersection of the Armenian “old” lead compositional field with those of Anatolia and the ores of Oman. So, it is unclear whether their source ores are within the region or from distant sources. More detailed lead isotope

Table 2.
Lead isotope ratio abundance values of metal ingots from Areni-1 cave.

Sample #	MA-124777	MA-124778
Original sample #	T3-Sp7	T2A-Sp20
Site, Description	Areni-1 cave	
Description	Copper ingots	
$^{208}Pb/^{206}Pb$	2.0848	2.0860
2σ	± 0.0001	± 0.0001
$^{207}Pb/^{206}Pb$	0.84746	0.84816
2σ	± 0.00005	± 0.00003
$^{208}Pb/^{204}Pb$	38.546	38.528
2σ	± 0.002	± 0.003
$^{207}Pb/^{204}Pb$	15.669	15.666
2σ	± 0.001	± 0.001
$^{206}Pb/^{204}Pb$	18.489	18.470
2σ	± 0.001	± 0.001

8. We gratefully acknowledge Dr. Nima Nezafati (Islamic Azad University of Tehran, Iran) for information about copper sources in Iran with low lead content.

investigations of ore sources around Areni-1, which is in progress, may provide further information about their provenance.

6. Discussion

Metallurgical developments in Armenia and the southern Caucasus region were directly connected with important social transformations. As we noted above, during the Late Neolithic (6,000–5,200 Cal BC) Armenia was involved in the "Shulaveri-Shomutepe" tradition, which by the Early/Middle Chalcolithic (5,200–4,300 Cal BC) was followed by the "Adablur" and, eventually, the "Sioni" traditions. These were, on the whole, uniform societies that relied on native copper and some relations to the South (Samarra, Halaf-Ubaid). Beginning with Late Chalcolithic (4,300–3,500 Cal BC) we see unprecedented complexity, intensive inter-regional contacts, and use of extractive metallurgy.

The Late Chalcolithic traditions in Armenia (Areni-1, Teghut, Nerkin Godedzor), Azerbaijan (Ovçular Tepesi, Mentesh Tepe, Leylatepe) and Georgia (Berikldeebi) share common characteristics and regional contacts to Maikop[9] and Ubaid-Uruk[10]. These societies are on the way towards growing complexity, a process reflected in the appearance of developed copper based metallurgy (molds, slags, ingots, kilns, pure and arsenic copper), new metal weapons/tools (knife/daggers, spearheads, flat axes), ceramics (potter's wheel, pottery signs), exotic and prestigious objects of gold, silver, and lapis-lazuli, stamp seals and status symbols (scepters), kurgans and jar burials, and rudiments of monumental architecture (cf. the "temple" of Berikldeebi). This is all accompanied by the blossoming of long distance trade, essential transfer of knowledge, and the development of centralized hierarchies[11].

Recent investigations demonstrate that although these developments were typical for the Near Eastern region[12], the highland zone between the Caucasus and Taurus, that is, territories

9. Maikop relations are reflected in ceramics (cf. Areshian *et al*. 2012, pp. 128-129) and kurgans (Üç Tepe, Telmankend, Kudurlu, Kavtiskhevi, cf. Makharadze 2007; Akhundov and Makhmudova 2008, pp. 3, 80).

10. In the literature Caucasian specialists speak mainly about the Ubeid-Uruk (Akhundov and Makhmudova 2008), Ubaid (Museibli 2007a) or Uruk (Munchayev 2007, pp. 8-9; Areshian *et al*. 2012, pp. 128-129) influences.

11. For the mentioned Late Chalcolithic developments, cf. Torosyan 1976; Narimanov 1987; Korobkova, 1987; Kiguradze and Sagona 2003; Narimanov *et al*. 2007; Museyibli 2007a; 2007b; Akhundov and Makhmudova 2008; Zardaryan and Gasparyan 2012; Helwing 2012; Areshian *et al*. 2012; Lyonnet 2000; Marro 2005; 2007; Makharadze 2007; Wilkinson *et al*. 2012; Courcier 2014.

12. So the Ubaid chaff-tempered ware alongside the Ubaid-related painted black-on-buff ware spreads not only in the southern Caucasus but also in the regions from Mediterranean coast to North Zagros (Helwing 2012, pp. 204-210; cf. Ivanova 2012, pp. 19-23).

from the Upper Euphrates to the regions around lakes Van, Urmia, and Sevan, also shared common trends of development[13]. This is a landscape of mountainous communities which were clearly distinguished by their mode of life from the Maikop people in the North (inhabitants of river valleys in the environment of steppe landscapes) and that of the Syro-Mesopotamian peoples in the South (inhabitants of the lowland).

These transformations have been often related to the establishment of Ubaid or Uruk related communities. Various ideas based on migration or early imperialism theories have been suggested as possible interpretations of those developments. However, recent approaches suggest new models that acknowledge more locally rooted paths towards complexity in the highlands (cf. Marro 2007; Thornton 2009; Helwing 2012). The material similarities are thereby understood to indicate shared practices/knowledge of production and consumption.

Metal seems to be a very essential factor in these regional connections, and it can also explain the interests of Mesopotamians in the southern Caucasus, being a kind of "*moteur des relations*" (Lyonnet 2007, p. 15; cf. Munchayev 2007, p. 9; Courcier 2014, p. 643)[14]. Other factors such as obsidian (cf. Chataigner *et al*. 2010, pp. 401-402) and wine[15] may also have played an essential role in those contacts, realized either by trade (cf. Palumbi 2007, p. 75) or through nomadic pastoralists (cf. Marro 2005, p. 32; 2007, p. 93; Chataigner *et al*. 2010, pp. 401-405).

Two routes from the Near East to the South Caucasus have been identified as contact zones, one passing through the Urmia basin (cf. Museyibli 2007a, p. 89; Ivanova 2012, p. 23) and the other through the Upper Euphrates region (cf. Marro *et al*. 2011), both of which have the nearest analogies to southern Caucasian materials and practices (cf. also Munchayev 1975, pp. 122-123, 130). In the same time, the southern Caucasian route over Dagestan to the North-West Caucasus could be essential for the transmission of Near Eastern influences to the North and vice

13. Cf. Torosyan 1976; Areshian and Ghafadaryan 1996; Lyonnet 2000; Marro 2005; 2007; 2008. For B. Helwing the Late Chalcolithic landscape of modern eastern Turkey, North-West Iran, and the southern Caucasus "falls into a series of parallel, largely comparable yet individual clusters of sites that develop in lockstep and share a general lifestyle, visible from a closely related material record" (Helwing 2012, pp. 201-203, 214).

14. In this regards noteworthy is the statistical point of L. Avilova, according to which, the Mesopotamian Ubaid period sites lack metal in sharp contrast to Iran, which implies that the technological skills elaborated in Mesopotamia during the Ubaid period apparently originated in Iran (Avilova 2009, pp. 52, 56). Perhaps the relations of the southern Caucasus to Mesopotamia were really conditioned by the growing interest of Syrian-Mesopotamian societies in metal.

15. The mentioned grape pressing context with preserved remains (seeds, stems, skins) of crushed or pressed grapes from Areni-1 (Horizon II, 4,223–3,790 Cal BC) is thus far the oldest known wine production complex (Barnard *et al*. 2011; cf. Areshian *et al*. 2012, pp. 128-129), which attests that the wine could be South Caucasian "brand" in the ancient Near East.

versa[16]. Chemical and isotope characteristics of Chalcolithic metal artifacts from Nerkin Godedzor also suggest that a North-West Iranian ore source may have been utilized to produce copper. This datum underlines the importance of the North-West Iranian route and is in accordance with other assemblages from this site, again hinting at a North-West Iranian direction of contacts, among which especially painted pottery (from South to North) and obsidian (from North to South) should be mentioned (Chataigner *et al*. 2010, pp. 399-401).

The transformational processes in the southern Caucasus described above did not develop further in the second half of the 6th millennium BC. Similar to highly developed Chalcolithic Carpato-Balkan metallurgical centers, which collapsed at the beginning of the Bronze Age in the wake of invasions from steppe nomads (Chernykh 1992, p. 55), the southern Caucasus's "Near Eastern way" stalled with the emergence of the Kura-Araxes complex. Although Late Chalcolithic diversity was changed by Early Bronze Age uniformity[17], in contrast to the Carpato-Balkan Early Bronze Age invaders, the Kura-Araxes people, who were indigenous to the region, possessed highly developed metallurgy and ceramic making traditions.

One of the most difficult questions is the relationship between the Late Chalcolithic and Kura-Araxes traditions. Various sites in modern Armenia, Georgia, Azerbaijan, and eastern Turkey show clear coexistence of the ceramic and metal (first use of arsenic, molds and heavy tools) traditions of these two stages going back to the end of the 5th and first half of the 4th millennia BC[18]. Essential differences between those traditions are reflected in other practices such as their

16. Some influences such as introduction of potters' wheel and Ubaid-Uruk similar ceramics appear also in Dagestan (Ginchi, Velikent) demonstrating some affinities to South Caucasian Chalcolithic centers (Magomedov 2007, p. 53; Munchayev 1982, p. 124; 2007, p. 8) as well as in Maikop (Ivanova 2007, p. 17). More Iranian-Central Asian than Mesopotamian direction of contacts for Maikop have been recently postulated on the ground of metal and precious stone finds (Ivanova 2012).

17. Kura-Araxes communities clearly secluded the Highlands from the Mesopotamian world (cf. Marro 2007, p. 92). Such a transformation was especially crucial for the sites which were deeply involved in Syrian-Mesopotamian developments, among which Arslantepe VIA, the large public building of which gave way to the settlement of wattle-and-daub architecture and Late Chalcolithic pottery diversity was narrowed to red-black burnished Kura-Araxes pottery (cf. Kiguradze and Sagona 2003, p. 92).

18. For Armenia, cf. Torosyan 1976; Avetisyan *et al*. 2006; Zardaryan 2011; Wilkinson *et al*. 2012; Zardaryan and Gasparyan 2012; for Georgia, cf. Kiguradze 1976; 2000; Kiguradze and Sagona 2003; for eastern Turkey, cf. Marro 2005; 2008, for Nakhijevan, cf. Marro 2011; for Karabakh, cf. Museyibli 2007a, pp. 60, 73, 87, 92, 142-143 (also as regards metallurgy, especially molds, cf. also Courcier 2014, p. 213) contra Narimanov *et al*. 2007, p. 74; Akhundov and Makhmudova 2008, p. 77. Based on materials from eastern Turkey C. Marro develops a possible point of view that in Late Chalcolithic (4,000–3,500 Cal BC) at least four pottery trends developed in the Highland zone where later Kura-Araxes culture came to existence: Late Sioni, Proto-Kura-Araxes, Tilki-Tepe and chaff-faced wares. If the chaff-faced ware was connected to Mesopotamia and Syria, than Late Sioni and Proto-Kura-Araxes were local. Tilki Tepe had both local and influenced traits. These four assemblages could develop more or less at the same time (Marro 2008).

use of painted pottery, potters' wheel, seals, gold and silver, lapis lazuli, flint, rather than obsidian, tools, and jar burials and kurgans, traits that are strange to the Kura-Araxes and typical more for the Upper Mesopotamian and Maikop traditions. Regardless, it is clear that the social context that accompanied Bronze Age developments in the region goes back to the Chalcolithic period (cf. Avetisyan 2012, p. 9). There is, moreover, one systematic feature common to both – the landscape: the Kura-Araxes tradition evolved in the same environment as the Late Chalcolithic communities, i.e. in the area from the Upper Euphrates to Mt. Ararat and around lakes Van, Urmia, and Sevan. This condition creates an essential background to consider both phenomena in the same developmental contexts.

7. Conclusion

According to new data, metallurgy in the southern Caucasus and Armenia in particular, appears with the extraction of native copper and cold-working-cum-annealing at the beginning of the 6th millennium BC. Copper smelting is practiced by the late 5th millennium BC. Metallurgical activities essentially increased in the early 4th millennium BC with evidence of *châine opératoire*, attested most spectacularly at Areni-1, which makes this site one of the most important in the whole Near Eastern landscape, and not only as regards the perfectly preserved organic materials. These all allow us to challenge the earlier understanding of the Caucasian Copper Age as a "fairly modest cultural focus" (Chernykh 1992, p. 54; cf. also Munchayev 1982, p. 136).

Due to its rich ores and important geographic location, the southern Caucasus turns out to be a kind of bridge between two metallurgical centers – Anatolia and Near East, where metallurgy commenced at the 8th–6th millennia BC, and South-East Europe, where during the 5th–4th millennia BC we have highly developed metallurgical centers. The southern Caucasus had definite Near Eastern (North Syrian-Mesopotamian and North Iranian) direction of contacts, which is reflected both in material assemblage and in metal industry.

However the Near Eastern relations of the southern Caucasus, which undoubtedly accelerated the process of the appearance of early complex societies in the region, should not be interpreted in terms of significant migrations, expansions, or colonizations from core to periphery being linked to forms of territorial control, as used to be the case, but more as a reflection of shared knowledge and widening of mental horizons born as the result of active interactions in which the "highland zone" turned out to be not only an imitator of Near Eastern values but possessed its own independent identities and even privileges: and this is especially visible in developments of metallurgy.

References

Akhundov, T.I. and Makhmudova, V.A.G. (2008) *Yuzhniy Kavkaz v kavkazsko-peredneaziatskikh etnokul'turnykh protsessakh IV tis. do n.e.* (The South Caucasus in Caucasian-Near Eastern Ethno-Cultural Processes, 4th millennium BC). Baku (in Russian).

Areshian, G.E. (2012) Neolithic and Chalcolithic (Eneolithic) Periods in Armenia, In: Simonyan, H. (ed.), *Archaeological Heritage of Armenia*. Yerevan: Ministry of Culture of the Republic Armenia, Historical–Cultural Heritage Scientific Research Centre, pp. 8–12.

Areshian, G.E., Gasparyan, B., Avetisyan, P.S., Pinhasi, R., Wilkinson, K., Smith, A., Hovsepyan, R. and Zadrdaryan, D. (2012) The Chalcolithic of the Near East and South-Eastern Europe: Discoveries and New Perspectives from the Cave Complex Areni-1, Armenia. *Antiquity* 86, pp. 115–130.

Areshian, G.E. and Ghafadaryan, K.K. (1996) Haykakan lernashkharhi chartarapetutiuny nakhnadaryan hamaynakan hasarakargi ev petakan arajin kazmavorumneri zhamanakashrjanum (The Architecture of the Armenian Highland during Prehistoric Times and in the Period of First State Formations). In: Tiratsyan, G.A. (ed.), *Hay Chartarapetutyan patmutyun* (History of Armenian Architecture). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 13–86 (in Armenian).

Arimura, M., Badalyan, R., Gasparyan, B. and Chataigner, C. (2010) Current Neolithic Research in Armenia. *Neo-Lithics* 1/10, pp. 77–85.

Avetisyan, P. (2012) Haykakan lernashkharhi hnamshakutayin mijavayri dsevapokhumneri himnakan mitumnery vagh bronzi darum (The Main Tendences of Transformation of the Ancient Cultural Environment of the Armenian Highland during the Early Bronze Age), *Patma-banasirakan handes* (Historical-Philological Journal) 2 (190), pp. 3–19 (in Armenian).

Avetisyan, P. and Bobokhyan, A. (2012) Archaeology of Armenia in Regional Context: Achievements and Perspectives. In: Avetisyan, P. and Bobokhyan, A. (eds.), *Archaeology of Armenia in Regional Context, Proceedings of the International Conference dedicated to the 50th Anniversary of the Institute of Archaeology and Ethnography Held on September 15-17, 2009 in Yerevan*. Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 7–20.

Avetisyan, P., Chataigner, C. and Palumbi, G. (2006) The Results of the Excavations of Nerkin Godedzor (2005–2006). Preliminary Report. *Aramazd* I, pp. 6–18.

Avilova, L.I. (2009) Models of Metal Production in the Near East (Chalcolithic - Middle Bronze Age). *Archaeology Ethnology and Anthropology of Eurasia* 37/3, pp. 50–58.

Azarnoush, M. and Helwing, B. (2005) Recent Archaeological Research in Iran – Prehistory to Iron Ages. *Archäologische Mitteilungen aus Iran und Turan* 37, pp. 189–246.

Badalyan, R., Lombard, P. Chataigner, C. and Avetisyan, P. (2004) The Neolithic and Chalcolithic Phases in the Ararat Plain (Armenia): The View from Aratashen. In: Sagona, A. (ed.), *A View from the Highlands – Archaeological Studies in Honour of Charles Burney*. Ancient Near Eastern Studies, Supplement 12. Leuven, pp. 399–420.

Badalyan, R., Lombard, P., Avestisyan, P., Chataigner, C., Chabot, J., Vila, E., Hovsepyan, R., Willcox, G. and Pessin, H. (2007) New Data on the Late Prehistory of the Southern Caucasus. The Excavations at Aratashen (Armenia): Preliminary Report. In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe millénaires avant notre ère). Leurs relations avec le Proche-Orient*. Paris, pp. 37–61.

Badalyan, R., Harutyunyan, A.A., Chataigner, C., Le Mort, F., Chabot, J., Brochier, J.-E., Balasescu, A., Radu, V. and Hovsepyan, R. (2010) The Settlement of Aknashen-Khatunarkh, a Neolithic Site in the Ararat Plain (Armenia): Excavation Results 2004–2009. *TÜBA-AR* 13, pp. 185–218.

Barnard, H., Dooley, A.N., Areshian, G.E., Gasparyan, B. and Faull, K.F. (2011) Chemical Evidence for Wine Production around 4000 BCE in the Late Chalcolithic Near Eastern highlands. *Journal of Archaeological Science* 38, pp. 977–984.

Chataigner, C. (1995) *La Transcaucasie au Néolithique et au Chalcolithique*. BAR International Series 634. Oxford.

Chataigner, C., Arimura, M. and Gasparyan, B. (2007). La néolithisation de l'Arménie. *Les dossiers d'archéologie* 321, pp. 30–35.

Chataigner, C., Avetisyan, P., Palumbi, G. and Uerpmann, H.-P. (2010) Godedzor, a Late Ubaid-related settlement in the Southern Caucasus. In: Carter, R.A. and Graham, P. (eds.), *Beyond the Ubayid. Transformation and Integration in the Late Prehistoric Societies of the Middle East*. Studies in Ancient Oriental Civilization 63. Chicago, pp. 391–409.

Chernykh, E.N. (1992) *Ancient Metallurgy in the USSR*. Cambridge.

Chernykh, E.N. and Orlovskaya, L.B. (2007) Radiouglerodnaya khronologiya Maykopskoy arkheologicheskoy obshchnosti (Radiocarbon Chronology of Maikop Archaeological Unity). In: Gadzhiev, M.S. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza. Materiali Mezhdunarodnoy nauchnoy konferentsii "Noveyshiye arkheologicheskiye i etnograficheskie issledovaniya na Kavkaze"* (Archaeology, Ethnology and Folkloristic of the Caucasus. Materials of International Conference,"Newest Archaeological and Ethnographic Investigatios in the Caucasus"). Makhachkala: Institute of History, Archaeology and Ethnography of the Russian Academy of Sciences. Dagestan Scientific Center, pp. 10–28 (in Russian).

Courcier, A. (2014) Ancient Metallurgy in the Caucasus from the Sixth to the Third Millennium BCE. In: Roberts, B.W. and Thornton, C.P. (eds.), *Archaeometallurgy in Global Perspective*. New York, pp. 579–664.

Courcier, A., Kuparadze, D. and Pataridze, D. (2008) Archaeometallurgical Researches on the Early Beginnings of Metallurgy (VI–III Millennia BC) in the Caucasus: An Example of Interdisciplinary Studies. *Metalla* 15, pp. 35–50.

Courcier, A., Guliyev, F. and Lyonnet, B. (2012) Metallurgy during the Middle Chalcolithic Period (Last Third of the 5th Millennium B.C.) in Southern Caucasus: An Insight Through Recent Discoveries at Mentesh-Tepe (Azerbaijan). In: Jett, P., McCarthy, B. and Douglas, J.G. (eds.), *Scientific Research on Ancient Asian Metallurgy: Proceedings of the Fifth Forbes Symposium at the Freer Gallery of Art*. London, pp. 205–224.

Di Nocera, G.M. (2010) Metals and Metallurgy. Their Place in the Arslantepe Society between the End of the 4th and Beginning of the 3rd Millennium BC. In: Frangipane, M. (ed.), *Economic Centralization in Formative States. The Archaeological Reconstruction of the Economic System in 4th Millennium Arslantepe*. Studi di Preistoria Orientale 3. Rome, pp. 255–274.

Gasparyan, B. (2013) Areni-1 karayri usumnasirutyan himnakan ardyunknery (Main Results of Investigation of Areni-1 Cave). In: Suvaryan, Y. (ed.), *Hayagitutiuny ev ardi zhamanakashrjani martahravernery. Hayagitakan mijazgayin erkrord hamazhoghov* (Armenien Studies and Challenges of Modern Times: Second International Congress on Armenian Studies). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 77–78 (in Armenian).

Gevorkyan, A.Ts. (1980) *Iz istorii drevneyshey metallurgii Armyanskogo Nagor'ya* (From the History of Ancient Metallurgy of the Armenian Highland). Yerevan: Armenian SSR Academy of Sciences Press (in Russian).

Gevorkyan, A.Ts. (1981) *Hayastani hin metaghagortsutyan zargatsman himnakan pulery* (The Main Stages of Developments of Ancient Metallurgy in Armenia). In: Arakelyan, B.N. (ed.), *Haykakan SSH-um 1979-1980 tt. dashtayin hnagitakan ashkhatankneri ardyunknerin nvirvats gitakan nstashrjan, Zekutsumneri tezisner* (Abstracts of Reports of the Conference devoted to the Archaeological Fieldwork Results in 1979-1980 in the Armenian SSR). Yerevan: Armenian SSR Academy of Sciences Press, pp. 13–14 (in Armenian).

Hansen, S. (2013) Innovative Metals: Copper, Gold and Silver in the Black Sea Region and the Carpathian Basin during the 5th and 4th Millennium BC. In: Burmeister, S., Hansen, S., Kunst, M. and Müller-Scheeßel, N. (eds.), *Metal Matters: Innovative Technologies and Social Change in Prehistory*. Rahden/Westf: Deutsches Archäologisches Institut, Verlag Marie Leidorf (VML), pp. 137–167.

Hauptmann, H. (1982) *Die Grabungen auf dem Norşuntepe, 1974, Keban Project 1974-1975 Activities*. Ankara, pp. 41–70.

Helwing, B. (2012) Late Chalcolithic Craft Traditions at the North-Eastern "Periphery" of Mesopotamia: Potters vs. Smiths in the Southern Caucasus. *Origini* XXXIV, pp. 201–220.

Ivanova, M. (2007) The Chronology of the "Maikop Culture" in the North Caucasus: Changing Perspectives. *Aramazd* II, pp. 7–39.

Ivanova, M. (2012) Kaukasus und Orient: Die Entstehung des "Maikop-Phänomens" im 4. Jahrtausend v. Chr. *Praehistorische Zeitschrift* 87/1, pp. 1–28.

Kiguradze, T.V. (1976) *Periodizatsia rannezemledel'cheskoy kul'turi Vostochnogo Zakavkaz'ya* (Periodization of Early Farming Culture of Eastern Transcaucasus). Tbilisi: "Metsniereba" Publishing House (in Georgian, with Russian Resume).

Kiguradze, T.V. (2000) The Chalcolithic-Early Bronze Age Transition in the Eastern Caucasus. In: Marro, C. and Hauptmann, A. (eds.), *Chronologie des pays du Caucase et de l'Euphrate au IVe–IIIe millénaires*. Varia Anatolica 11. Paris, pp. 321–328.

Kiguradze, T. and Sagona, A. (2003) On the Origins of the Kura-Araxes Cultural Complex. In: Smith, A. and Rubinson, K. (eds.), *Archaeology in the Borderlands: Investigations in Caucasia and Beyond*. Cotsen Institute of Archaeology Monograph 47. Los Angeles, pp 38–94.

Korenevskiy, S.N. (2004) *Drevneyshie zemledel'tsi i skotovodi Predkavkaz'ya: Maykopsko-novosvobodnenskaya obshchnost', problemi vnutrenney tipologii i simvoliki pogrebal'noy praktiki* (The Ancient Farmers and Cattle-Breeders of the Anterior Caucasus: Maykop-Novosvobodnenskaya Unity, the Problems of Inner Typology and Symbolism of Burial Practices). Avtoreferat dissertatsii na soiskanie uchenoy stepeni doktora istoricheskix nauk (Synopsis of Doctoral Dissertation). Moscow: Institute of Archaeology of Russian Academy of Sciences (in Russian).

Korobkova, G.F. (1987) *Khozyaystvenniye kompleksi rannix zemledel'chesko-skotovodcheskix obshchestv yuga SSSR* (Economic complexes of the early farming-cattle-breading societies of the South of the USSR). Leningrad: "Nauka" Publishing House, Leningrad Branch (in Russian).

Kunze, R., Bobokhyan, A., Pernicka, E. and Meliksetian, Kh. (2013) Project Ushkiani. Investigations of the cultural landscape around the Sotk prehistoric gold-working region. In: Meller, H. and Avetisyan, P. (eds.), *Archäologie in Armenien II*. Halle: Veröffentlichungen des Landesamtes für Denkmalpflege und Archäologie Sachsen-Anhalt – Landesmuseum für Vorgeschichte, pp. 49–88.

Kushnareva, K.Kh. (1997) *The Southern Caucasus in Prehistory, Stages of Cultural and Socioeconomic Development From the Eight to the Second Millennium B.C.* University Museum Monograph 99. Philadelphia: the University Museum, University of Pennsylvania.

Lyonnet, B. (2000) La Mésopotamie et le Caucase du Nord au IVe et au début du IIIe millénaires av. n.e.: Leurs rapports et les problèmes chronologiques de la Culture de Majkop. Etat de la question et nouvelles propositions. In: Marro, C. and Hauptmann, H. (eds.), *Chronologies des Pays du Caucase et de L'Euphrate aux IVe-IIIe Millénaires*. Varia Anatolica 11. Paris, pp. 299–320.

Lyonnet, B. (2007) Introduction. In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe millénaires avant notre ère). Leurs relation avec le Proche-Orient*. Paris: CNRS Éditions, pp. 11–19.

Lyonnet, B., Guliyev, F., Helwing, B., Aliyev, T., Hansen, S. and Mirtskhulava, G. (2012) Ancient Kura 2010–2011: The First Two Seasons of Joint Field Work in the Southern Caucasus. *Archäologische Mitteilungen aus Iran und Turan* 44, pp. 1–190.

Magomedov, R.G. (2007) Eneolit i rannyaya bronza na severno-vostochnom Kavkaze (Eneolithics and Early Bronze Age of the North-East Caucasus). In: Gadzhiev, M.S. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza. Materiali Mezhdunarodnoy nauchnoy konferentsii "Noveyshiye arkheologicheskiye i etnograficheskie issledovaniya na Kavkaze"* (Archaeology, Ethnology and Folkloristic of the Caucasus. Materials of International Conference, "Newest Archaeological and Ethnographic Investigatios in the Caucasus"). Makhachkala: Institute of History, Archaeology and Ethnography of the Russian Academy of Sciences. Dagestan Scientific Center, pp. 47–55 (in Russian).

Makharadze, Z. (2007) Nouvelles données sur le Chalcolithique en Géorgie orientale. In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe millénaires avant notre ère). Leurs relation avec le Proche-Orient*. Paris: CNRS Éditions, pp. 123–132.

Marro, C. (2005) Cultural Duality in Eastern Anatolia and Transcaucasia in Late Prehistory (ca. 4200–2800 BC). *Archäologische Mitteilungen aus Iran und Turan* 37, pp. 27–34.

Marro, C. (2007) Upper Mesopotamia and Transcaucasia in the Late Chalcolithic Period (4000–3500 BC). In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe millénaires avant notre ère). Leurs relation avec le Proche-Orient*. Paris: CNRS Éditions, pp. 77–94.

Marro, C. (2008) Late Chalcolithic Ceramic Cultures in the Highlands (4000–3500 BC). In: Rubinson, K.S. and Sagona, A. (eds.), *Ceramics in Transition: Chalcolithic through Iron Age in the Highlands*. Ancient Near Eastern Studies 27. Louvain, pp. 9–37.

Marro, C., Bakhshaliyev, V. and Ashurov, S. (2011) Excavations at Ovçular Tepesi (Nakhichevan, Azerbaijan). Second Preliminary Report: The 2009–2010 Seasons. *Anatolia Antiqua* XIX, pp. 53–100.

Meliksetian, Kh., Pernicka, E., Badalyan, R. and Avetisyan, P. (2003) Geochemical Characterisation of Armenian Early Bronze Age Metal Artifacts and their Relation to Copper Ores. In: Proceedings vol. 1 at the International Conference Archaeometallurgy in Europe, 24–26 September 2003, Milan, Italy, pp. 597–606.

Meliksetian, Kh., Pernicka, E. and Badalyan, R. (2007) Compositions and Some Considerations on the Provenance of Armenian Early Bronze Age Copper Artefacts, In: Proceedings of the 2nd International Conference "Archaeometallurgy in Europe", Aquileia, Italy, 17–21 June 2007, organized by Associazione Italiana di Metallurgia, Milano, pp. 1–13.

Meliksetian, Kh. and Pernicka, E. (2010) Geochemical Characterization of Armenian Early Bronze Age Metal Artifacts and Their Relation to Copper Ores. In: Hansen, S., Hauptmann, A., Motzenbäcker, I. and Pernicka, E. (eds.), *Von Majkop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4. - 2. Jt. v. Chr*. Beiträge des Internationalen Symposiums in Berlin vom 1.-3. Juni 2006. Bonn, pp. 41–58.

Meliksetian, Kh., Kraus, S., Pernicka, E., Avetisyan, P., Devejian, S. and Petrosyan, L. (2011) Metallurgy of Prehistoric Armenia. In: Yalçın, Ü. (ed.), *Anatolian Metal V*. Bochum, pp. 201–210.

Munchayev, R.M. (1975) *Kavkaz na zare bronzovogo veka. Neolit, eneolit, rannyaya bronza* (The Caucasus on the Threshold of the Bronze Age. Neolithic, Eneolithic, Early Bronze Age). Moscow: "Nauka" Publishing House (in Russian).

Munchayev, R.M. (1982) Eneolit Kavkaza (Eneolithic of Caucasus). In: Masson, V.M. and Merpert, N.Ya. (eds.), *Eneolit SSSR* (Eneolithic of USSR). Arkheologiya SSSR (Archaeology of USSR). Moscow: "Nauka" Publishing House, pp. 100–164 (in Russian).

Munchayev, R.M. (2007) Urukskaya kul'tura (Mesopotamiya) i Kavkaz (Uruk Culture [Mesopotamia] and the Caucasus). In: Gadzhiev, M.S. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza. Materiali Mezhdunarodnoy nauchnoy konferentsii "Noveyshiye arkheologicheskiye i etnograficheskie issledovaniya na Kavkaze"* (Archaeology, Ethnology and Folkloristic of the Caucasus. Materials of International Conference, "Newest Archaeological and Ethnographic Investigatios in the Caucasus"). Makhachkala: Institute of History, Archaeology and Ethnography of the Russian Academy of Sciences. Dagestan Scientific Center, pp. 8–9 (in Russian).

Museyibli, N.A. (2007a) *Böyük Kesik. Eneolit Dövrü Yaşayış Məskəni* (Chalcolithic settlement Beyuk Kesik). Baku: "Nafta Press" Publishing House (in Azeri, Russian and English).

Museyibli, N. (2007b) K voprosu o khronologii leylatepinskoy kul'turi (Towards the Question of Chronology of Leylatepe Culture). In: Gadzhiev, M.S. (ed.), *Arkheologiya, Etnologiya i Fol'koristika Kavkaza. Materiali Mezhdunarodnoy nauchnoy konferentsii "Noveyshiye arkheologicheskiye i etnograficheskie issledovaniya na Kavkaze"* (Archaeology, Ethnology and Folkloristic of the Caucasus. Materials of International Conference, "Newest Archaeological and Ethnographic Investigatios in the Caucasus"). Makhachkala: Institute of History, Archaeology and Ethnography of the Russian Academy of Sciences. Dagestan Scientific Center, pp. 155–158 (in Russian).

Narimanov, I. (1987) *Kul'tura drevneishego zemledel'chesko-skotovodcheskogo naseleniya Azerbaijana (Eneolit. VI–IV tis. do n.e.)* (The Culture of the Ancient Farming Population of Azerbaijan [the Chalcolithic Period. VI–IV millennia BC]). Baku: "Elm" Publishing House (in Russian).

Narimanov, I.G., Akhundov, T.I. and Aliyev, N.G. (2007) *Leylatepe*. Baku: "Elm" Publishing House (in Russian).

Palumbi, G. (2007) A Preliminary Analysis on the Prehistoric Pottery from Aratashen (Armenia). In: Lyonnet, B. (ed.), *Les cultures de Caucase (VIe-IIIe millénaires avant notre ère). Leurs relation avec le Proche-Orient*. Paris: CNRS Éditions, pp. 63–76.

Pernicka, E. (1990) Gewinnung und Verbreitung der Metalle in prähistorischer Zeit. *Jahrbuch des Römisch-Germanischen Zentralmuseums* 37, pp. 21–129.

Pigott, V.C. (1999) The Development of Metal Production on the Iranian Plateau: An Archaeometallurgical Perspective. In: Pigott, V.C. (ed.), *The Archaeometallurgy of the Asian Old World*. University Museum Monograph 89. Philadelphia: University of Pennsylvania, pp. 73–106.

Pinhasi, R., Gasparian, B., Areshyan, G.E., Zardary an, D., Smith, A., Bar-Oz, G. and Higham, T. (2010) First direct evidence of Chalcolithic footwear from the Near Eastern Highlands. *PLOS ONE* 5 (6) (http://www.plosone.org/ article/info:doi/10.1371/journal.pone.0010984).

Radivojević, M., Rehren, T., Pernicka, E., Dušan, Š., Brauns, M. and Dušan, B. (2010) On the Origins of Extractive Metallurgy: New Evidence from Europe. *Journal of Archaeological Science* 37, pp. 2775–2787.

Radivojević, M., Rehren, T., Kuzmanović-Cvetković, J., Jovanović, M. and Peter Northover, J. (2013) Tainted Ores and the Rise of Tin Bronzes in Eurasia, c. 6500 Years Ago. *Antiquity* 87, pp. 1030–1045.

Seeliger, T.C., Pernicka, E., Wagner, G.A., Begemann, F., Schmitt-Strecker, S., Eibner, C., Özuntali, Ö. and Baranyi, I. (1985) Archäometallurgische Untersuchungen in Nord- und Ostanatolien. *Jahrbuch des Römisch-Germanischen Zentralmuseums* 32, pp. 597–659.

Tedesco, L.A. (2006) *Redefining Technology in Bronze Age Transcaucasia: Copper-Alloy Metallurgy in Armenia in the 3rd-mid 2nd millennium BC*. Ph.D Dissertation, Department of Anthropology, New York University.

Thornton, C.P. (2009) The Emergence of Complex Metallurgy on the Iranian Plateau: Escaping the Levantine Paradigm. *Journal of World Prehistory* 22, pp. 301–327.

Torosyan, R.M. (1976) *Teghuti vagh erkragortsakan bnakavairy (m.t.a. IV hazaramyak)* (The Early Farming Settlement of Teghut [IV Millennium BC]). Hnagitakan peghumnery Hayastanum (Archaeological excavations in Armenia) N14. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian with Russian Resume).

Wilkinson, K.N., Gasparian, B., Pinhasi, R., Avetisyan, P., Hovsepyan, R., Zardaryan, D., Areshian, G.E., Bar-Oz, G. and Smith, A. (2012) Areni-1 Cave, Armenia: A Chalcolithic-Early Bronze Age Settlement and Ritual Site in the Southern Caucasus. *Journal of Field Archaeology* 37/1, pp. 20–33.

Zardaryan, D.E. (2011) O rannikh proyavleniyakh elementov kuro-arakskoy kul'tury v pozdneeneoliticheskoy keramike Areni-1 (Towards Early Reflections of Elements of Kura-Araxes Culture in the Late Eneolithic Ceramics of Areni-1). In: Skakov A.Yu. (ed.), *Problemi Arkheologii Kavkaza: k 70-letiyu Yu.N. Voronova. Sbornik materialov Mezhdunarodnoy nauchnoy konferentsii posvyashchennoy 70-i letiyu Yu.N. Voronova (10-11 maya, 2011 g., g. Sukhumi)* (Problems of Archaeology of the Caucasus: to the 70th anniversary of Yu.N. Voronov, Collection of Materials of the International Conference dedicated to the 70th anniversary of Yu.A. Voronov, 10-11th of May 2011, Sukhum). Sukhum: AbIGI Press, pp. 53–57 (in Russian).

Zardaryan, D. and Gasparyan, B. (2012) Kul'turnye vzaimosvyazi pozdneeneoliticheskikh obitateley peshcheri Areni-1: na osnove sravneniya keramicheskikh materialov (Cultural Contacts of Late Eneolithic Inhabitants of Areni-1: According to Comparisons of Ceramic Materials). In: Gadzhiev M.S. (ed.), *Noveyshie otkrytiya v arkheologii severnogo Kavkaza: issledovanniya i interpretatsii, XXVII Krupnovskie Chteniya*. Materiali Mezhdunarodnoy nauchnoy konferentsii, Makhachkala, 23-28 aprelya 2012 g. (The Newest Discoveries in Archaeology of the North Caucasus: Investigations and Interpretations, XXVII Krupnov Readings. Materials of the International Conference, Makhachkala, 23-28 April 2012). Makhachkala: "Mavraev" Publishing House, pp. 46–49 (in Russian).

Zwicker, U. (1977) Investigations on the Extractive Metallurgy of Cu/Sb/As Ore and Excavated Smelting Products from Norşun-Tepe (Keban) on the Upper Euphrates (3500–2800 B.C.). In: Oddy, W.A. (ed.), *Aspects of Early Metallurgy*. London: Historical Metallurgy Society, pp. 13–26.

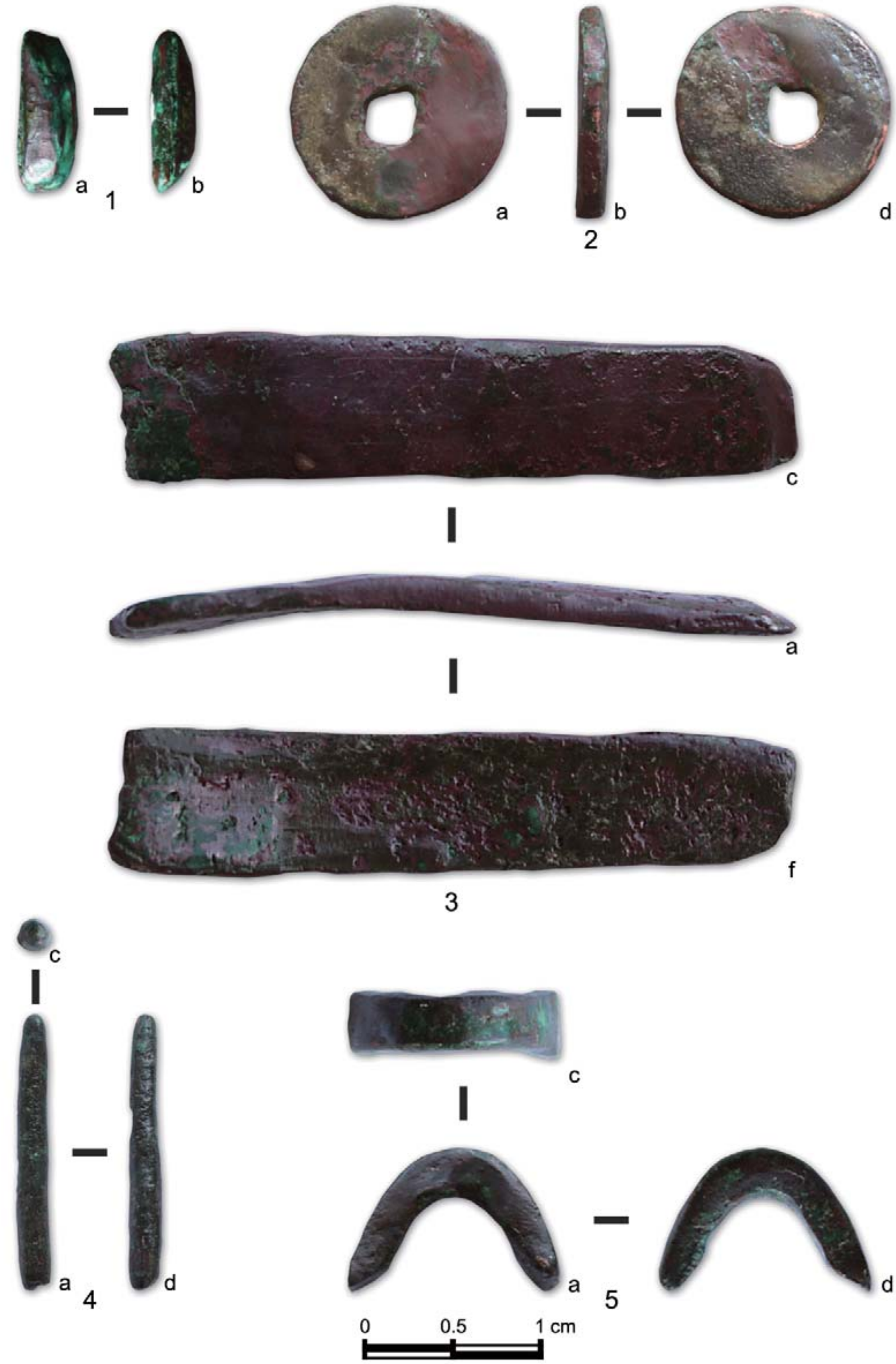

Figure 1
Mushakan-4. Metal artifacts from the Chalcolithic Horizon I (third quarter of the 5th millennium BC).
1. Small piece of copper; 2. Holed disk (bead?); 3. Bracelet fragment; 4. Awl/retoucher; 5. Hook?

Figure 2
Areni-1 cave. Copper ores from the Chalcolithic Horizon II (4,000–3,700 Cal BC).

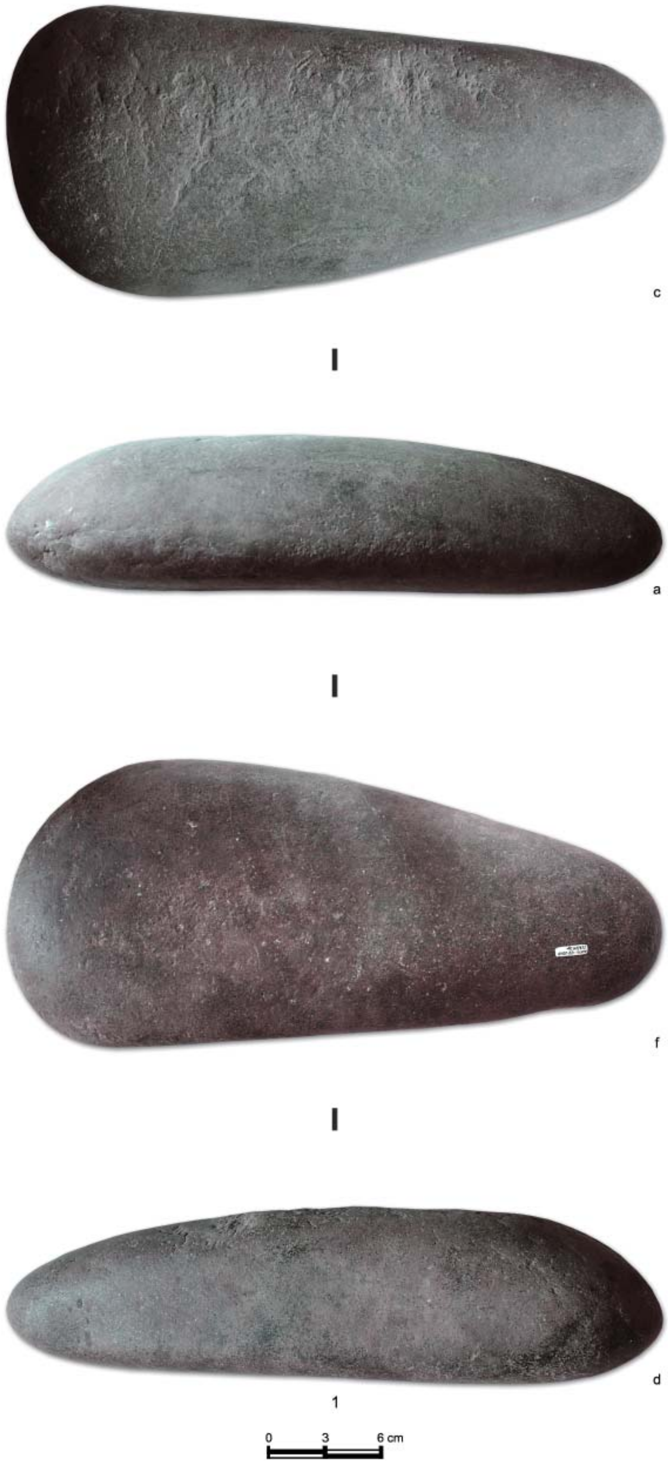

Figure 3
Areni-1 cave. Basalt pestle-hammer and grinding stone from the Chalcolithic Horizon II (4,000–3,700 Cal BC).

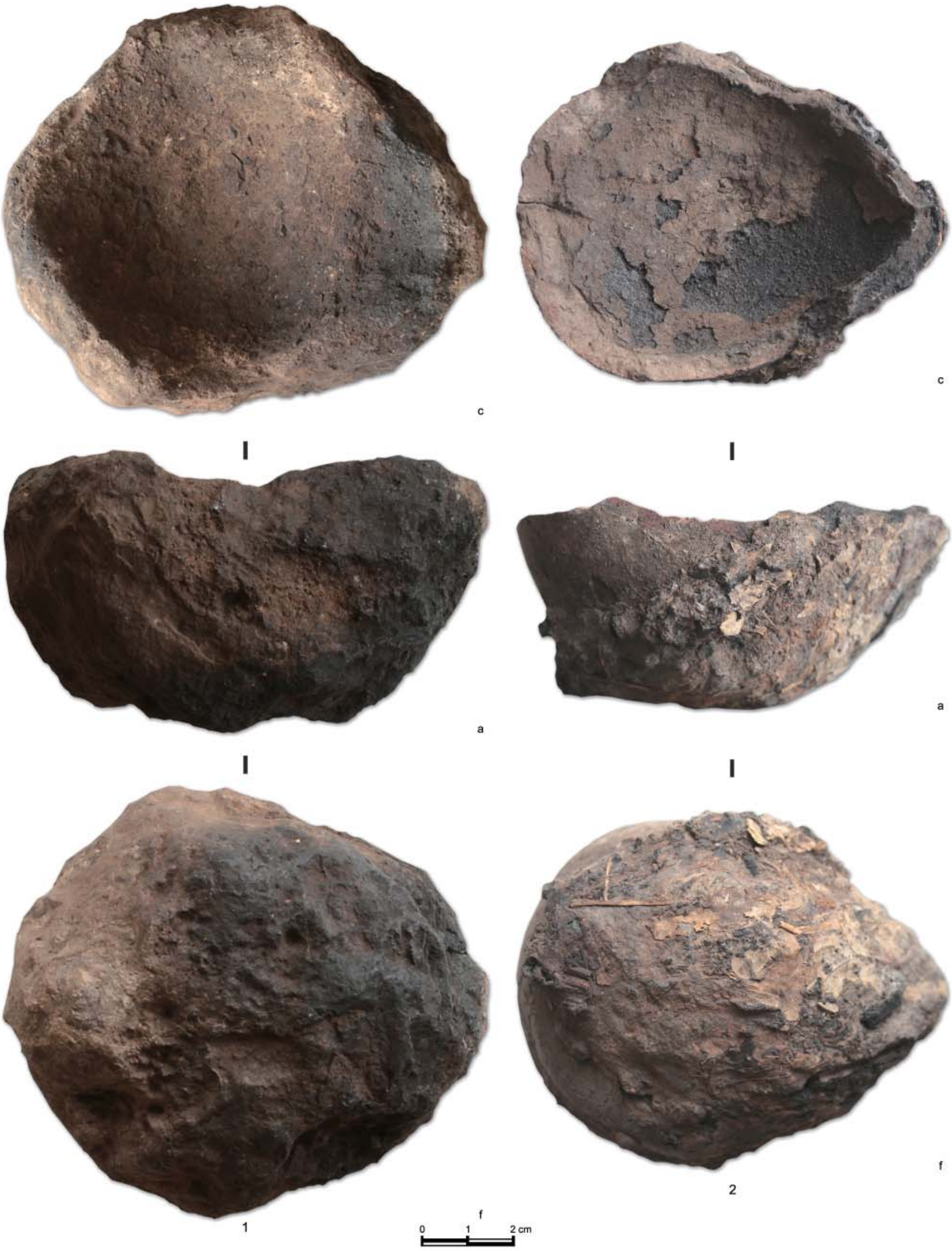

Figure 4

Areni-1cave. Basalt (1) and clay (2) crucibles from the Chalcolithic Horizons I (1) and II (2) (4,000–3,400 Cal BC).

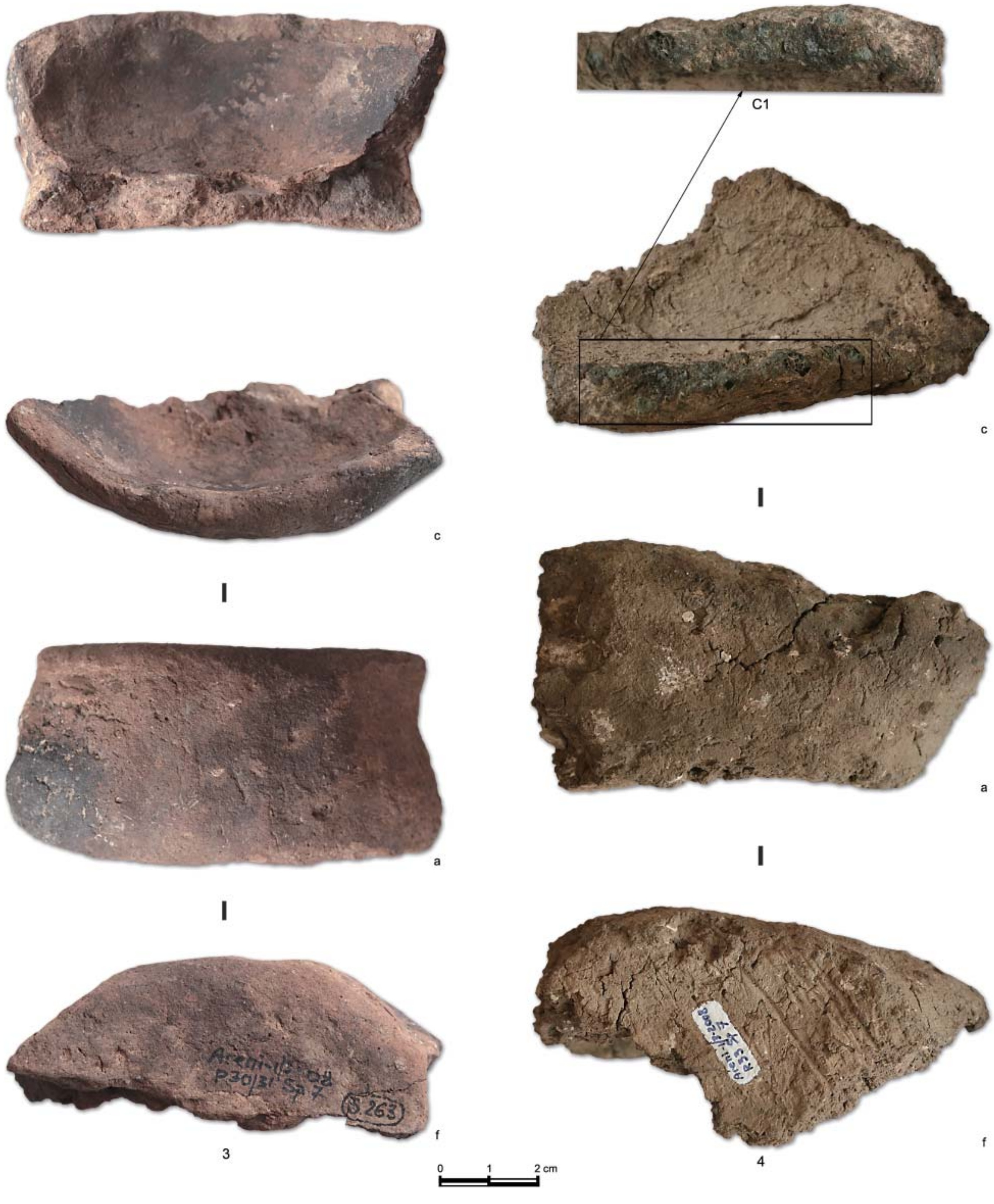

Figure 5
Areni-1cave. Clay crucibles from the Chalcolithic Horizons I (1) and II (2) (4,000–3,400 Cal BC).

Figure 6

1-6, 9-11: Areni-1 cave. Ceramic artifacts (1-2. Pourers; 3-5. Crucibles; 6. Spouted vessel; 9-10. Casting moulds; 11. Ventilation pipe) from the Chalcolithic Horizons I (4, 10) and II (1-3, 5-6, 9, 11) (4,000–3,400 Cal BC).

7-8: Aknashen/Khatunarkh. Clay crucibles from Chalcolithic Horizon (mid 5th millennium BC).

Figure 7

1, 4-8: Areni-1 cave. Metal artifacts (1. Copper ingot; 4-5. Knives; 6. Knife base fragment; 7. Adze; 8. Bowl fragment) from the Chalcolithic garbage layer (1) (4,000–3,700 Cal BC) and the Chalcolithic Horizon II (4-8) (4,000–3,700 Cal BC). 2: Teghut. Knife from the Chalcolithic Layer (after new restoration, 4,000–3,700 Cal BC). 3: Sotk 2. Knife from Horizon IIa (3,700–3,400 Cal BC).

Figure 8
1-4, 10: Areni-1 cave. 1. Pike head; 2. Awl; 3-4. Ingots; 10. Bracelet fragment from the Second Chalcolithic Horizon (4,000–3,700 Cal BC). 5-9: Nerkin Godedzor. 5-8. Awls; 9. Earring from the Late Chalcolithic Layers (3,700–3,400 Cal BC).

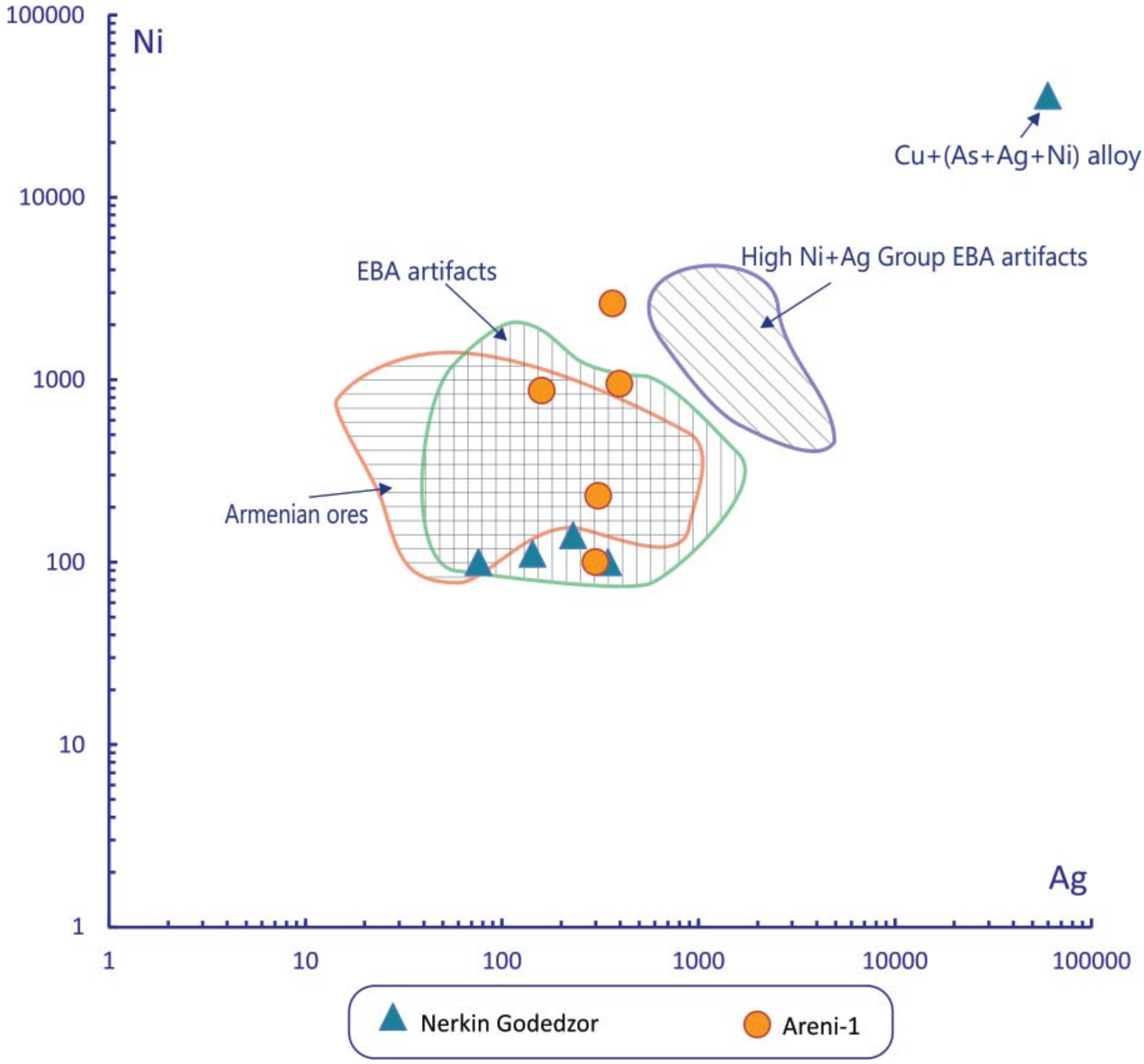

Figure 9
Ag vs. Ni diagram from comparison of Armenian ores, Early Bronze Age artifacts and analyzed Chalcolithic artifacts from Areni-1 cave and Nerkin Godedzor settlement.

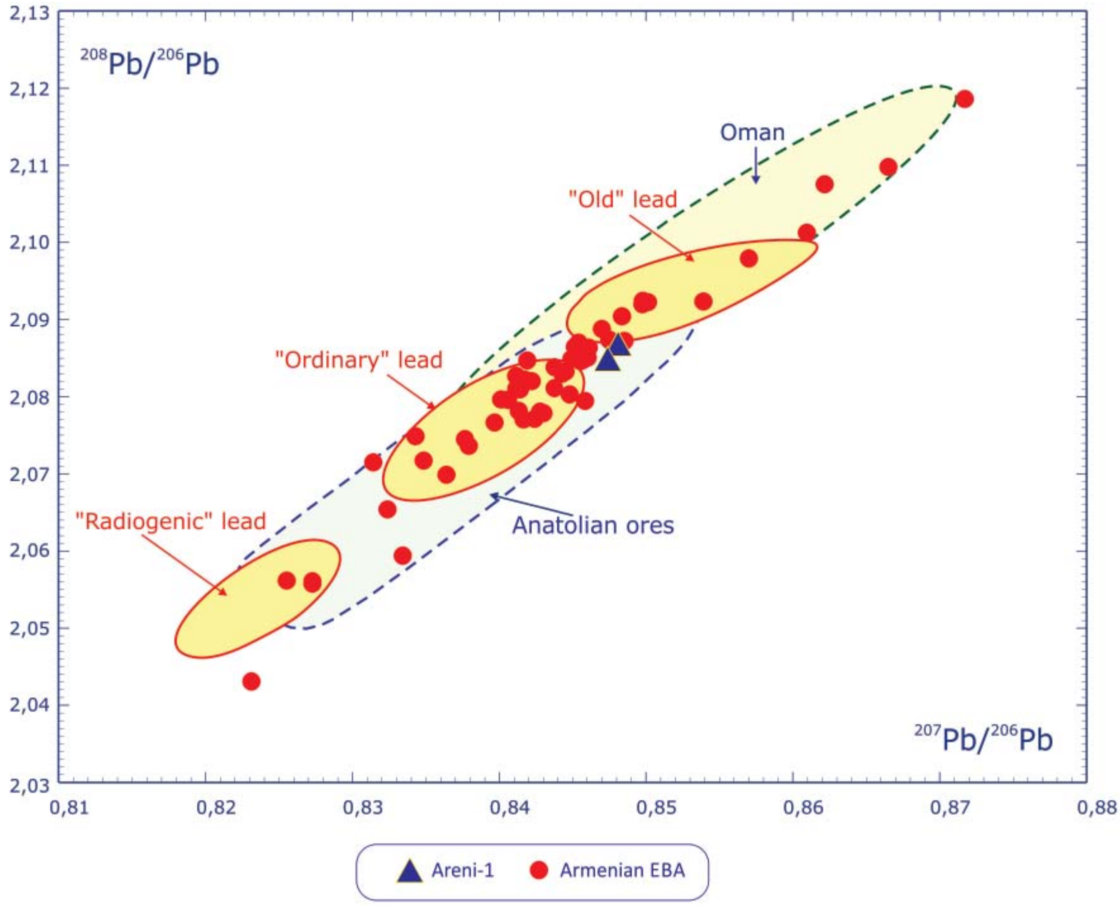

Figure 10

Diagram of the 207Pb/206Pb vs. 208Pb/206Pb in analysed artifacts from Areni-1 cave and previously analysed Early Bronze Age Armenian artifacts. Isotope compositional fields of Armenian ores are shown.

1. “Radiogenic” lead group; 2. “Ordinary” lead group; 3. “Old” lead group (Meliksetian and Pernicka 2010). Lead isotope compositional fields of ores of Anatolia and Oman are given for comparison.

Rock-Painting Phenomenon in the Republic of Armenia

Anna Khechoyan and Boris Gasparyan

1. Introduction: The history of the discoveries

The earliest discoveries of rock-painting in the territory of the Republic of Armenia date to the end of the 1970s and involved the description of paintings from a cave in the Khosrov Reserve, itself within the Darband River valley (a tributary of the Azat River) (Arekelyan 1982). According to B. Arakelyan, among the 166 rock-paintings in Darband cave, 164 represented anthropomorphic silhouette style figures (Figure 1: 1, 2) while the remaining two represented zoomorphic figures. Brown, red, and black pigments were used for to construct the paintings. B. Arakelyan, based on the relatively small sizes of the images and their monochromaticism, silhouette style solutions, schematization, and overall stylistic features, referred the paintings to the Neolithic period. He reported further that test excavations within the cave sediments unearthed two lithic tools (Arekelyan 1982, pp. 52-53). Doubts remained about the authenticity of the Khosrov Reserve images, however, with some even attributing them to modern authors. Nevertheless, the Darband Cave works are likely the first reported cave paintings in Armenia, although additional, and more detailed, study of these and other works are required, particularly in light of newly discovered sites with similar finds.

During systematic surveys in 2002 in the Kasakh River gorge, 3.5 km NW of the modern village of Artashavan, a new cave site, Geghamavan-1 (called Red Cave by locals) was discovered near the newly founded village of Geghamavan at the western foot of Mt. Ara. The interior of the cave – ceiling, walls, and facade – and the surfaces of broken rock slabs retain red ochre paintings. The newly discovered site was thoroughly studied in 2002-2003 by a joint Armenian-French expedition (led by B. Gasparyan – Institute of Archaeology and Ethnography and C. Chataigner

– Maison de l’Orient et de la Méditerranée, Lyon). Along with the documentation of the rock-paintings themselves, test excavations were carried out as well (Gasparyan and Sargsyan 2003a; 2003b; Gasparyan *et al*. 2005; Feruglio *et al*. 2005; Khechoyan and Gasparyan 2005; Feruglio and Khechoyan 2007; Khechoyan *et al*. 2007).

In 2009, another group of rock-paintings was discovered in the Kasakh River gorge by A. Asryan, who was the first to notice one of the figures during his survey (Figure 9: 1a). In 2011 an expedition from the Institute of Archaeology and Ethnography headed by A. Khechoyan visited the site and managed to document the whole complex, which consisted of four poorly preserved, and barely perceptible, rock-paintings made with red ochre. This site is located on the NW approaches of the town of Ashtarak, 13 km south of Geghamavan-1 cave, on a hill on the left bank of the Kasakh River – on an imposing rock called Pokaberd by locals (Shahaziz 1987, p. 179) and just in front of the famous caves of Darabavor[1].

And, finally, in 2013 a rare rock-painting was discovered on the southern foothills of Mt. Aragats in the northern outskirts of the village of Kakavadzor at the head of the Kakavadzor River gorge. This drawing, which was initially discovered by a local villager A. Stepanyan, forms part of the Kakavaberd archaeological complex and is represented by a bichrome painting on the surface of a small rock niche. A detailed analysis of the rock-painting was carried out by A. Khechoyan (Institute of Archaeology and Ethnography) that same year.

2. Description of the sites

2.1. Geghamavan-1 cave

Geghamavan-1 cave is situated on the eastern side of Mt. Aragats and on the western foothills of Mt. Ara upon basalt formations of the left 4th terrace of the Kasakh River gorge. The site is located about 70 m above the river at an altitude of 1738 m above sea level (Figure 2). The covered portion of the shelter is relatively large (11 m wide, 4 m high, 8 m deep at its opening) and opens to south-west. The cave’s ceiling is continuously peeling off in decimeter-size slabs that may have formed the backing for paintings. An active spring located at the back of the shelter produces water that runs over the layers of basalt and tuff. The tuff itself, which is laden with iron oxide, is a possible source of pigment. Although all the shelter’s walls are exposed to daylight, only those in the front are affected by direct light.

The paintings were composed out on the smooth surface of the basalt slabs that can be found both inside and outside the shelter. They spread over some twenty meters with smaller panels

1. The rock-paintings of Pokaberd and Kakavadzor are being published here for the first time.

at the center and larger panels placed laterally. They are located at heights ranging from 40 cm to 6.50 m above the floor. The folded basalt layers create a set of vertical slabs cut like a canyon, and inside the shelter the figures are found on the cleavage faces of the slabs, while the panels outside the shelter face the canyon (Figure 3). Frontal anthropomorphic and profiled zoomorphic figures face either towards the south or towards the floor. The panels at the site are morphologically defined by breaks, fissures, or major ruptures on the slope of the rocks. There are over 60 panels that house a total of 112 figures; two examples of Arabic inscriptions and graffiti, which cover the earlier paintings, are also present. Zoomorphic forms dominate (43%), followed by anthropomorphic forms (28%), signs (24%), and undetermined lines (5%). The works are generally small or medium in size, with very few reaching 50-56 cm in maximum dimension.

All the observed paintings were made with a red monochromic solution that was likely obtained from a natural paint extracted from the red volcanic tuff formations inside the cave. Judging from preservational differences in the ochre, the quality and color tones suggest the use of tuff both on its own and as part of a mixture. Various application techniques were also employed. There are, for example, simple lines made with a block of tuff and lines applied by a finger soaked in a coloring liquid. A variety of consistences are also evident, ranging from liquid to paste-like. The authors of the more recent graffiti also made use of the immediately available red tuff. There is, nonetheless, a range of red tones and it is difficult to determine whether this is due to pigment source, the addition of binders, or differential preservation. Based on stylistic peculiarities, one can distinguish three groups of paintings with different approaches:

1. In the first group the figure is isolated with no compositional connection to other figures. Paintings of profiled animals differ from other iconography in correct proportionality, static position, and the usage of volume, solid style, and a more detailed and realistic treatment and greater dimensions (Figures 3 and 4).
2. The second group has two subgroups:
    a. One subgroup of paintings has simple compositional scenes with partial large-size figures that have both stylistic and static solutions as well as a solid style (Figure 5: 1).
    b. The paintings of the other subgroup represent schematic and stylized figures of comparatively small sizes.
3. The third group includes two Arabic inscriptions and contemporary graffiti, which covered, and partly destroyed, the rock paintings.

Unfortunately, excavations inside the rock-shelter failed to obtain a cultural attribution for the art: only numerous fragments of a Medieval pottery wheel were identified. Another small test excavation was made on the slope in front of the shelter, also with no results. In the absence of archaeological evidence, chronological attribution thus must rely on a stylistic and thematic comparison of the designs. The artistic analyses of the paintings show that they have features characteristic of both ancient and later periods and confirm that Geghamavan-1 cave had been visited and used continuously. Compositional stratigraphy (i.e. some superimposition of paintings) is noticeable (Figures 5: 1 and 6). The fundamental subject of the first group of paintings is cognition and representation of the animal's real image, which suggests an ancient age (Figures 3 and 4). In addition, panel N20-1 preserves a drawing of a horse-like animal, most likely a kulan or *Equus hemionus* (Figure 4). The remains of this animal were found during excavations of the prehistoric layer 5 at Apnagyugh-8/Kmlo-2 cave, which is situated nearly 2 km north along the same canyon and is dated by a set of C14 dates to the 12–8th millennia BC. Kulan were among the main hunting objects of the inhabitants of the cave. Remains of kulan were also recorded at another site of this culture in the vicinity, the open-air locality of Gegharot-1 (see Petrosyan *et al*. this volume). All of this suggests that the earliest paintings of Geghamavan-1 cave belong to the Late Mesolithic/Proto-Neolithic population occupying the Aparan Depression and the Kasakh River valley during the terminal Pleistocene and Early Holocene, and they could date back to the same time period; i.e., the 12th–8th millennia BC. In the second group the interconnected disposition of figures gives the impression of information transfer. Here, the concept of a generalized image of animals can be seen with the consequent importance of rendering an ideological content through a schematic solution. This stylistic variant is common among populations of later time periods, perhaps, as their similarities to Near Eastern art indicate, the Late Neolithic, that is the 7th–6th millennia BC (Figure 5: 1-2). Another subgroup with highly schematic representations – a linear technique and themes similar to petroglyphs known from different parts of Armenia (Gegham Range, Vardenis Range and Syunik) – could date back to the 4th to 1st millennia BC, although it is not inconceivable that some of them (the stylized goats and crosses, for example) were painted in the Middle Ages (Figures 6 and 7). The third group, the two Arabic inscriptions, can be dated to contemporary graffiti from 1680. Natural processes of decay are also responsible for the disappearance of the best parts of the drawings (Feruglio *et al*. 2005; Khechoyan and Gasparyan 2005; 2008; Feruglio 2008; Feruglio and Khechoyan 2007; Khechoyan *et al*. 2007).

2.2. Pokaberd rock-shelter

The rock-paintings of Pokaberd are similarly localized to the smooth surfaces of the basaltic rocks. The cliff recognized today as Pokaberd was, in fact, a cave or rock-shelter in earlier times. Its roof gradually collapsed, causing damage to the rock-paintings via continuous natural weathering and water erosion (Figure 8: 1-2). This is the main reason for the rarity of paintings, the poor preservation of those still extant, and their difficult discernment (their complete shape is visible only by contrast editing).

There is currently a total of four known preserved images, all of which were composed with a monochrome pigment of red color. The source of the pigment, like that at Geghamavan-1 cave, is located on-site, as reddish tuffs exist under the basalt lava flow. Image 1 is a 20 × 15 cm vertical figure resembling a scorpion, which is possibly a stylized anthropomorphic drawing (Figure 9: 1a). Image 2 represents an anthropomorphic figure with legs splayed upwards, which probably forms a complete composition with Image 3 (an arc facing upwards) (Figure 9: 1b). Image 4 is only partially preserved as its left and lower parts were flaked off together with the surface of the basalt rock[2]. The image depicts a double incomplete circle with a leaf-like painting in the center (Figure 10: 1-1a). The most interesting and obvious analogy for this occurs on a brown glazed ceramic beaker from Susa, dated back to the 4th millennium BC (Musée du Louvre, Paris)[3], where a goat with a girdled foliage between its horns is depicted (Figure 10: 2). This observation could serve as a basis for dating the Image 4 from Pokaberd. In general, the rock-paintings of Pokaberd show a linear and stylized design, among which Image 1 finds a direct parallel with a paintings of the third group from Geghamavan-1 cave (Figure 9: 2). Overall, however, the dearth of rock-paintings at Pokaberd and their poor preservations do not allow the construction of a precise chronological and cultural context. For now, we favor a general date sometime within the 4th millennium BC.

2.3. Kakavadzor rock-shelter

The site is located at an altitude of 1683 m above sea level on a hill on the left bank of the Kakavadzor River. The rock-shelter is a 3.5 × 4 m niche formed as a result of mechanical weathering in the tuff lava flow formation (Figure 11: 1). The site's single drawing is hidden under the semi-oblique, sloped natural roofing (azimuth 2460, oriented to the SW) and as a result of its constant shading, is relatively well-preserved (Figure 11: 2). A study of the image progressed, it became evident that the image was drawn not on the raw surface but on plaster attached to it. This means that Kakavadzor preserves the earliest appearance of a fresco (Figure 12 and 13: 1). Moreover, two colors were used for drawing – reddish and bluish paints. The latter color is partially preserved on the lower part of the figure (Figures 12 and 13: 2). Closer examination allowed the

2. Unfortunately, this fragment could not be located during the study of the cave.

3. The authors express their gratitude to the Senior Researcher of the IAE, Dr. F. Ter-Martirosov who drew their attention to this similarity.

sequence of the paint use to be established. In this case, the surface of the clay plaster was painted with a blue pigment, over which the reddish ochre zoomorphic image was applied (Figure 13: 2). Study of the technological features shows that the drawings were applied with a brush. A reddish tuff layer located not far from the cave was used as the raw material for the red paint (Figure 14: 2). The fresco of Kakavadzor depicts a 2.3 × 2.45 m zoomorphic figure enclosed within a stripe of a triple row of circles (Figure 12). Its size it differentiates it from the rock-paintings of other known sites in Armenia and the region. The image was created by a linear technique and is very stylized. The upper part of the stripe surrounding the animal is relatively symmetric and consists of 48 circles. The stripe in the lower part is composed of a randomly placed 10 circles, which are almost washed away and are visible only on the edited photo (Figure 12).

In general, the dating of this image is unclear as it is a one-of-the-kind composition. The archaeological context suggests that the fresco is a part of the Kakavaberd complex. According to the surface material, the earliest traces of occupation date to the Late Chalcolithic – the initial stages of the Early Bronze Age dated back to the second half of the 4th millennium BC.

As mentioned above, the bichrome fresco of Kakavadzor is probably the earliest sample among those discovered in the region. A polychrome fresco was found during the excavations of Lori Berd in 1992-1993. There, on a wall of the burial chamber of Tomb N79 (mid 2nd millennium BC) figures of various kinds of animals (deer, snakes, and birds) were painted with yellow, green, and orange colors (Devejyan 2001, p. 39; 2006, p. 51-67). As for the usage of bluish shades, the earliest samples are known from the sites of the Van Kingdom, such as Erebouni, Teyshebaini – Karmir Blur, Altintepe, etc. (Hovhannisyan 1973).

3. Concluding remarks

Summarizing the general description of the rock-paintings discovered in Armenia, it may be stated that, as a rule, they are located in small caves and rock-shelters formed in basalt and tuff formations within river gorges at altitudes ranging between 1100-1700 m above sea level. Both the internal and external smooth surfaces of these natural caverns were chosen for drawings. These surfaces are characterized by small, vertical and horizontal slabs and separated by fissures. The reddish ochre-like tuff formations that appear in the lower contacts of the basaltic lava flow at or nearby were used as paint for the drawings.

At the cave of Geghamavan-1 these formations are concentrated just inside, and at the bottom of the cave. As for the other sites, the formations occur on the areas surrounding the sites (Figure 14: 1-2). The images were created on the surface of the rock “canvases,” are monochromatic, and composed most likely by a mixture of organic contents and binders. In the case of Kakavadzor, a bichrome or two-colored drawings was performed with pigments of reddish and bluish color shades applied onto a coating base; that is, it represents a fresco. Figures were drawn by fingers soaked in the pigment, with a "brush" made of animal fur, and the direct application of the raw material to the walls.

By iconography, most of the rock-paintings are zoomorphic, while anthropomorphic and geometric drawings are relatively rare. As for the morphological and stylistic peculiarities of the images, these are: solid, contour, and linear schematized designs. The images also differ by theme, perception of the concept, and the variety of the depiction manner: from the single images of anthropomorphic figures and animals to the complex, multi-figure dynamic compositional systems. These rock-paintings vary greatly size: from 10-20 cm to 2.5 m. This difference makes it possible to divide the drawings into groups and suggest a comparative chronology. Unfortunately, the limited number of such sites and the incomplete archaeological contexts do not currently allow the creation of an absolute chronology for the rock-paintings. Nevertheless, the summarizing of the existing data makes it possible to consider the period of the creation of the rock-paintings in the territory of Armenia as 12th–1st millennia BC and to assume that these are products of Mesolithic, Neolithic-Chalcolithic, and Bronze–Iron Age populations.

The discovery and study of rock-paintings in Armenia is still in its initial stage. Pigment outcrops of tuff origin at the foot of Mt. Aragats exist in many places and a large number of natural cavities in the form of caves, rock-shelters, and niches should be present in the immediate vicinity. Undoubtedly, new sites of rock-art will be discovered if and when these areas are studied.

References

Arakelyan, B. (1982) Obnaruzhenie peshchernoy zhivopisi v Armenii (predvaritel'noe soobshenie) (Discovery of cave paintings in Armenia [preliminary report]). *Lraber hasarakakan gitutyunneri* (Herald of Social Sciences) N8 (476), pp. 47–54 (in Russian).

Devejyan, S. (2001) Lori Berdi N79 dambarany (Tomb N79 of Lori Berd), Hayastani hnaguyn mshakuyty (Ancient Culture of Armenia). In: Kalantaryan, A. and Harutyunyan, S. (eds.), *Abstracts of the reports of the conference in commemoration of H. Martirosyan*. Yerevan: National Academy of Sciences of the Republic of Armenia Institute of Archaeology and Ethnography Press, p. 39 (in Armenian).

Devejyan, S. (2006) *Lori Berd* II (Mijin Bronz) (Lori Berd II [Middle Bronze Age]). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House (in Armenian, in French and in English with Russian Resume).

Feruglio, V. (2008) Art rupestre – Méthodes d'étude. In: Sanz, N. (ed.), *L'art rupestre dans les Caraïbes. Vers une inscription transnationale en série sur la Liste du patrimoine mondial de l'UNESCO*. World Heritage Papers 24. Paris : World Heritage Centre UNESCO, pp. 172–178.

Feruglio, V. and Khechoyan, A. (2007) L'art rupestre d'Arménie. *Les dossiers d'archéologie* 321, pp. 46–49.

Feruglio, V., Khechoyan, A., Gasparyan, B. and Chataigner, C. (2005) The Geghamavan-1 painted shelter, Aragatsotn Province, Republic of Armenia. *International Newsletter on Rock Art (INORA)* 41, pp. 1–7.

Gasparyan, B., Khechoyan, A. and Sargsyan, G. (2005) Geghamavan-1 karayri ("Karmir karandzav") zhayrankarnery (Wall-paintings of Geghamavan-1 cave ["Red Cave"]). In: S. Shahinyan (ed.), *Hayastani karandzavnery* (Caves of Armenia). Book A, Appendix IX. Yerevan, pp 139–142 (in Armenian).

Gasparyan, B. and Sargsyan, G. (2003) Kasakhi kirchi hnagitakan hushardzanneri usumnasirutyan nakhnakan ardyunknery (Preliminary results of investigation of the archaeological monuments in the Kasakh River Canyon). In: T*he Jubilee Conference "Aragatsotn. Spiritual and Cultural Heritage", dedicated to the 1700th anniversary of the unction of the Mother Temple of Holy Ejmiatsin*. Theses of the Conference. Oshakan, pp. 58−59 (in Armenian).

Gasparyan, B. and Sargsyan, G. (2003b) Zhayrankarneri norahayt khumb Geghamavani "Karmir karandzavum" (Newly discovered group of rock paintings in Geghamavans' "Red Cave"). In: Kalantaryan, A. and Badalyan, R. (eds.), *Hayastani hnaguyn mshakuyty 3* (Ancient Culture of Armenia 3). Materials of conference dedicated to 70th anniversary of T. Khachatryan. Yerevan: "Mughni" Publishing House, pp. 5–12 (in Armenian).

Karakhanyan, G.H. and Safyan, P.G. (1970) *Syuniki zhayrapatkernery* (The Rock-Carvings of Syunik). In: Tiratsyan, G.A. (ed.), *The Archaeological Monuments and Specimens of Armenia, vol. 4, Issue 1*. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian, with Russian and English Resumes).

Khechoyan, A., Feruglio, V., Gasparyan, B. and Chataigner, C. (2007) The Rock Art of the Mt. Aragats System. In: Papers presented of Rock Art in the Frame of the Cultural Heritage of Humankind, XXII Valcamonica Symposium, 18th–24th May 2007, Centro Cogressi Darfo Boario Terme (BS), Italy, pp. 247–252.

Khechoyan, A. and Gasparyan, B. (2005) Geghamavan-1 karayri zhayrankarneri gegharvestakan verlutsutyan pordz (Artistic analyses attempt of the wall-paintings of the Geghamavan-1 cave). In: Kalantaryan, A.A., Badalyan, R.S. and Avetisyan, P.S. (eds.), *Hin Hayastani mshakuyty* XIII (The Culture of Ancient Armenia XIII). Materials of the Republican Scientific Conference. Yerevan: "Mughni" Publishing House, pp. 28–33 (in Armenian).

Khechoyan, A. and Gasparyan, B. (2008) Gegharvestapatkerayin mtatselakerpi artahaytman mijotsnery zhayrarvestum (Manner of Expression of Creative and Artistic Thinking in Rock Art). In: Mohammadi, M.-M. (ed.), *The First International Armenology and Iranology Conference, Isfahan, 10–11 November*. Isfahan: University of Isfahan Press, pp. 295–301 (in Armenian).

Martirosyan, H.A. (1981) *Geghama lerneri zhayrapatkernery* (The Rock-Carvings of the Ghegham Mountain Range). In: Harutyunyan, S.B. (ed.), *The Archaeological Monuments and Specimens of Armenia, vol. 11, Issue 3*. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian, with Russian and English Resumes).

Martirosyan, H.A. and Israelyan, H.R. (1971) *Geghama lerneri zhayrapatkernery* (The Rock-Carved Pictures of the Gheghamian Mountains). In: Arakelyan, B.N. (ed.), *The Archaeological Monuments and Specimens of Armenia, vol. 6, Issue 2*. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian, with Russian and English Resumes).

Hovhannisyan, K.L. (1973) *Erebunu vormnankarnery* (The wall-paintings of Erebouni). Yerevan: Armenian SSR Academy of Sciences Press (in Armenian, in Russian and in English).

Shahaziz, Y. (1987) *Ashtaraki patmutyuny* (History of Ashtarak). Yerevan: “Hayastan” Publishing House (in Armenian).

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Figure 1
Rock-paintings on the walls of the Darband cave (provided by B. Yeritsyan).

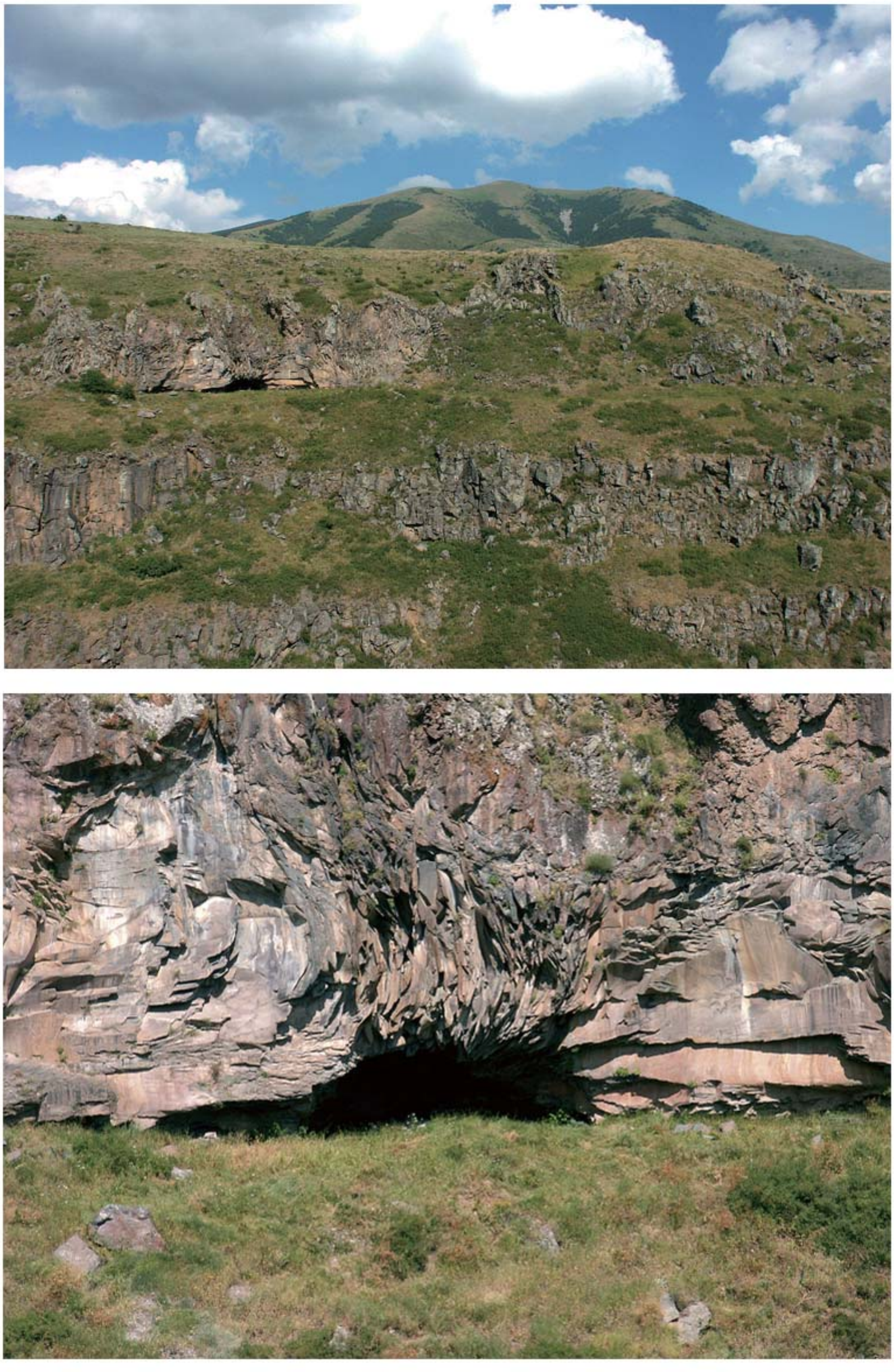

Figure 2
General view of the Ghegamavan-1 cave from the west (the opposite bank of the Kasakh River).

Figure 3
Panel N20-1 outside of the Geghamavan-1 cave, on the left side above the entrance.

Figure 4
Drawing of a horse-like animal (kulan or *Equus hemionus*) from Panel N20-1 of the Geghamavan-1 cave.

Figure 5
Rock-paintings from Geghamavan-1 cave. 1: Panel N23-2, 2: Panel N20-2 (“Milking scene”).

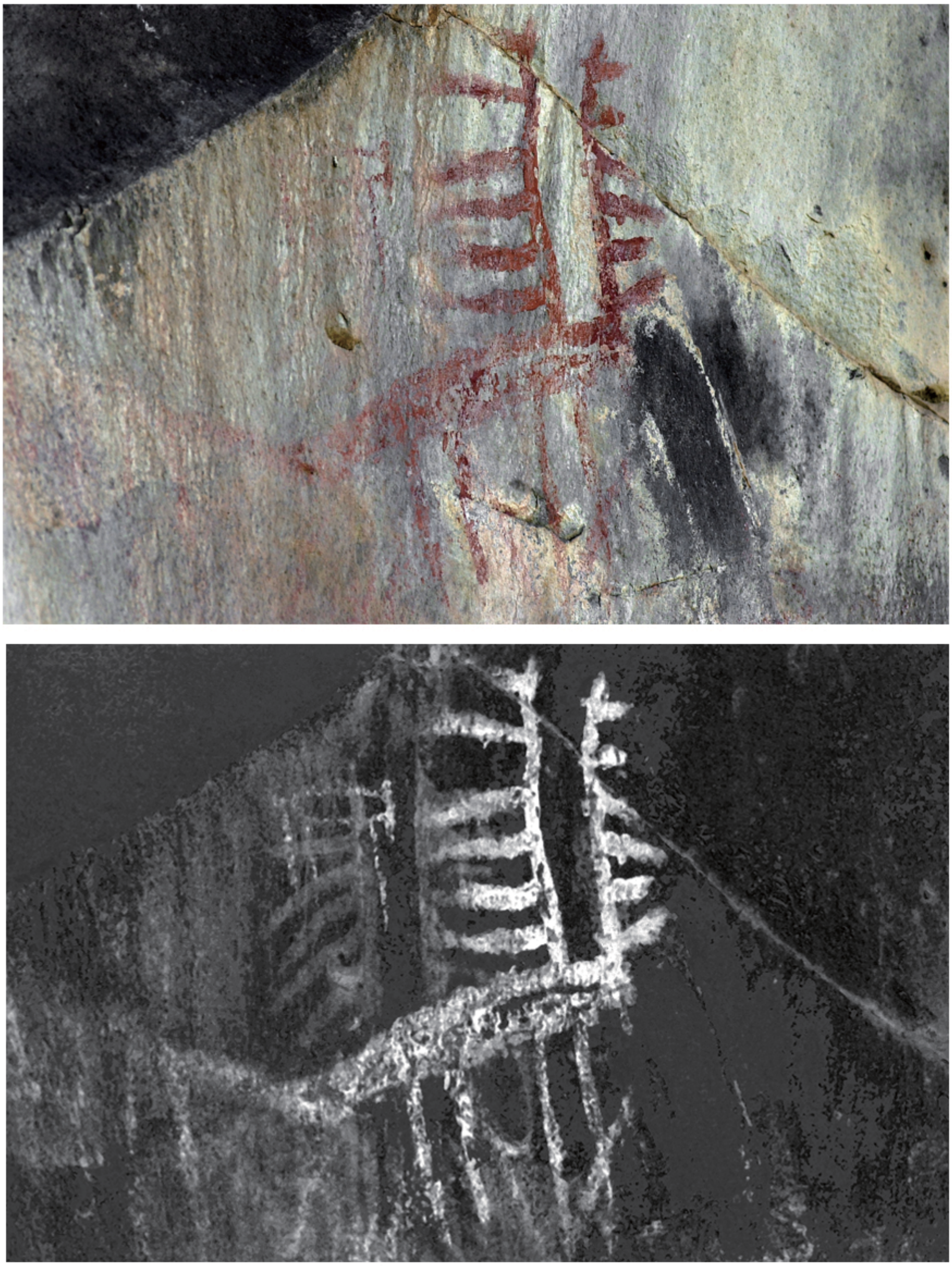

Figure 6
Drawing of a deer from Panel N20-1 of the Geghamavan-1 cave.

Figure 7
Schematic paintings from the Geghamavan-1 cave. 1. Panel H7-1 (“Domestication scene”); 2. Panels M13-1-2 (“Anthropomorphic and stair-like figures”); 3. Panel L13-2 (“Goat”).

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Figure 8

1. General view of the Pokaberd rock-shelter from the north-west (the opposite bank of the Kasakh River);

2. Facade of the Pokaberd rock-shelter with traces of paintings.

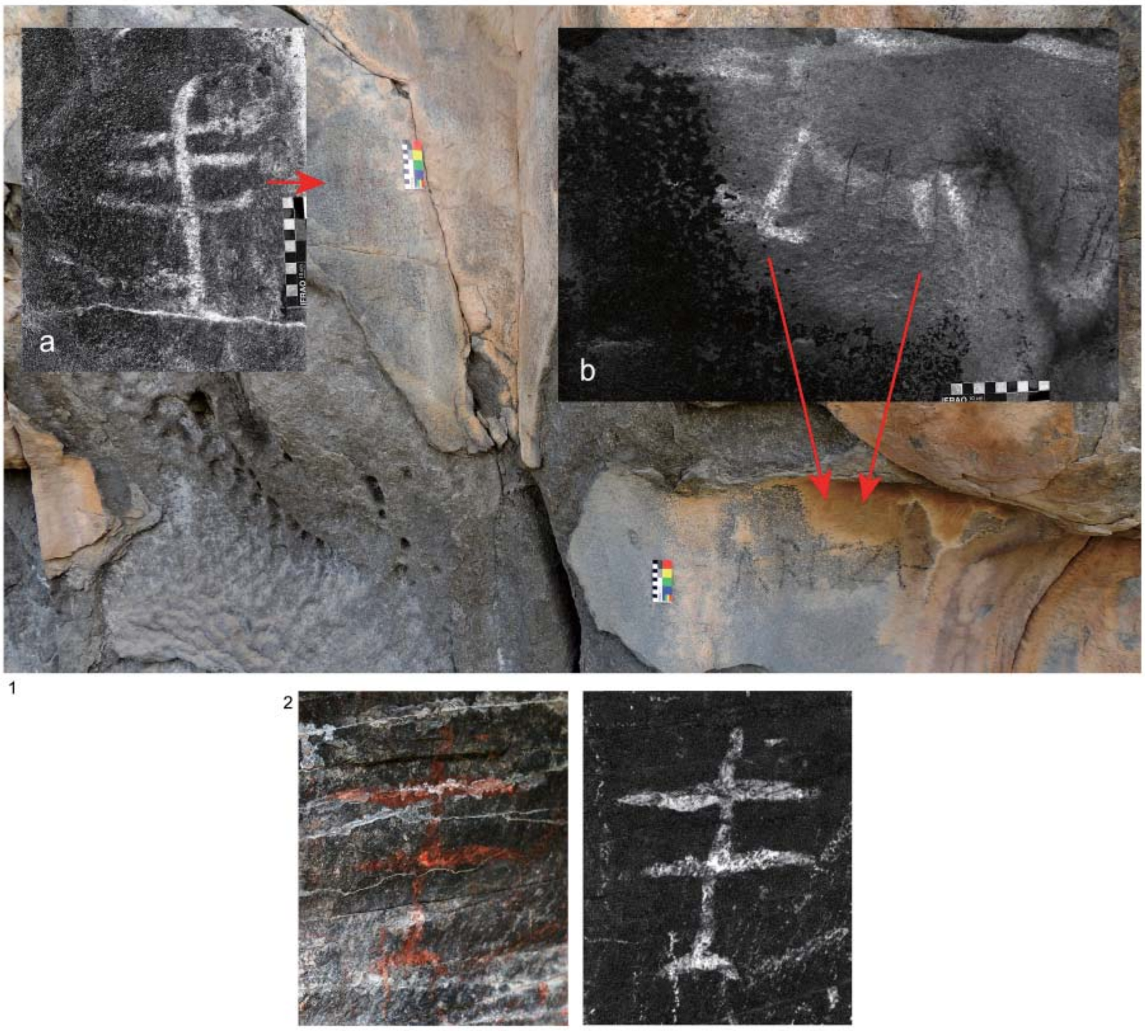

Figure 9

1. Wall-paintings from Pokaberd rock-shelter, 1a: Anthropomorphic stylized figure, 1b: Anthropomorphic stylized figure and arch;

2. Anthropomorphic stylized figure from Panel O16-1 of the Geghamavan-1 cave.

Figure 10
1, 1a. Figure 4 from Pokaberd rock-shelter (Foliage enclosed into double circle);
2. Ceramic beaker painted in brown glaze from Susa (Musée du Louvre, Paris), 4th millennium BC.

Figure 11
1. General view of the Kakavadzor cavity from the north-east; 2. Interior of the Kakavadzor cavity with painting.

Figure 12
Wall-painting (fresco) of Kakavadzor (general scene).

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Figure 13
Fragments from wall-painting (fresco) of Kakavadzor. 1. Triple circle ornament painted on the plaster base; 2. Bichrome section at the lower part of the painting.

Figure 14
Pigment sources used for the paintings. 1. Interior of the Geghamavan-1 cave; 2. Kakavadzor river valley near the village of Baysz.

Discovery of the First Chalcolithic Burial Mounds in the Republic of Armenia

Firdus Muradyan
with contributions by Diana Zardaryan, Boris Gasparyan and Levon Aghikyan

– To the memory of our colleague and friend Firdus Muradyan –

1. Introduction

The expedition of the Institute of Archaeology and Ethnographyof the National Academy of Sciences of the Republic of Armenia (led by F. Muradyan), conducted excavations in 2007 and 2011 at the burial ground of Aknalitch, which is located on the northern outskirts of the village of Aknalitch in the Province of Armavir. This fieldwork detected six tombs, two of which (N5 and N6) date to the Chalcolithic period. The remaining tombs–represent different phases of the Late Bronze Age (from the second half of the 16th century BC to the 12th century BC) and the Iron Age (7th–6th centuries BC).

The main goal of this paper is to describe the Chalcolithic tombs, which, until now, were previously unknown in the territory of Armenia. In fact, such finds are rare throughout the entire region, and the earliest ones (Üç-tepe, Soyugh Bulagh tumulus, Telmakend, tombs N1 and N2 of Küdurlu, Dübendi, and Seidli in Azerbaijan, Kavtiskhevi in Georgia, and the “Maikop” tradition kurgan of Kishpek in the northern Caucasus) date to the first quarter of the 4th millennium BC (Chechenov 1987; Makharadze 2007; Lionnet 2006; Akhundov and Makhmudova 2008; Museyibli 2009; 2012).

1.1. Kurgan (tumulus) N5

Kurgan N5 is constructed of roughly hewn, similarly sized basalt pieces and is sub-circular in plan view (Figure 1: 1). The east-west diameter measures 11.0 m and the north-south diameter measures 11.5 m (Figure 1: 1 and 2). The barrow was constructed on a slope and is 1.1 m high on the south-western side and 0.45 m on the north-eastern side. The cromlech of the kurgan, which lay under the fill and was best preserved in the southern area, was not detected until the mound itself was cleaned (Figure 2). A large piece of black tuff is located in the western area (Figure 2). During the removal of the topsoil from the south-eastern side of the tumulus a large amount of Late Bronze Age potsherds was uncovered. In the lower layers of the excavated area, Late Bronze Age potsherds were found mixed with those from the Late Chalcolithic. In the western area an intrusive Late Bronze Age burial chamber was unearthed. The axis of this burial's orientation was later modified sometime in the Iron Age (Figures 1: 2, 2 and 3: 1). The associated pottery indicates that the original intrusive burial dates back to the 15th–14th centuries BC while the later Iron Age modification occurred around the 7th–6th centuries BC.

While cleaning the various parts of the mound, especially the northern area, a good amount of chaff and obsidian tempered pottery was collected. The main chamber was uncovered on the northern side of the tumulus, with some deviation from the center. It is oval (almost circular) in plan view (Figures 1 and 2) and is constructed with large basalt clasts that clearly differ from the mound fill. The burial chamber was free of rock fill, and in the sediment a large amount of chaff and obsidian tempered potsherds and obsidian implements were found. The complete chamber (length - 1.43 m, width - 0.93 m, depth - 0.75 m) was oriented from north-east to south-west (with 62º of inclination to the east) and slightly dug into the basalt bedrock. The direction of the black tuff piece that made a part of the cromlech, matches the orientation of the chamber axis (Figure 2). On the uneven floor of the burial chamber there was a skeleton covered by loam saturated with fine carbonized debris. The skeleton was lying on its right side in a flexed position, as if it had been tied (Figures 2 and 3: 2). Its head was placed on a rock[1] and was facing to the west. The mandible was disarticulated. The skeleton itself was lying on its right side oriented towards the north-east. The upper and lower extremities were flexed in a V-shaped position. The skeleton was almost complete: only the lower and upper phalanges were absent, but that fact could be the result of poor preservation. The skeleton is generally poorly preserved because of the environmental conditions. The only indication of anatomical disturbance is the displacement of the mandible, although this is likely the result of natural decay. The laboratory examination made it possible to establish some age and sex-related characteristics of the individual: pronounced superciliary arches, the massiveness of mastoiditis, the significant relief of the occipital bone, an everted ramus of the mandible, and a

1. The custom of placing the head of the burid individual on a rock or a slab is noted in some Chalcolithic and Kura-Araxes burials from several regional sites (see Tumanyan 1993, p.11).

distinct mental protuberance all suggest the skeleton represents a male. Based on suture closure, the individual was between 35-50 at the time of death. It is also noteworthy that the face preserves traces of artificial deformation and trepanation.

In addition to the human skeleton, a small number of poorly preserved faunal remains were recovered. Among the identifiable fragments are a scapula of a muflon, a skull fragment of a young sheep, four skull fragments of sheep, and a fragment of the forearm of a coot (a water bird)[2]. Some of the potsherds were found under the skeleton as well.

1.2. Kurgan (tumulus) N6

Kurgan N6 was constructed in the central and highest part of a natural hill. The upper part of the mound on the northern, western, and eastern sides was destroyed. The mound consists of dark basalt clasts of various sizes and is round in plan view. The central, complete part is oriented along a north-west axis is 25 m in diameter. The height of the mound and the hill together is 1.10 m (Figures 4: 1 and 5). Basalt clasts eroded from nearby outcrops served as the construction material for the kurgan's mound. The stratigraphy of the mound reveals that in addition to large basalt clasts, loam and basalt pebbles were used in its construction. Under the mound fill a brownish loam of variable thickness mixed with rubble directly covered the bedrock. In the north-eastern part of the mound fill a regular rectangular platform and a wall segment were uncovered. These elements were both constructed in the 20th century and changed the original character of the eastern part of the mound (Figures 4: 1-2 and 5). In the south-eastern part an Iron Age (7th–6th centuries BC) intrusive burial was excavated. Its chamber differed from the surface of the tumulus fill by the existence of fine stones, gravel, carbonized debris, and a light brown loam (Figures 5 and 6: 1). The cromlech of the kurgan that was opened under the fill was best preserved on the northern side of the barrow and was constructed with porous basalt blocks of different sizes that resulted in an irregular outline (Figures 4: 1 and 5).

From the upper horizon of the mound fill artifacts made of chipped obsidian and potsherds representative of various periods (Middle Ages, Early Bronze Age, and mostly of the Chalcolithic period) were collected. From the lower horizons, including the undisturbed soil, only Chalcolithic pottery and obsidian tools were encountered. The area near the central part of the kurgan, which borders the SW corner of the structure built on the north-eastern side, is irregular in plan view and is filled with relatively small stones and a dark-brown loam. Excavations in that area revealed

2. We gratefully acknowledge Dr. N. Manaserova from the Scientific Center of Zoology and Hydroecology of the NAS RA for the study and identification of the faunal remains.

Chalcolithic pottery. The burial chamber itself was uncovered beneath this layer. The content of the burial fill differed from the previous layers, being lossy and stoneless with dark sediments of ash, fine sand, and rubble. Among the Chalcolithic material exposed from the different horizons of the mound are ceramics, obsidian artifacts, four pieces of friable black tuff, and bones. The chamber (length - 1.74 m, width - 0.87 m, depth with the mound - 1.42 m), which was dug into the underlying bedrock, was excavated completely and was oriented from the north-east to the south-west (Figures 5 and 6: 2). The individual was placed on the uneven floor with the back facing down and the body oriented from east to west. Unfortunately, the bones of the individual are very poorly preserved, and only the vertebrae and the lower left extremities are in anatomical position. The skull was placed on its left side facing to the north. The mandible was found on top of the left clavicle (Figure 6: 2). The size and morphology of the long bones and the innominates indicate the skeleton is that of a male. The facts that all the epiphyses are closed indicate an age of at least 25 years at the time of death.

Animal bones were also found in association with the human skeleton and they too are poorly preserved. The identified remains include two sheep astragali (from the same individual), a second phalanx of a sheep/mouflon, a fragment of a mouflon metacarpal bone, the humerus of small owl, and two bone fragments (ulna and radius) of a hare.

2. Description of the archaeological finds

Given the general paucity of archaeological material, its description for both kurgans will be presented together.

2.1. Ceramic finds

Although the Chalcolithic pottery uncovered from the two Aknalitch tombs is quite fragmented, there are some samples with distinctive features. On the basis of techno-morphological study, it is possible to divide a handful of finds into five distinct groups:

group I - pottery with crushed obsidian temper;

group II - pottery made with fine organics, fine sand, and fine gravel;

group III - pottery tempered with seeds and volcanic lava grit;

group IV - fine chaff tempered pottery;

group V - probable imported pottery.

The pottery of the **First group** is of great interest and is a subject of special study of the Chalcolithic ceramics of the southern Caucasus. The ware from Aknalitch made with crushed obsidian admixtures appears as fragments of large, thin-walled kitchen vessels. One of these is a brownish (10YR 6/3, 5/3) egg-shaped pot. The clay paste is saturated with grayish obsidian debirs that make the pottery both shiny and coarse, although both the inner and outer surfaces were smoothened with a comb-like tool. The external surface is also covered with a light grayish (7.5YR 6/3) slip.

The most remarkable samples are two fragments of wavy rim belonging to a large coarse pinkish-brown (5YR 5/4) pythos (Figure 7: 1-1, 1-1a, 1-2, 1-2a). The decorative rim was modeled through the application of finger pressure from both sides. Such items has also been documented at the sites of Tsopi, Sioni, Ovçulartepesi, Mushakan-4, and Areni-1 cave (Chalcolithic horizon III)[3] and are considered as one of the main characteristics of the "Sioni-like" ceramics or "Sioni-ware" (Bakhshaliyev *et al*. 2010, p. 53, Plate XVIII: 1-3; Kiguradze and Sagona 2003, p. 51, Fig. 3.6: 5, p. 52, Fig. 3.7: 6, 11; Kushnareva and Chubinishvili 1970, p. 32). As for the crushed obsidian temper, this has been noticed among the pottery of the Middle and first phase of the Late Chalcolithic at the southern Caucasian sites of Aratashen (0), Menteshtepe, Tsopi, Sioni, Delisi, Mushakan-4, Ovçulartepesi, and Nerkin Sasnashen, all of which date to 4,500 to 4,000 Cal BC (Arutyunyan and Mnatsakanyan 2010, pp. 215, 219, Fig. 2b, p. 224, Table IV: 10-11; Bakhshaliyev *et al*. 2010, p. 92; Kiguradze and Sagona 2003, p. 48; Lyonnet *et al*. 2012, p. 98; Palumbi 2007, pp. 68, 70, Fig. 2.1, p. 71, Fig. 3.5-6, p. 72, Plate 2: 6; Palumbi *et al*. 2014).

The ceramics with fine organics, fine sand, and/or pebbles, which make up the **Second group** are represented by five fragments: the neck and rim of a thick-walled pythos, the shoulder-rim of a large jar, the body-shoulder of a thin walled vessel with the base of a spout, and profiling parts of a small bowl and pitcher. The pythos (Figure 8: 2, 2a) has a low and narrow neck with a thickened and rounded rim and, most probably, a piriform body. While it has not been processed and fired, its external surface has experienced some combing.

The bowl (Figure 9: 2, 2a) has uneven walls, is hemispherical in shape, and 18.5-20 cm in diameter; the pitcher (Figure 7: 3, 3a) has rounded walls and is open and deep (diameter: 10 cm). Both pieces are fine, smoothened sherds and are well-fired. Unfortunately, the bases of both the bowl and pitcher are absent. Techno-morphologically, these finds resemble those from Late

3. Some of the pottery samples from Areni-1, Barepat, Mushakan-4, Nerkin Sasnashen, and Teghut mentioned here and below are not published, and being presented here according to our observations (D. Z.).

Chalcolithic sites dated back to 4,300–3,800 Cal BC such as Ovçulartepesi, Barepat-1, Areni-1 (Chalcolithic Horizon II), and Teghut (Bakhshaliyev *et al*. 2010, p. 41, Plate VI: 1-2; Torosyan 1976, Plate V: 2).

The jar fragment differs subtly from the other pottery samples of this group. It has a straight, low neck with a cut and almost flat rim and paunchy body that recalls so called "holemouth vessels" dated to 4,800–4,000 Cal BC (Figure 8: 1, 1a). The fragment is well-fired and well-processed.

The fragment of a spouted vessel is of great interest (Figure 8: 3, 3a). It is thin-walled, coarse, and well-fired. While all the ceramic samples mentioned above were made with organic temper as fine chaff, the moulding of the spouted vessel is composed of fur or hairy plants (panicle of *Poaceae*, e.g. reeds). Because spouted vessels are rare among the ceramic material of the southern Caucasus, it is difficult to refer them to a specific cultural phase, as this type of vessels is seen at early farming sites of various phases. They are known, for example, from the sites of Aknashen (Horizon IV) (5,900–5,500 Cal BC), Böyük Kesik, Teghut (4,000–3,800 Cal BC), and from the first Horizon of Areni-1 cave (3,700–3,400 Cal BC) (see Hrutyunyan 2014, Figure 1: 13 this volume; Museyibli 2007, p. 201, Table XXV: 4; Zardaryan and Gasparyan 2010, p. 155). Taking into account the technological features of the fragment, however, it seems reasonable to consider it a product of the transitional phase between the Second and Third phases of the Late Chalcolithic (3,800–3,600 Cal BC).

The fragments of the large pythos and the jar have brown (7.5YR 5/3, 4/3) external surfaces, while the bowl possesses grayish shades of brown (10YR 5/3) and the spouted vessel (7.5YR 6/4) and the pitcher (10YR 6/4) are light shades of brown. Some of these samples have differently colored internal surfaces: the pythos is a sandy-brown (7.5YR 6/6), the jar is a brownish-grey (2.5Y 5/2, 5YR 6/3), and the spouted vessel is a pinkish-grey (7.5YR 6/2). The bowl is covered with a yellowish-brown (10YR 7/3) slip, and the pitcher with one of greyish-beige color (10YR 6/2). A gray or brown core is visible in the cross-section of all the fragments, and the light gray core of the pythos is surrounded by a bright orange lining.

The only pottery sample separated into the **Third group** is the neck and rim of a pinkish brown (5YR 6/4) thin-walled vessel of medium size (Figure 9: 1, 1a). The surface is smoothened and well-fired. The distinctive feature of this fragment is its impurities, which are a volcanic lava grit and elongated seeds resembling those of fennel or carum. The seeds saturating the paste of the clay made imprints on the surface, which created a pattern of sorts. Ceramics with organic inclusions are extremely rare, although among the pottery from Areni-1 there is a single fragment tempered with round seeds, probably of coriander.

The **Forth group** is represented by a fragment of body-shoulder with an ellipsoid application (Figure 7: 2, 2a) that belongs to a thin-walled pot of medium size. The sherd is a greenish light gray (Gley1 5/10Y) and its external surface is smoothened, processed, combed vertically, and coated with beige (10YR 7/2) slip. The clay paste is saturated with fine and medium-sized organics (including chaff). It is well-fired; the potsherd is dry, light, and clear. A grayish core is visible in the cross section. A vertical ellipsoid relief application is visible on the shoulder. Relief applications like knobs and ellipsoids are common among the ceramics of the Neolithic and Chalcolithic periods of the southern Caucasus. These are usually located either below the rim or on the shoulder. While knobs below the rim and on the shoulder appear in both the Neolithic-Chalcolithic periods and in the Early Bronze Age, ellipsoids on the shoulder are found only on the pottery of the Middle Chalcolithic and in the first phase of the Late Chalcolithic (until 4,300–4,000 Cal BC) (see Zardaryan 2014 this volume).

The **Fifth group** of the Aknalitch pottery is represented by a fragment of a saucer, 12 cm in diameter and 2 cm high (Figure 8: 4, 4a). Its rim is slightly thickened, rounded, and underlined; the base is absent. The sample is of high quality and made of relatively clean and well washed clay with few stones. The silt in the clay is probably natural. It is pinkish-brown (5YR 6/4), well fired, and probably imported.

2.2. Chipped stone implements

Chipped stone implements uncovered from both kurgans are made exclusively from obsidians of different coloration and texture (black, black-streaked gray, gray-transparent, red with gray spots), which suggests multiple sources, most probably from Arteni and Geghasar. In total, over 120 pieces were recovered from various parts of the burial constructions – the mound fill, under the mounds on the surface of the bedrock, and from the fill of the chambers themselves. It is difficult to determine if they appeared within the burial structures as part of ceremony, ritual practices, and/or grave goods, or whether they were incorporated accidentally during the construction of the kurgans[4]. In general, the collection looks homogeneous in terms of surface preservation, content, and techno-

4. Bronze-Iron Age burial mounds in Armenia generally contain chipped stone implements (mainly from obsidian and flint). This phenomenon has not received much attention, but there was a hypothesis that obsidian and flint have sacred meaning and appeared within the burials with ceremonial attributes (see Simonyan 1988; Tumanyan 1993, p. 9). Meanwhile, our personal observations are showing that some chipped stone implements appeared inside the burials as a part of the grave goods complex (B. G.).

typological characteristics. Cores and core fragments, small flakes and bladelets and their fragments, as well unidentified or miscellaneous fragments or chunks (i.e. knapping debris) are all present in the assemblage. The collection also includes an inventory of small tools that contains examples of prismatic and protoprismatic irregular bladelet cores produced mainly from small pebbles that are very typical of the Chalcolithic period (Figure 11: 1-1a – 5-5a). A majority of the bladelets and small flakes in the collection correspond to the negative removals from these cores, which demonstrates that the knapping operation took place at the site. Formal tools, on the other hand, were produced mainly on larger flake blanks; as the corresponding cores are completely absent, it is very likely that these artifacts were produced elsewhere and were subsequently transported on-site as ready-made implements. Among the blade blanks used for tool preparation are products of direct knapping from single platform conical-shaped cores (Figure 10: 1-1a – 4-4a and Figure 12: 6-6a – 7-7a, 12-12a) with overshot samples (Figure 10: 1-1a and Figure 12: 6-6a). There are also numerous examples of tools prepared on thin, elongated flakes produced through pressure flaking from single platform bullet cores or double platform cylindrical-shaped cores (Figure 10: 6-6a – 8-8a and Figure 12: 8-8a, 11-11a – 12-12a). The toolkit is composed of blades with irregular and partial retouch (knives?), sometimes with denticulated working edges showing advanced stages of utilization (Figure 10: 1-1a – 3-3a, 12: 6-6a – 9-9a). A single example of a regular blade heavily modified from the dorsal side by oblique retouch is also present (Figure 12: 10-10a). Among the most interesting tools are the sickle insert fragments prepared on thin elongated blanks through pressure flaking and later modified by bifacial sharpening and edge retouching of the base (Figure 11: 5-5a – 7-7a and Figure 12: 13-13a). This particular tool also shows multiple refreshing through the removal of the working edges by burin blows and re-retouching. The collection also contains an example of an end-scraper (Figure 11: 4-4a) and two burins – both single and double (Figure 12: 11-11a – 12-12a). Finally, there is an example of a tanged and winged arrowhead produced on a Kombewa flake through partial bifacial retouch of one of the edges (Figure 12: 14-14a).

The described tools have noticeable parallels with those from the Middle Chalcolithic sites of the region – Mushakan-4, Sioni, and Ovçulartepesi, particularly the arrowhead, burins, and the sickle inserts[5].

5. Unfortunately, the lithic assemblage of Mushakan-4, which is the closest to the Aknalich kurgan collection, is not yet published. The lithic assemblages of Sioni and Ovçulartepesi are published, but only to a very limited extent. For comparison, see Kiguradze and Menabde 2004, p. 397, Fig. 29, p. 398, Fig. 30 and Marro *et al*. 2011, pp. 81-82, 97-10, Pl. XI-XIV (B. G.).

3. Dating and concluding remarks

The result of the radiocarbon analysis of the tooth sample from the Kurgan N5 individual is given below (Table 1)[6].

Table 1 Radiocarbon date of the sample from the Kurgan N5.

Sample	*Radiocarbon Age (BP)*	*δ13C (‰)(**)*
LTL13060A	5377 ± 50	-19.1 ± 0.7

The time range of 4,340–4,050 Cal BC resulting from the 2-sigma calibration, or 95.4% probability (Figure 13)[7], fits within the third quarter and the end of the last quarter of the 5th millennium BC. The upper limit of the calibration of this date coincides nicely with our idea on the chronological position of the archaeological materials (pottery and chipped stone implements) found from the excavations of the Aknalich kurgans. They have close parallels with the material from two recently discovered and test excavated settlements – Mushakan-4 and Nerkin Sasnashen – that probably belong to the final phase of the Middle Chalcolithic and date to between 4,500–4,300 BC. They would, therefore, represent the sites of the so-called "Sioni" cultural tradition in the territory of Armenia. As noted before, it is difficult to state whether these materials appeared in kurgans as part of funerary ceremonial practices or grave goods. The presence of faunal remains from the chambers with human bones may indicate the existence of funerary practices to which the cultural finds could also belong. The existence of owl remains in the chamber of Kurgan N6 could indicate that the burial was left open for some time until it was filled with sediment.

Based on the results of the study of the archaeological materials and radiocarbon data, it can be stated that the Kurgans N5 and N6 of Aknalitch chronologically precede similar Late

6. The dating was carried out at the Centro di Datazione e Diagnostica dell' Università Del Salento. Macro contaminants were removed from the sample by mechanical handpicking under an optical microscope. The selected portion of the sample was treated in order to chemically remove any possible source of contamination. The purified sample material was then converted to carbon dioxide by combustion in sealed quartz tubes. The obtained carbon dioxide was converted at 550°C into graphite by using ultrahigh purity Hydrogen as a reducing medium and 2 mg iron powder as a catalyst. The sample yielded enough graphite to allow an accurate determination of the radiocarbon age by the accelerator mass spectrometer.

The radiocarbon concentrations have been determined in the accelerator mass spectrometer by comparing the 12C, 13C currents and the 14C counts obtained from the samples with those obtained from standard materials supplied by IAEA (International Atomic Energy Agency) and NIST (National Institute of Standard and Technology).

7. The "conventional radiocarbon age" was calculated with a δ13C correction based on the 13C/12C ratio measured directly with the accelerator. For the estimation of the measurement uncertainty (standard deviation) both the radioisotope counting statistics and the scattering of the data have been taken into account. The conventional radiocarbon age of the sample was converted into calendar years by using the software OxCal Ver. 3.5 based on the last atmospheric dataset (Reimer *et al*. 2013).

Chalcolithic regional funerary monuments dated by the first quarter of the 4th millennium BC. This fact extends the time period for the existence of the burial mounds at least to the last quarter of the 5th millennium BC. It also allows us to hypothesize that the spread of early phase Kura-Araxes culture burial mounds in the mid 4th millennium BC in our region (Avan, Jrvezh, Maisyan, Talin, Tsaghkalanj, etc.) most likely has some connections with the architectural, building, and ritual traditions of the burial complexes of the Middle Chalcolithic period (Areshian 1985; 1986; 1988; Avetisyan *et al*. 2010; Badalyan and Avetisyan 2007, pp. 242-249, 272-275; Kalantaryan 2011)[8].

8. Two Kura-Araxes kurgans excavated by the leading author (F. Muradyan) in the Avan district of Yerevan in 2012 date, according to the results of C14 analysis, within the time range 3,633–3,355 and 3,627–3,104 Cal BC (95.4% probability). The publication of the material is in process.

References

Akundov, T.I. and Makhmudova, V.A. (2008) *Yuzhniy Kavkaz v kavkazsko-peredneaziatskikh etnokul'turnikh protsessakh IV tys. do n.e.* (South Caucasus in Caucasus - Front Asian ethno-cultural processes at IV millennium B.C.). Baku (in Russian, with Azeri and English summaries).

Areshian, G.E. (1985) Okhranniye raskopki v Maisyane (Rescue excavations in Maisyan). In: R.M. Munchayev (ed.), *Arkheologicheskie Otkritiya 1983 goda* (Archaeological Discoveries for year 1983). Moscow: "Nauka" Publishing House, pp. 494–495 (in Russian).

Areshian, G.E. (1986) Raskopki v Maisyane (Excavations in Maisyan). In: Shilov, V.P. (ed.), *Arkheologicheskie Otkritiya 1984 goda* (Archaeological Discoveries for year 1984). Moscow: "Nauka" Publishing House, pp. 427–428 (in Russian).

Areshian, G.E. (1987) Maisyanskie kurgani (Kurgans of Maisyan). In: Shilov, V.P. (ed.), *Arkheologicheskie Otkritiya 1985 goda* (Archaeological Discoveries for year 1985). Moscow: "Nauka" Publishing House, pp. 558–559 (in Russian).

Arutyunyan (Harutyunyan), A. and Mnatsakanyan, A. (2010) Petrograficheskoe izuchenie neolit-eneoliticheskoy keramiki Araratskoy ravnini (The Petrographic Research on the Neolithic-Chalcolithic Ceramics of the Ararat Plain. In: Avetisyan, P. and Petrosyan, A. (eds.), *Khaldyan zorutyamb... Hodvatsneri zhoghovatsu nvirvats Boris Piotrovsku 100-amyakin* (Through Haldi's Power... Studies in honour of the 100th anniversary of the birth of Boris Piotrovsky). Yerevan: National Academy of Sciences of the Republic of Armenia "Gitutyun" Publishing House, pp. 210–224 (in Russian).

Avetisyan, P., Muradyan, F. and Sargsyan, G. (2010) Early Bronze Age burial mounds at Talin. In: Hansen, S., Hauptmann, A., Motzenbäcker, I. and Pernicka, E. (eds.), *Von Maikop bis Trialeti. Gewinnung und Verbreitung von Metallen und Obsidian in Kaukasien im 4.-2. Jt. v. Chr*. Beiträge des Internationalen Symposiums in Berlin vom 1.-3. Juni 2006. Bonn: Habelt Verlag, pp. 161–165.

Badalyan, R.S. and Avetisyan, P.S. (2007) *Bronze and Early Iron Age Archaeological sites in Armenia I, Mt. Aragats and its Surrounding Region*. BAR International Series 1697.

Bakhshaliyev, V., Marro, C. And Ashurov, S. (2010) Ovçulartəpəsi (2006–2008-ci il tədqiqatlarının ilk nəticələri) (Ovçulartepesi. First Preliminary report: the 2006-2008 seasons). Baku: "Elm" Publishing House (in Azeri, Russian and English).

Chechenov, I.M. (1987) Vtorie kurganniye gruppi u seleniy Kishpek i Chegem II (Second kurgan groups near the villages of Kishpek and Chegem II). In: Markovin, V.I. (ed.), *Arkheologicheskie issledovaniya na novostroykakh Kabardino-Balkarii* (Archaeologichal investigations at the Newbuildings of Kabardino-Balkaria) Volume 1. Nalchik: "Elbrus" Publishing House, pp.164–253 (in Russian).

Kalantaryan, I. (2011) The Early Bronze Age Complexes of Talin Cemetery. *Studii de Preistorie* 8, pp. 123–138.

Kiguradze, T. and Menabde, M. (2004) The Neolithic of Georgia. In: Sagona, A. (ed.), *A View From the Highlands. Archaeological Studies in Honour of Charles Burney*. Ancient Near Eastern Studies, Supplement 12. Louvain: Peeters, pp. 345–398.

Kiguradze, T. and Sagona, A. (2003) On the origins of the Kura-Araxes cultural complex. In: Smith, A.T. and and Rubinson, K.S., *Archaeology in the Borderlands. Investigations in Caucasica and Beyond*. Los Angeles: Univercity of California, Cotsen Institute of Archaeology, pp. 38–94.

Kushnareva, K.Kh. and Chubinishvili, T.N. (1970) *Drevniye kul'turi Yuzhnogo Kavkaza (V – III tis. do n.e.)* (Ancient Cultures of Southern Caucasus [V – III mill. BC]). Leningrad: "Nauka" Publishing House, Leningrad Branch (in Russian with English Resume).

Lyonnet, B. (2009) Preliminary results from the first joint Azerbaijan-French excavations at Soyuq Bulaq (2006). In: Abasov, A. (ed.), *Arkheologiya, Etnologiya i Fol'kloristika Kavkaza* (Archaeology, Ethnology and Folkloristics of the Caucasus). Baku: "Elm" Publishing House, p. 69.

Lyonnet, B., Guliyev, F., Helwing, B., Aliyev, T., Hansen, S. and Mirtskhulava, G. (2012) Ancient Kura 2010-2011: The first two seasons of joint field work in Southern Caucasus. *Archäeologische Mitteilungen aus Iran und Turan* 44, pp. 1–190.

Makharadze, Z. (2007) Nouvelles Données sur le Chalcolithique en Géorgie Orientale. In: Lyonnet, B., *Les Cultures du Caucase (VIe - IIIe millénaires avant notre ère). Leurs relations avec la Proche-Orient*. Paris: Éditions Recherche sur les Civilisations, CNRS Editions, pp. 123–131.

Marro, C., Bakhshaliev, V. and Ashurov, S. (2011) Excavations at Ovçular Tepesi (Nakhchivan, Azerbaijan). Second preliminary report: The 2009-2010 seasons. *Anatolia Antiqua* XIX, pp. 53–101.

Museyibli, N.A. (2007) *Böyük Kesik. Eneolit Dövrü Yaşayış Məskəni* (Chalcolithic settlement Beyuk Kesik). Baku: "Nafta Press" Publishing House (in Azeri, Russian and English).

Museyibli, N.A. (2009) Kurgani Souyugbulagha (Kurgans of Soyugbulagh). In: Abasov, A. (ed.), *Arkheologiya, Etnologiya i Fol'kloristika Kavkaza* (Archaeology, Ethnology and Folkloristics of the Caucasus). Baku: "Elm" Publishing House, p. 56 (in Russian).

Museyibli, N.A. (2012) Kurganniy mogil'nik pozdnego Eneolita u s. Souyug Bulagh v Azerbayjane (Kurgan cemetery of Late Aeneolithic near the village of Soyugh Bulagh in Azerbaijan). *Rossiyskaya Arkheologiya* (Russian Archaeology) N1, pp. 16–25 (in Russian).

Palumbi, J. (2007) A preliminary analysis of the prehistoric pottery from Aratashen (Armenia). In: Lyonnet, B., *Les Cultures du Caucase (VIe - IIIe millénaires avant notre ère). Leurs relations avec la Proche-Orient*. Paris: Éditions Recherche sur les Civilisations, CNRS Editions, pp. 63–76.

Palumbi, J., Gratuze, B., Harutyunyan, A. and Chataigner C. (2014) Obsidian-tempered pottery in the Southern Caucasus: a new approach to obsidian as a ceramic temper. *Journal of Archaeological Science* 44, pp. 43–54.

Reimer, P.J., Bard, E., Bayliss, A., Beck, J.W., Blackwell, P.G., Ramsey, C.B., C., Buck, C.E., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T.J., Hoffmann, D.L., Hogg, A.G., Hughen, K.A., Kaiser, K.F., Kromer, B., Manning, S.W., Niu, M., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Staff, R.A., Turney, C.S.M. and van der Plicht, J. (2013) IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. *Radiocarbon* 55, pp. 1869–1887.

Simonyan, H. (1998) Obsidian i kremen’ kak atributi pogrebal’nogo obryada (Obsidian and flint as attributes of burial ceremony). In: Kharatyan, Z.V. and Petrosyan, H.L. (eds.), *Hay zhoghovrdakan mshakuyti hetazotman hartser, Mshakuyt ev lezu* (Questions of Study of the Armenian Popular Culture. Culture and Language), *Yeritasard gitnakanneri VIII konferans (1988 t., aprili 19-21)* (VIII Conference of young scientists [1988, April 19-21]), *Zekutsumneri tezisner* (Abstracts of Reports). Yerevan: Armenian SSR Academy of Sciences Institute of Archaeology and Ethnography Press, pp. 79–81 (in Russian).

Torosyan, R.M. (1976) *Teghuti vagh erkragortsakan bnakavairy (m.t.a. IV hazaramyak)* (The Early Farming Settlement of Teghut [IV Millennium BC]). Hnagitakan peghumnery Hayastanum (Archaeological excavations in Armenia) N14. Yerevan: Armenian SSR Academy of Sciences Press (in Armenian with Russian Resume).

Tumanyan, G.S. (1993) Jrvezhi vaghbronzedaryan N1 dambanabluri peghumnery (Excavations of Early Bronze Age burial mound N1 of Jrvezh). In: Tiratsyan, G.A., Kalantaryan, A.A. and Areshyan, G.E. (eds.), *Hnagitakan ashkhatanknery Hayastani norakaruytsnerum I (1986-1987 tt. peghumneri ardyunknery)* (Archaeological Works at Newbuildings of Armenia I [Results of Excavations of 1986-1987]), *G.A. Tiratsyani hishatakin* (In memory of G.A. Tiratsyan). Yerevan: National Academy of Sciences of Armenia Press, pp. 7–14, Tables I–VI (in Armenian).

Zardaryan, D. and Gasparyan, B. (2010) Pozdeeneoliticheskaya keramika peschery Areni-1 (The Late Chalcolithic pottery of Areni-1 cave). In: Gambashidze, G., *Mezhdunarodnyaya konferentsiya “Arkheologiya, Etnologiya i Fol’kloristika Kavkaza”* (International Conference “Archaeology, Ethnology and Folkloristics of the Caucasus”), *Sbornik kratkikh soderzhaniy dokladov* (Proceedings of the abstracts of the reports). Tbilisi: “Meridiani” Publishing House, pp. 154–156 (in Russian).

Figure 1
1. Main view of Kurgan N5 after cleaning of the mound surface (from south); 2. Main view of Kurgan N5 after recovery of intrusive Late Bronze Age – Iron Age and the Chalcolithic burial chambers (from north-east).

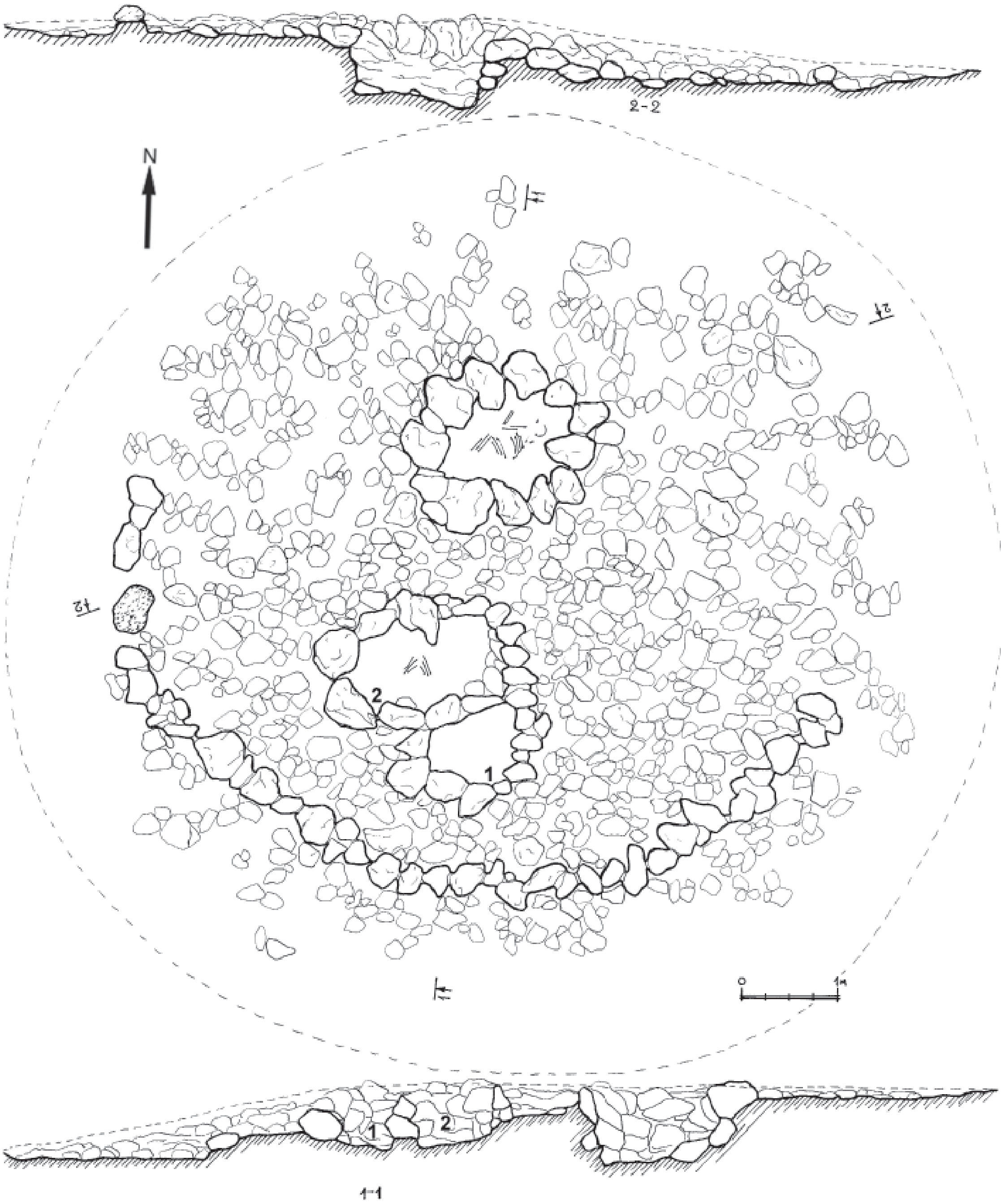

Figure 2
Plan and section drawings of Kurgan N5.

1

2

Figure 3

1. Kurgan N5. Main view of the intrusive Late Bronze Age – Iron Age burial chamber (15th–14th and 7th–6th centuries BC); 2. Kurgan N5. Main view of the Chalcolithic burial chamber (4,340–4,050 Cal BC).

1

2

Figure 4

1. Main view of Kurgan N6 after cleaning of the mound surface and recovery of the 20th century regular rectangular platform and the wall segment (from east); 2. Same with view from west.

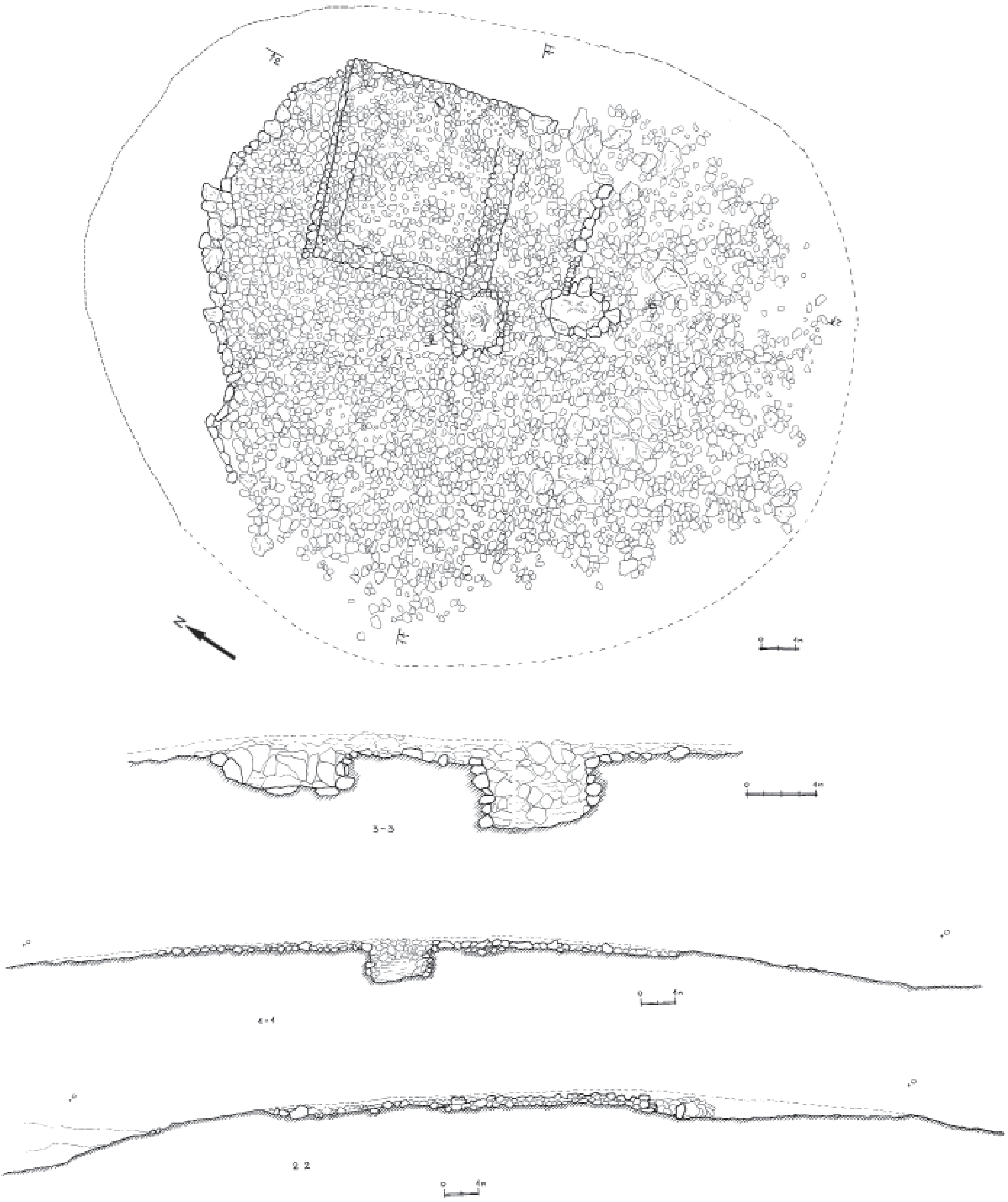

Figure 5
Plan and section drawings of Kurgan N6.

1

2

Figure 6

1. Kurgan N6. Main view of the intrusive Iron Age burial chamber (7th–6th centuries BC); 2. Kurgan N6. Main view of the Chalcolithic burial chamber (second to first quarter of the 5th millennium BC).

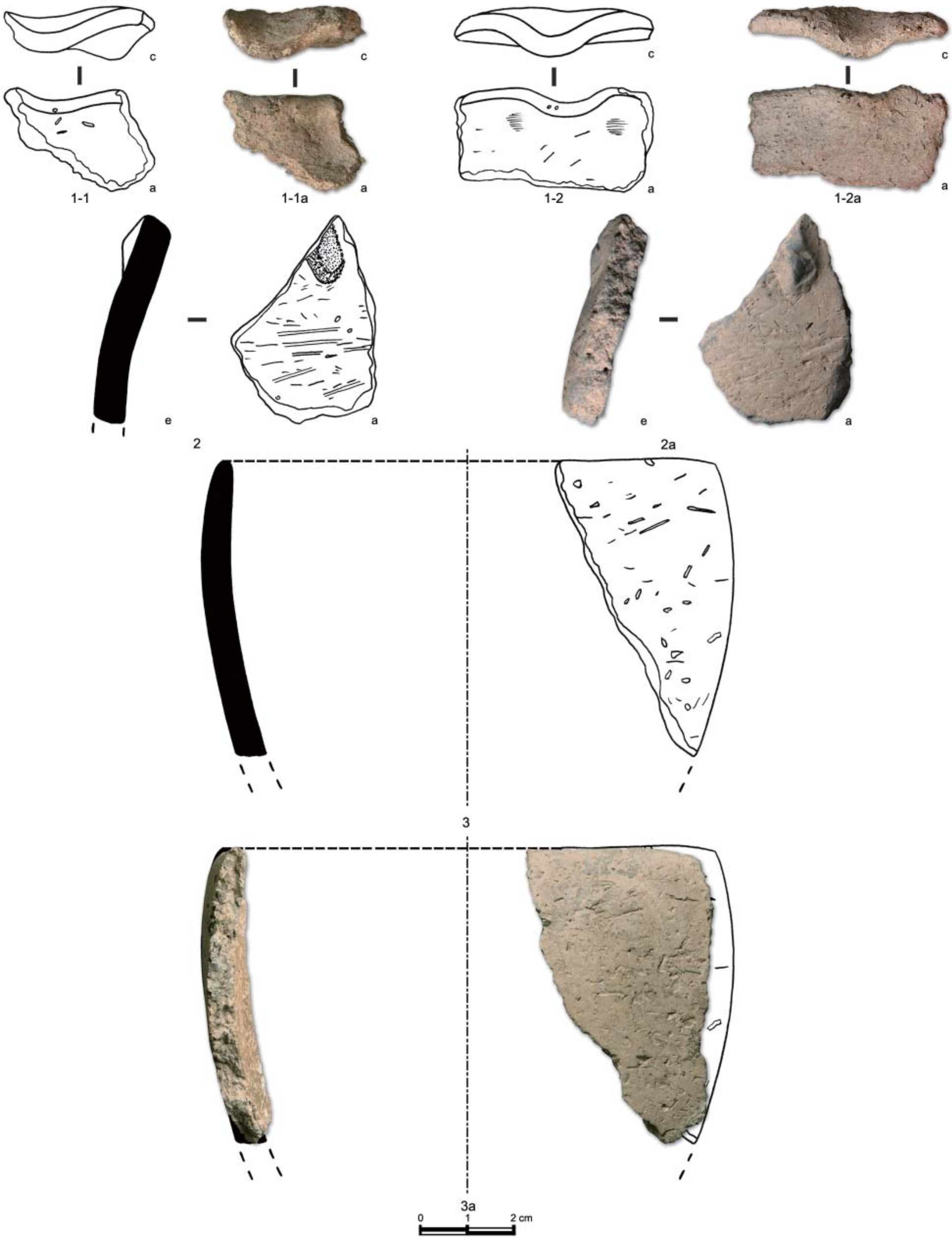

Figure 7
Selected Chalcolithic ceramic fragments from Kurgan N5. 1-1, 1-2. Wavy rims of a large coarse pythos; 2. Body-shoulder with an ellipsoid application of a medium size thin-walled pot; 3. Open and deep pitcher with rounded walls.

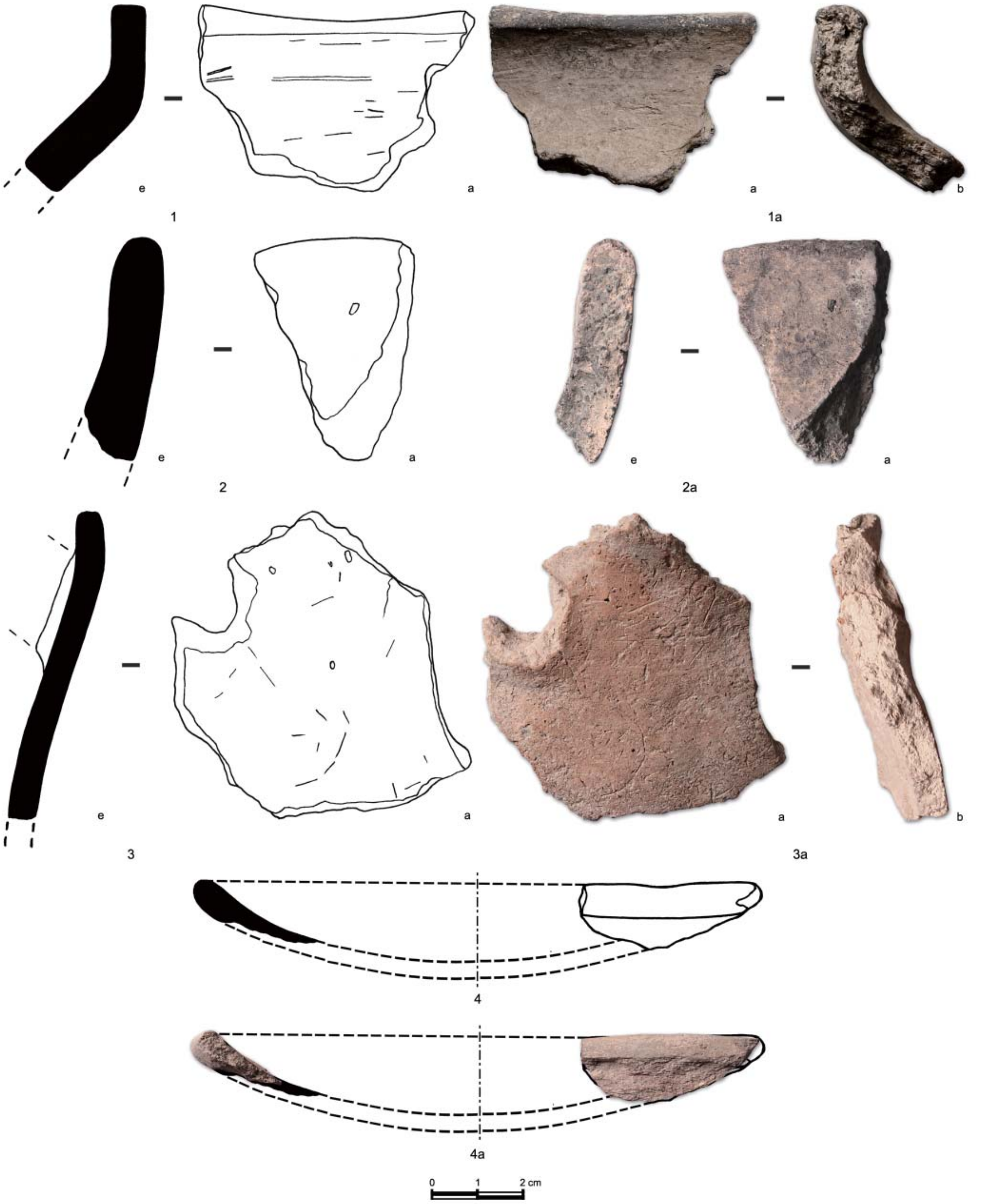

Figure 8
Selected Chalcolithic ceramic fragments from Kurgan N6. 1. Jar with straight low neck and with cut and almost flat rim and paunchy body ("holemouth vessel"); 2. Pythos with low and narrow neck and with thickened and rounded rim, and, probably, piriform body; 3. Thin-walled spouted vessel; 4. Saucer with rounded, underlined and a little thickened rim.

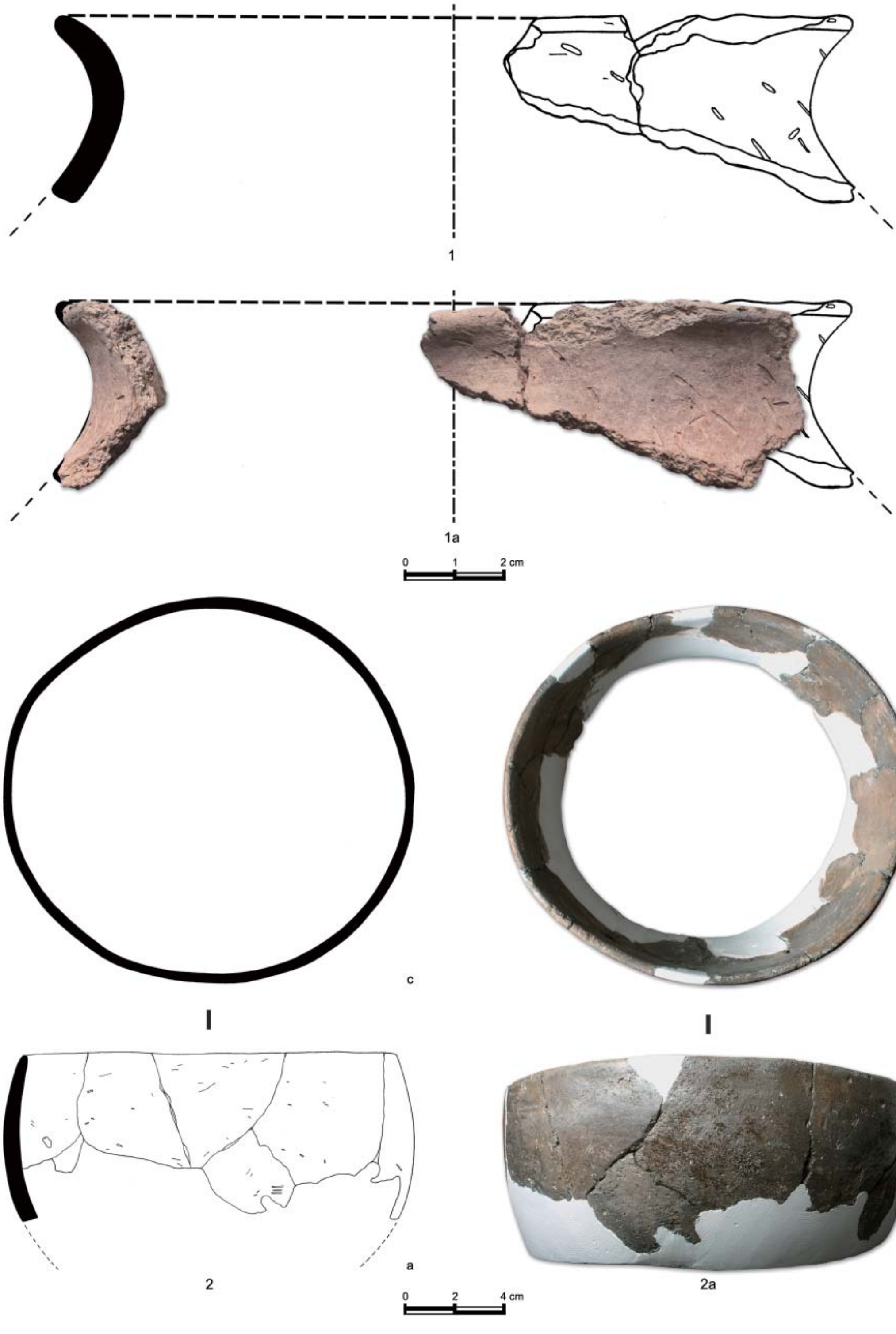

Figure 9
Selected Chalcolithic ceramic fragments from Kurgan N6. 1. Neck and rim of a thin-walled medium size vessel; 2. Hemispherical bowl with uneven walls.

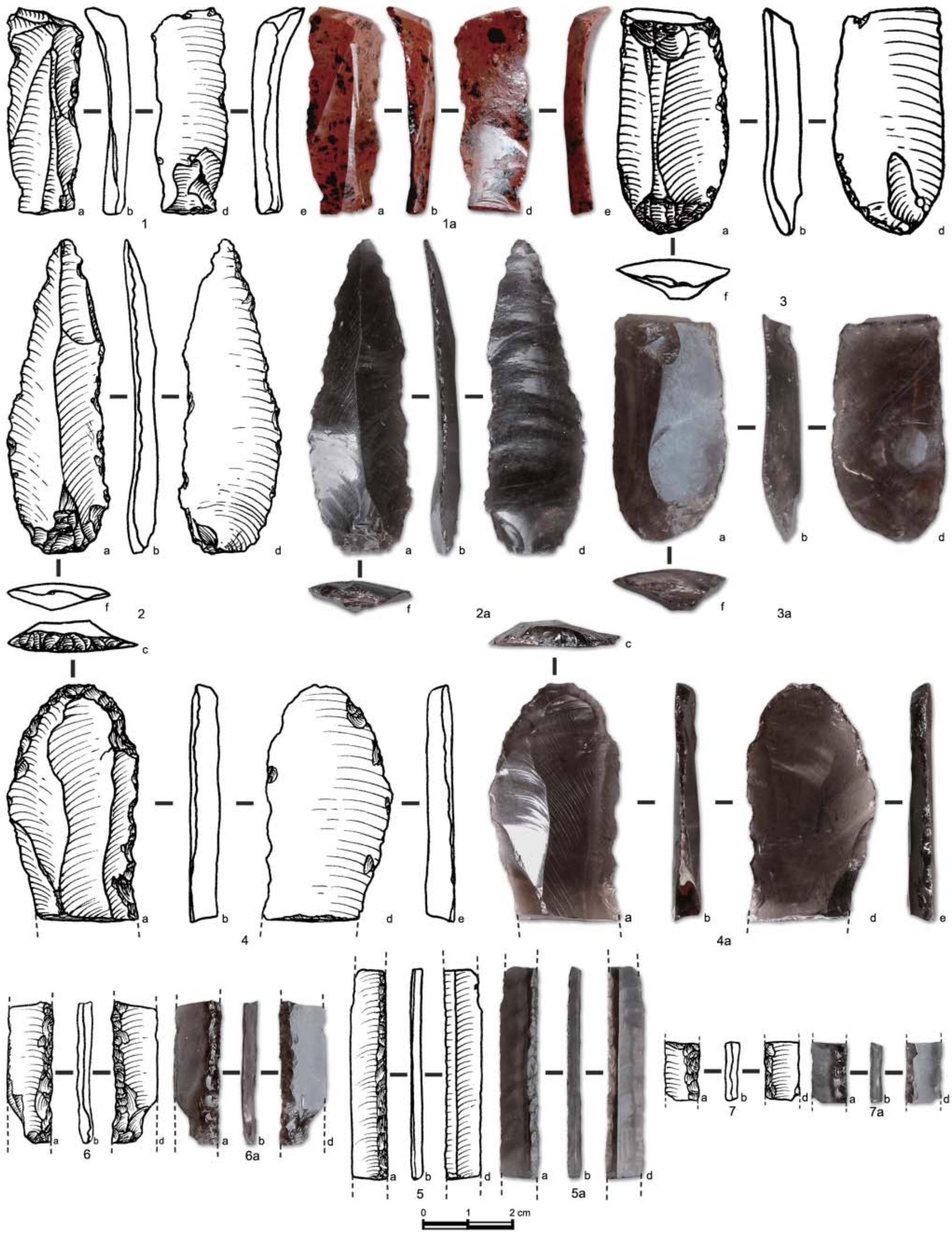

Figure 10
Selected Chalcolithic obsidian chipped stone implements from Kurgan N5. 1-3. Blades modified by retouch; 4. Endscraper; 5-7. Sickle inserts.

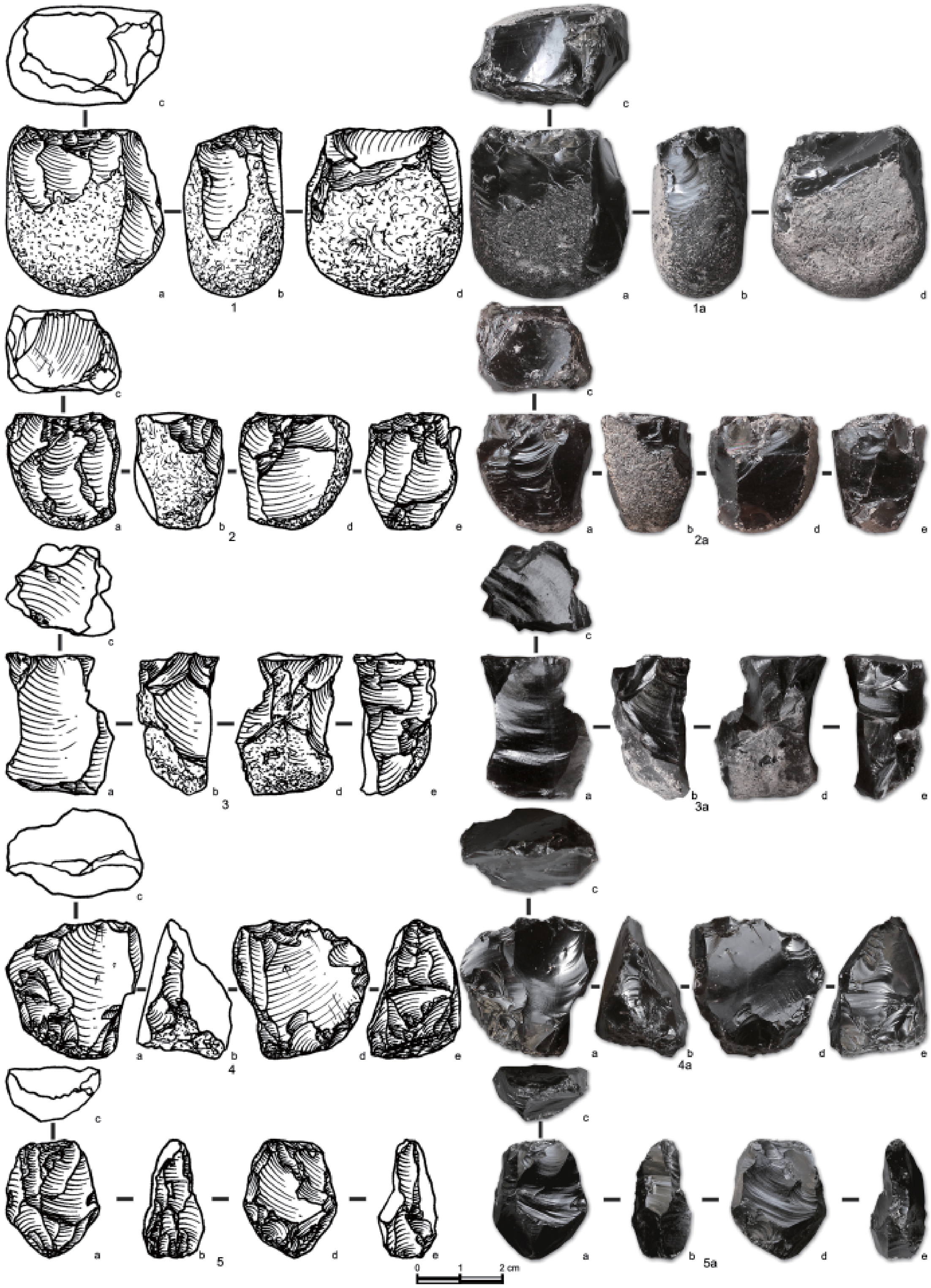

Figure 11
Selected Chalcolithic obsidian chipped stone implements from Kurgan N6. 1-5. Small prismatic cores.

Figure 12

Selected Chalcolithic obsidian chipped stone implements from Kurgan N6: 6-10. Blades and blade fragments modified by retouch; 11-12. Burins; 13. Sickle insert; 14. Tanged and winged arrowhead on combewa flake.

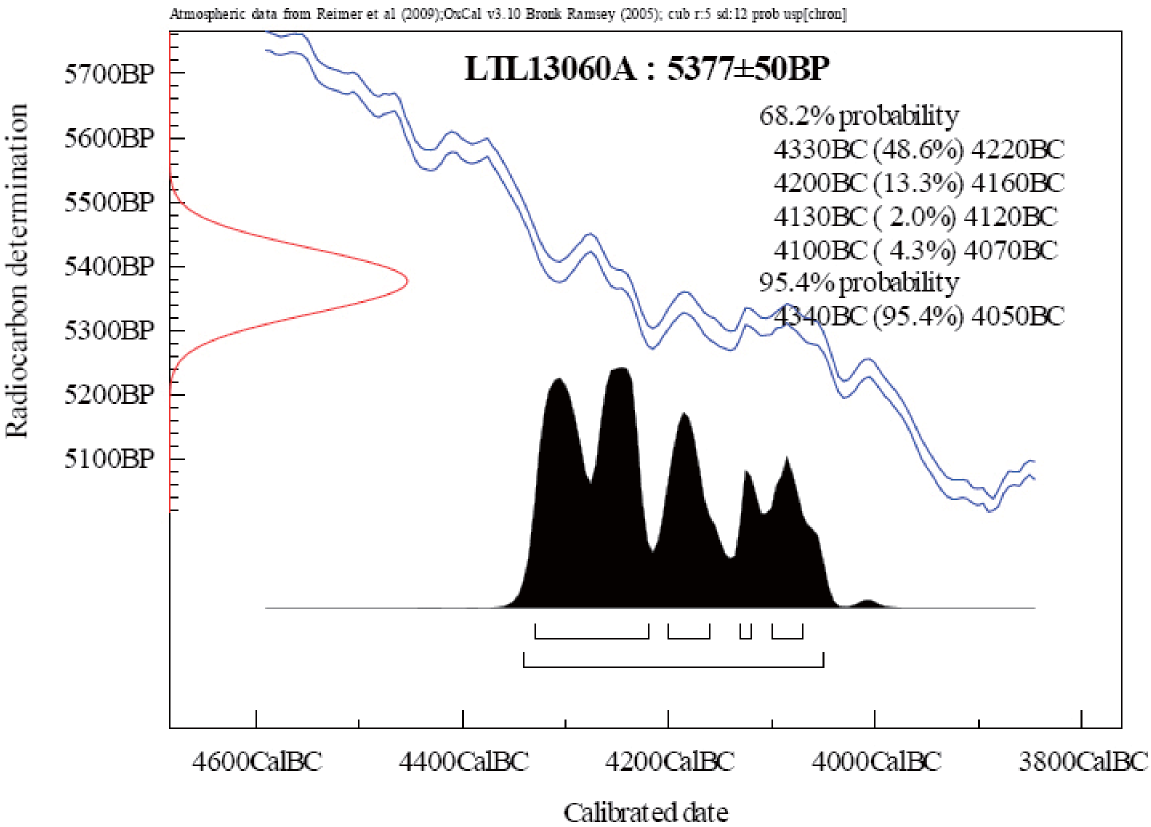

Figure 13

Calibration of the radiocarbon age of the sample LTL13060A from Kurgan N5.

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