

Areni-1 Cave, Armenia: A Chalcolithic–Early Bronze Age settlement and ritual site in the southern Caucasus

Keith N. Wilkinson¹, Boris Gasparian², Ron Pinhasi³, Pavel Avetisyan², Roman Hovsepyan², Diana Zardaryan², Gregory E. Areshian⁴, Guy Bar-Oz⁵ and Alexia Smith⁶

¹University of Winchester, Winchester, U.K., ²National Academy of Sciences of Armenia, Yerevan, Armenia, ³University College Cork, Cork, Ireland, ⁴University of California at Los Angeles, Los Angeles, California, ⁵Zinman Institute of Archaeology, University of Haifa, Mount Carmel, Israel, ⁶University of Connecticut, Storrs, Connecticut

The beginning of the Bronze Age in the southern Caucasus has been thought to coincide with the appearance of the Kura Araxes (KA) culture around 3500 CAL B.C. KA artifacts are known not only from the southern Caucasus but also from sites in Anatolia, Iran, and the Levant. Recent discoveries from Areni-1 Cave in the Vayots Dzor region of Armenia demonstrate that the origin of the distinctive KA artifact assemblage lies in the Late Chalcolithic of the late 5th to early 4th millennia B.C. The cave contains rich assemblages of desiccated botanical remains that allow the site to be precisely dated and that demonstrate that its inhabitants exploited a wide variety of domesticated and wild plants. It would appear that from 4000 CAL B.C. onwards, people used Areni-1 Cave for habitation and for keeping goats, storing plant foods, and ritual purposes; unusual for this time period are ceramic vessels containing the skulls of children.

Keywords: Armenia, southern Caucasus, Areni-1 Cave, Kura Araxes, Late Chalcolithic, child burials

Introduction

The Kura Araxes (KA) archaeological culture (sometimes termed the “Early Transcaucasian”) comprises groups of sites in the southern and northeastern Caucasus, eastern Turkey, and western Iran, and is currently thought to be a phenomenon of the third quarter of the 4th to the third quarter of the 3rd millennia B.C. (Areshian 2006, 2007). As such, it is approximately contemporary with the following cultures outside the southern Caucasus: the Late Maikop of the northwestern Caucasus, the Late Uruk and Ninevite V of Mesopotamia, and the late Pre-Dynastic and Early Dynastic periods of Egypt. The KA culture is widely regarded as having a geographically restricted heartland in the Kura and Arax river valleys (FIG. 1) (e.g., Kushnareva 1997: 49). The KA has a much wider geographic significance and greater cultural importance given that its distinctive pottery, cult-related artifacts, system of pictorial symbols, and some architectural forms have been

found as far afield as Syria, Israel, and Jordan (KA pottery is called Khirbet-Kerak Ware in the Levant) (Greenberg 2007; Greenberg and Goren 2009; Iserlis 2009; Paz 2009), and central Anatolia (Kohl 2007: 97–102). Indeed KA artifacts have been found on Uruk and Ninevite sites in Mesopotamia and the Levant suggesting both trade and possibly population movement to those locations from the southern Caucasus during the Early Bronze Age.

Despite the importance of the KA culture in the Late Chalcolithic–Early Bronze Age of the southern Caucasus, Anatolia, Iran, and the Levant, there is little consensus on the chronology of its appearance, its economy, social organization, or religious practices. The chance discovery of an extremely well-preserved Chalcolithic cave called Areni-1, also known as Birds’ Cave, in southern Armenia, provided a good opportunity to study these aspects of the culture. Here, we examine data from excavations at Areni-1 in the light of current views of the origins and nature of the KA culture, and offer conclusions on how the discoveries at Areni-1 might modify existing paradigms. We begin by examining current views on the origin and geographic distribution

Corresponding author: Keith N. Wilkinson, University of Winchester, Department of Archaeology, Winchester, SO22 4NR, U.K. Email: Keith.Wilkinson@winchester.ac.uk

of the KA culture. Then we describe the stratigraphy, chronology, and material culture from the Areni-1 Cave excavations and assess the significance of those data for the study of the formative period of the KA culture. Our findings suggest that the KA developed from a Late Chalcolithic culture prior to 3800 CAL B.C.

The KA Culture

The KA culture (or “cultural-historical community” using the terminology of Kushnareva [1997: 44]) was first recognized on the basis of distinctive types of ceramic artifacts found in layers underlying some Bronze Age tells and tepes (mounds formed as a result of the collapse of mudbrick structures) in the southern Caucasus (Kuftin 1941; Kuftin and Field 1946). Such finds were concentrated between the Kura and the Arax rivers in the present states of Armenia, Azerbaijan, Georgia, and Turkey (FIG. 1). Their stratigraphic relationship with other prehistoric artifact groups was first established during excavations at Mukhannat-Tapa in Yerevan conducted by Bayburtian (Areshian 2006). Since the excavations of Kuftin, a broad variety of types of KA culture settlement sites have been investigated (Sagona 1984). These include densely populated tepes located on the plains of river valleys (e.g., Mokhra Blur, Kyul Tepe 1, Khizanaant Gora, Kvatskhelebi, Yanik Tepe and Norsuntepe), as well as low-density settlements with stone architecture tens to hundreds of hectares in area high in the mountains (e.g., Gora-Amiranis, Gegharot) (FIG. 1). The presence of settlements in the highlands has been taken to indicate that there were transhumant aspects to the KA economy (sheep and goat bones predominate on many of the settlement sites), a logical conclusion given that mountainous regions would have been inhospitable during the winter months (Kohl 2007: 91). In contrast to settlements, relatively few KA burials have been excavated and many of those that have been are located within habitation sites rather than in separate cemeteries (Kohl 2007: 113). With the exception of very occasional rich inhumations such as at Arslantepe (Frangipane *et al.* 2001), most KA burials are individual inhumations in flat graves or in small kurgans lacking any evidence for wealth accumulation (Kohl 2007: 91).

KA artifact assemblages are both rich and diverse, while it appears that there were several regional (Kohl 2007: 89) and chronological variants (Kushnareva 1997: 54–73). Pottery was handmade, its most distinctive features being black burnished external surfaces with a red, pink, orange, or gray coloration of the internal side of the vessels and the presence of functional semiglobular handles or their decorative substitutes. It has been suggested, however, that the

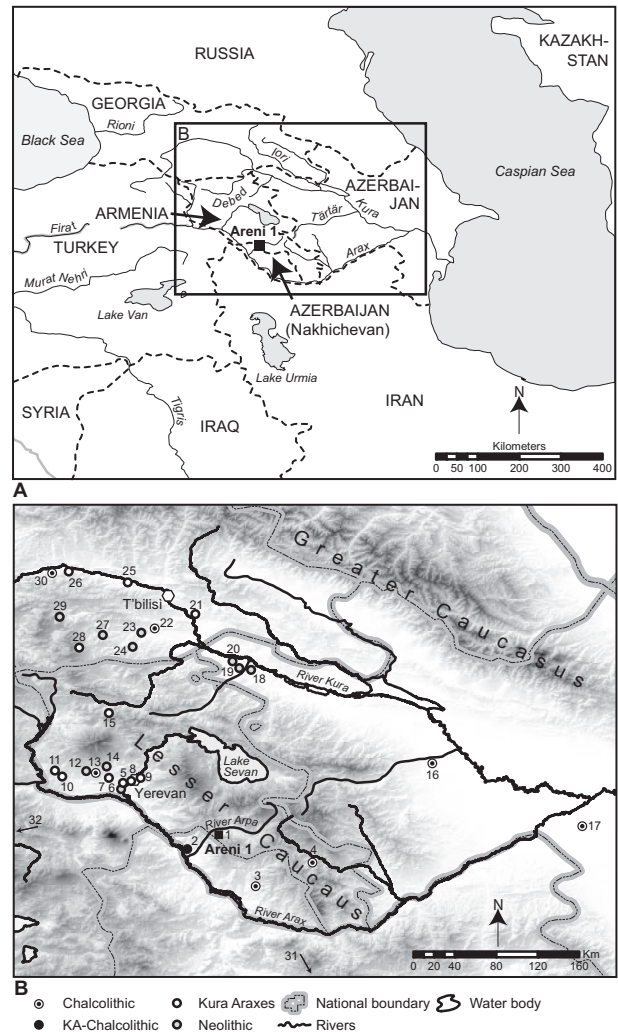


Figure 1 A) Modern political geography of the Caucasus; B) Positions of major Late Neolithic, Chalcolithic, and KA culture sites in the southern Caucasus region. Key: 1=Areni-1, 2=Kyul Tepe 1, 3=Ovchular Tepesi, 4=Nerkin Godedzor, 5=Masis Blur, 6=Norabats, 7=Mokhra Blur, 8=Shengavit, 9=Mukhanat Tapa, 10=Mayisyan, 11=Talin, 12=Aratashen, 13=Teghut, 14=Aknashen, 15=Gegharot, 16=Leilatepe, 17=Alikemek Tepesi, 18=Gargalar Tepesi, 19=Toyre Tepe, 20=Shomu Tepe, 21=Didube, 22=Sioni, 23=Imiris Gora, 24=Khramis Didi Gora, 25=Kvatskhelebi, 26=Khizanaant Gora, 27=Shulaveris Gora, 28=Samshvilde, 29=Arukhlo 1–3, 30=Berikldeebi, 31=Yanik Tepe (94 km south of map), 32=Norsuntepe (374 km west of map), 33=Gora-Amiranis (49 km west of map). Map by K. Wilkinson and B. Gasparian.

black-and-red ceramic style that is characteristic of the KA culture might have originated in northeastern Anatolia and spread to the southern Caucasus (Kiguradze and Sagona 2003; Palumbi 2003; Kohl 2007: 89), although Palumbi (2008: 42–49) has argued that this distinctive pottery was a late KA development and would not, therefore, be expected on early KA sites. Whereas ceramic remains are numerous on settlement and burial sites alike, metal artifacts are rare. Indeed very little metalwork has been recovered from strata predating 3000 B.C., and these examples are mostly knives and axes made of copper or arsenical

copper. Nevertheless, a few tin bronzes have been found on early KA sites (Gevorkyan 1980; Kavtaradze 1999; Kohl 2003; Peterson 2003; Badalyan and Avetisyan 2007: 242–245).

The origins and nature of the spread of the KA are not only important in understanding the Late Chalcolithic and Early Bronze Age of its heartland in the southern Caucasus, but also for comprehending trade and migration networks in the wider Near East. There are various theories to explain the origin and spread of the KA culture. The conventional view, as articulated by Kushnareva (1997: 49), is that it originated on the Ararat Plain (present day Armenia and Turkey), eastern Georgia, and Nakhichevan (Azerbaijan) around the mid-4th millennium B.C. and spread from there to surrounding mountainous areas as populations increased. Others, however, (e.g., Kohl 2007: 88) have argued that the archaeological evidence may indicate the reverse process given that the earliest known KA sites are in the Shida Kartli (Georgia) uplands. In other words, according to Kohl, the KA culture originated in mountain valleys—which later became overcrowded—resulting in colonists moving onto adjacent plateaux and plains. The cultural-chronological status of the KA culture has also been debated. Soviet archaeologists of the 1940s considered it to be a Chalcolithic phenomenon (Kuftin 1941; Kuftin and Field 1946; Piotrovsky 1949), but later investigators argued that it was the first Bronze Age culture of the southern Caucasus (Burney 1958; Martirosyan 1964; Chubinshvili 1965, 1971; Selimkhanov 1965; Munchaev 1975, 1994; Kohl 1995, 2007: 87; Kushnareva 1997: 52), while others still define the KA as a transitional culture spanning the Late Chalcolithic to Early Bronze Age (Kavtaradze 1983, 1999, 2004). Sagona (2004) has suggested that the KA culture lasted into the first half of the 2nd millennium B.C., thereby overlapping with the Middle Bronze Age. The evidence from Areni-1 Cave suggests that the third of the above hypotheses is most likely to be correct and that the KA gradually developed from a Late Chalcolithic culture prior to 3800 CAL B.C.

The Chronology of the KA Culture

In reviewing when and how the KA first appeared it is necessary to provide some background on the chronology of preceding periods in the southern Caucasus. The earliest stages of the Neolithic have yet to be identified and the earliest systematically excavated agricultural settlements appear to belong to the Shulaveri-Shomutepe culture of the Late Neolithic. As sites of the latter type are known from river valleys and plains, and are characterized by Near Eastern-style tell or tepe settlements (Kiguradze 1986), Kohl (2007: 67–68) has argued that the Shulaveri-Shomutepe represented a movement of people from northern Mesopotamia into

previously uncultivated land in the southern Caucasus in the 6th millennium B.C. He further suggests that the Shulaveri-Shomutepe people subsequently returned to Anatolia and Mesopotamia or integrated with local mountain-dwelling peoples in the southern Caucasus. Hovsepyan and Wilcox (2008) have instead argued that agriculture in the southern Caucasus was an autochthonous development meaning that there need not have been a population movement. According to the ^{14}C dates of Shulaveri-Shomutepe sites reviewed by Kavtaradze (1999) and Kushnareva (1997: 22), the culture spans the period ca. 6500–4900 CAL B.C., while six recently published ^{14}C dates from Shulaveri-Shomutepe layers at the site of Aratashen in the Ararat Plain (Armenia) encompass the period from ca. 5900–5480 CAL B.C. (Badalyan et al. 2007: table 1; supplementary material <http://dx.doi.org/10.1179/0093469011Z.0000000002.S>).

Kohl (2007: 68) suggests that there is a temporal hiatus and a geographic discontinuity between the Shulaveri-Shomutepe and the subsequent Chalcolithic Sioni culture. There are no ^{14}C dates for Sioni sites in the southern Caucasus, but a level below Sioni strata at the site of Kyul Tepe I (Nakhichevan) has been dated to 4830–4370 CAL B.C. (supplementary material <http://dx.doi.org/10.1179/0093469011Z.0000000002.S>) (Kushnareva 1997: 22). The only other published date from post-Shulaveri-Shomutepe and pre-KA layers is from Machara IV in Abkhazia (4830–4370 CAL B.C.), although the dated stratum does not contain Sioni artifacts. Sites of the Sioni culture are concentrated in the Ararat plain (Armenia and Turkey), central Georgia, Nakhichevan, and the southern bank of the Kura River in Azerbaijan, precisely those areas where the KA culture is traditionally thought to have emerged (Kushnareva 1997: 49). Nevertheless, there is disagreement among researchers on whether the KA culture developed out of the Sioni culture, thereby indicating continuity (e.g., Kushnareva 1997: 49; Kiguradze 2000), or whether there is a disjunction between the Sioni and the KA represented by a break in depositional sequences or settlement shifts (e.g., Kohl 2007: 69–70).

While there is little consensus as to whether the KA developed from preceding Chalcolithic cultures, there is more agreement on its spread outwards from the southern Caucasus. It would seem that the movement of KA culture artifacts and probably people into modern day western Iran, central Anatolia, and the Upper Euphrates generally coincided with, and may have been a result of, opportunities afforded by the “Uruk contraction” at the end of the 4th and beginning of the 3rd millennia B.C. (Kohl 2007: 97, 2009). In the second quarter of the 3rd millennium B.C., KA artifact styles spread southwards along the Mediterranean coast into the southern Levant as witnessed by the distribution of Khirbet Kerak

ceramics in these areas (de Miroschedji 2000; Philip and Millard 2000).

The KA culture faded away at the same time as Early Kurgan cattle herding peoples appeared in the southern Caucasus in the middle of the 3rd millennium B.C., and by ca. 2300 B.C. KA artifacts are no longer seen in the southern Caucasus (Kavtaradze 1999). Nevertheless, in the Elazığ-Malatya area (Turkey) of the Upper Euphrates, KA-style artifacts continued to be produced until the end of the 3rd millennium B.C. (Avetisyan 2008).

The Late Chalcolithic at Areni-1

Areni-1 Cave is 1 km east of the village of Areni in the Vayots Dzor province, Armenia, on the southern bank of the Arpa River (a north bank tributary of the Arax River) at 39°43'53"N, 45°12'13"E (FIGS. 1, 2). The first archaeological discoveries were made in 1997 when Boris Gasparian recovered a bone awl and an obsidian blade from a rear gallery of the cave during the prospection of a series of caves in Vayots Dzor. The cave was visited subsequently by Boris Gasparian and Ron Pinhasi in 2004 during a reconnaissance to search for sites likely to contain Middle and Upper Palaeolithic strata. Given that Areni-1 is one of the few large karstic caves in the region with easy access, and that it contains a thick sediment sequence, test excavations commenced in summer 2007. These were carried out under the joint direction of Firdus Muradyan (Institute of Archaeology and Ethnology, National Academy of Sciences, Armenia) and one of the authors (KW) with the objective of determining whether Upper Pleistocene strata containing cultural remains existed within the cave. Upper

Pleistocene strata were found at the base of the test trenches but they lacked cultural remains. A 0.3 m thickness of medieval layers was excavated through to reach the prehistoric deposits in the front of the cave. The intervening 2 to 4 vertical meters of Late Chalcolithic and Early Bronze Age layers were deemed of greatest archaeological significance given the nature of the finds.

Two trenches were excavated to test these layers, one in the central gallery where natural light does not penetrate (Trench 1) and the other close to the mouth of the cave (Trench 2) (FIG. 3A–C). Standard context recording excavation techniques were employed (Barker 2003: 116–121), although thicker units were subdivided into spits to enable more precise determination of the provenience of the finds. Sections were drawn at a scale of 1:10 on completion of the excavation (FIG. 4), and plans were made by georeferencing digital vertical photographs taken of the trenches and tracing off relevant features in the project GIS (ArcGIS 9.2) (FIG. 3B–C). Fills of all pits and ceramic vessels were retained in their entirety, while additional bulk samples were taken from other units on an opportunistic basis. Bulk samples were dry sieved through a nest of sieves down to 0.25 mm and the residues sorted by eye and with the use of a low power binocular microscope. Samples of desiccated seeds, stems, leaves, and wood charcoal were collected separately for ¹⁴C dating, while other materials for chronometric studies were recovered from the bulk samples and from human skeletal remains (teeth). Ten samples were submitted to the Oxford Radiocarbon Accelerator Unit, University of Oxford and the W. M. Keck Carbon Cycle

Table 1 AMS ¹⁴C dates from Areni-1 Cave. OxA-Oxford Radiocarbon Accelerator Unit, University of Oxford, U.K.; KCCAMS-Keck Carbon Cycle Accelerator Mass Spectrometry Laboratory, University of California, Irvine, U.S. Results are calibrated using IntCal04 (Reimer et al. 2004) and OxCal v4 (Bronk Ramsey 2008).

Lab no.	Material	Unit	¹⁴ C age	Calendar age
OxA 18197	Desiccated <i>Prunus</i> seeds	1002	5077 ± 29 B.P.	3960–3790 CAL B.C. (95.4%)
KCCAMS 48413	Desiccated <i>Vitis</i> twig	1002	5240 ± 20 B.P.	4230–4200 CAL B.C. (3.0%) 4160–4130 CAL B.C. (6.2%) 4070–3970 CAL B.C. (86.3%)
OxA 18599	Tooth, <i>Homo sapiens</i> , Burial 3	1004	5285 ± 29 B.P.	4240–4190 CAL B.C. (20.2%) 4180–4030 CAL B.C. (71.1%) 4020–3990 CAL B.C. (4.1%)
OxA 19331	Tooth, <i>Homo sapiens</i> , Burial 2	1003	5366 ± 31 B.P.	4330–4220 CAL B.C. (51.9%) 4210–4150 CAL B.C. (23.3%) 4140–4050 CAL B.C. (20.2%)
OxA 19332	Tooth, <i>Homo sapiens</i> , Burial 1	1003	5323 ± 30 B.P.	4260–4040 CAL B.C. (95.4%)
KCCAMS 40183	Charcoal (unidentified), within pot containing Burial 1	1003	5090 ± 25 B.P.	3970–3900 CAL B.C. (32.3%) 3890–3800 CAL B.C. (63.2%)
KCCAMS 40182	Charcoal (unidentified)	1004	5230 ± 25 B.P.	4230–4210 CAL B.C. (2.1%) 4160–4130 CAL B.C. (4.4%) 4070–3970 CAL B.C. (88.8%)
KCCAMS 40181	Charcoal (unidentified)	1006	7440 ± 25 B.P.	6390–6240 CAL B.C. (95.4%)
OxA 18198	Desiccated <i>Poaceae</i> stems	2004	5098 ± 28 B.P.	3970–3900 CAL B.C. (35.0%) 3890–3800 CAL B.C. (60.4%)
KCCAMS 52415	Desiccated <i>Gossypium</i> sp. buds	2014	635 ± 15 B.P.	CAL A.D. 1290–1320 (37.7%) CAL A.D. 1350–1400 (57.7%)

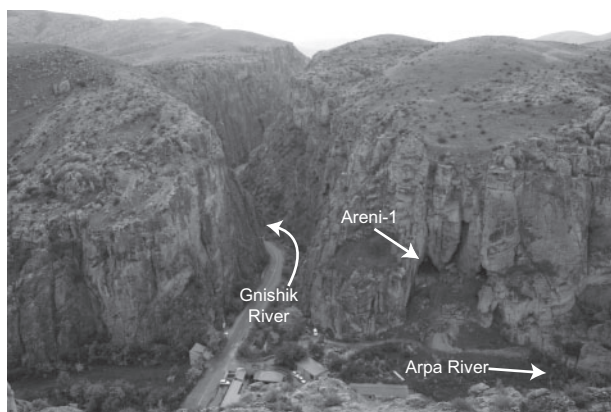


Figure 2 Areni-1 from the north side of the Arpa River. Photo by B. Gasparian.

Accelerator Mass Spectrometry Laboratory, University of California, Irvine for AMS ^{14}C measurement to provide a chronology for the site (TABLE 1).

The excavation results suggest that the Late Chalcolithic inhabitants used specific parts of the cave for different purposes such as habitation, economic, and ritual activities. As evidenced by Trench 1, the rear part of the central gallery was predominantly used for storage and/or for ritual purposes. A stratum at the base of the trench lacking artifacts (Unit 1006), and ^{14}C dated from associated wood charcoal to 6390–6240 CAL B.C., was overlain by four archaeological layers (Units 1002–1005) of Late Chalcolithic date, together totaling 4.5 m in thickness. This sequence was covered by a crust (Unit 1001) of desiccated dung that had formed since the Chalcolithic. The stratigraphy lies unconformably on angular gravels and sands of probable Early Holocene–Late Pleistocene age (Unit 1007). Contexts 1002–1005 were subdivided into tabular units in order to separate finds made at different elevations, and it is likely that deposition continued throughout the time cultural activities took place in the back of the cave. Thus, Units 1002–1005 are all fine, very dark gray (Munsell 10 YR 3/1) sand-rich silts. The predominant grain size and the polished surface of the sand grains suggest that the deposits were derived from allochthonous aeolian sediment combined with autochthonous fecal material from birds and bats living inside the cave. It is unclear whether the aeolian component blew directly into the rear cave gallery or if it was reworked from other deposits within the cave. The absence of rock debris derived from the cave walls suggests that deposition was a result of gentle mechanisms, and it is clear that human activity took place in an environment of constant low energy sediment accretion. Nevertheless, Units 1002–1004 contain ceramic sherds and many broken animal bones. The fact that cultural material was lacking from the base of Unit 1005 indicates that the onset of

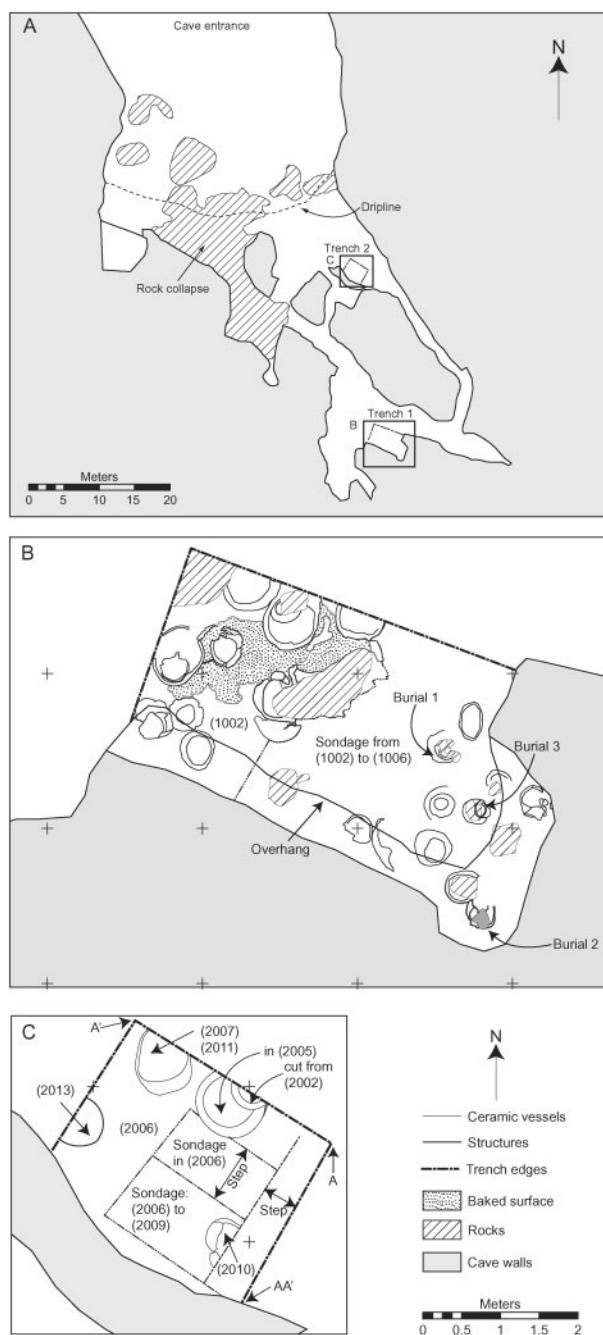


Figure 3 A) Plan of Areni-1; B) Plan of Trench 1; C) Plan of Trench 2. Coordinates positioned around the margin of the plans are the site grid (measured in meters). Drawn by Keith Wilkinson.

fine aeolian-derived sediments predates Chalcolithic activity at the site.

It is likely that human activity was more or less continuous throughout the deposition of Units 1005 to 1002 given the gradual sediment infilling of the rear gallery and the presence of similar artifact assemblages in each layer. Units 1005, 1004, and 1003 were exposed in a sondage in the southeastern part of the trench where the structural elements within Unit 1002 were lacking (see below and FIG. 3). The base of Unit 1005 contained no cultural material, but scatters of ceramics and animal bones occurred from the middle of the unit upwards. Indeed the

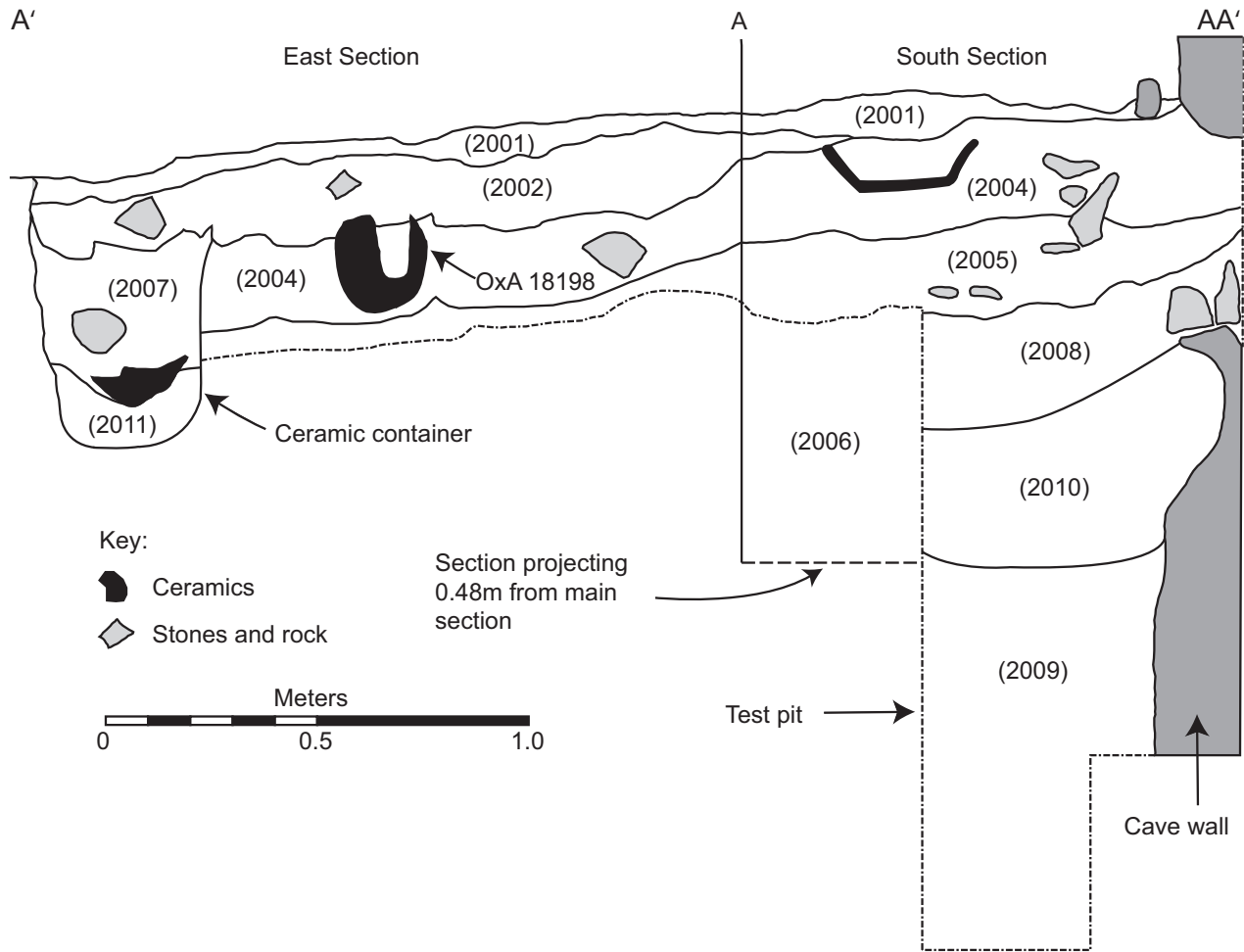


Figure 4 Sections exposed in the northeast and southeast walls of Trench 2. See Figure 3C for locations. Drawing by K. Wilkinson.

animal bones from Unit 1005 are mainly of sheep and goats and of a similar taxonomic and taphonomic composition as those in overlying units (TABLE 2). Separation of sheep (*Ovis aries*) from goats (*Capra hircus*) was based on morphological criteria of selected bones (following Boessneck 1969), and the latter was found to be dominant (together sheep and goat comprise ca. 70% of the assemblage from Unit 1002–1005 on the basis of Number of Identified Specimens [NISP]), although cattle are also important (ca. 24% of NISP). In Units 1002–1005, the

pattern of bone breakage and the high frequency of such damage alongside fresh fractures suggest that the bone assemblages are an accumulation of food debris because of clear evidence for bone processing, marrow extraction, and cooking. The bone assemblages lack evidence for in situ postdepositional bone fragmentation and for carnivore gnawing, and therefore probably indicate that the animal bones were rapidly buried. Units 1004 and 1003 were consecutive stratigraphic successors of Unit 1005 and both contained whole ceramic vessels, pottery fragments,

Table 2 Summary of zooarchaeological data from Areni-1. NISP=Number of Identified Specimens.

Unit	NISP	No. of taxa	Main taxa (NISP and %)	Other taxa represented (NISP)
1002–1005	374	8	Goats (and sheep)=251 (~70%; goats outnumber sheep considerably); cattle=89 (24%)	Fox (10); dog (6); pig (3); medium birds (3); deer (1)
1006	125	5	Goats=95 (~75%); cattle=23 (18%)	Fox (4); pig (2); medium bird (1)
2001–2002	10	1	Goats	–
2004–2008	72	5	Goats=62 (82%); cattle=4 (~6%)	Pig (3); dog (1); fox (1)
2009	21	1	Goats	–
2010	32	3	Goats=26 (81%); cattle=5 (18%)	Fox (1)

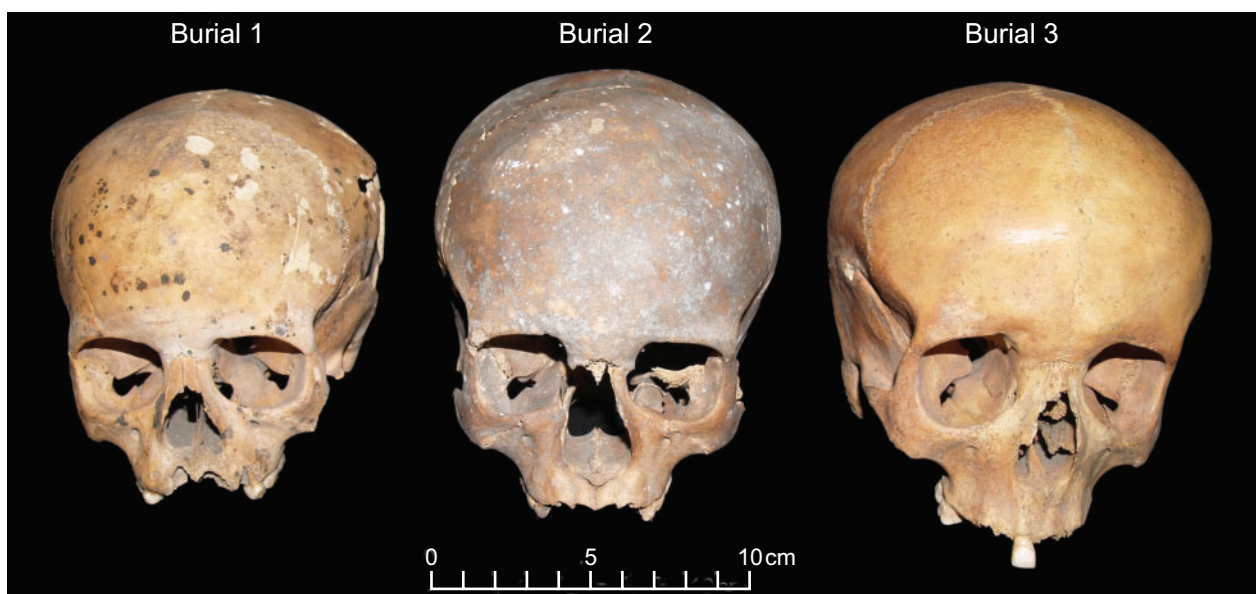


Figure 5 The three crania found in Trench 1. Photograph by K. Wilkinson.

animal bones, and obsidian artifacts. A ^{14}C date on charcoal (of indeterminate species) from Unit 1004 suggests that deposition occurred around 4230–3970 CAL B.C. (TABLE 1). Three whole pots partially sealed by ball-shaped plastered clay tops were found in Units 1003 and 1004. Two of the pots contained single sub-adult human crania and the other a sub-adult cranium together with the charred left femoral shaft fragment of an adult (FIG. 5). Sex and age assessment based on cranial morphology, suture closure, and dental calcification and eruption charts, respectively (cf. Buikstra and Ubelaker 1994) indicate that one of the skulls (Burial 3) is a female of approximately 15 years of age. The other two crania are sub-adult aged 8 (± 2) (Burial 1) and 11 (± 2.5) (Burial 2) years; these could not be reliably sexed. The cranial cavity of Burial 1 was found to contain the desiccated remains of brain tissue, currently the subject of detailed study. Radiocarbon dates of teeth from the skulls and accompanying charcoal found within the clay ball sealing the pot containing Burial 1 demonstrate a discrepancy, i.e., the former are 20–360 years older than the charcoal (at a

95.4% confidence level) and are likely to have been curated as part of a secondary burial practice, i.e., exhumed from the primary burial locale following full skeletonization and placed in the containers (FIG. 6, TABLE 1). The ^{14}C date on the charcoal from the clay ball associated with Burial 1 suggests that the ritual during which the skulls were plastered into the vessels took place around 3970–3800 CAL B.C. (TABLE 1).

Unit 1002 was exposed over the entire trench, but was only fully removed to expose Unit 1003 in the southeastern end. Although Unit 1002 is inseparable from Units 1003–1005 on the basis of its morphological properties, its artifactual and biological contents relate entirely to storage. Six large ceramic storage vessels lined with reeds (*Phragmites australis* [common reed]) and containing rich assemblages of plant remains were found in the northwestern part of Unit 1002. The storage jars were set within clay basins, which in turn formed part of a more extensive baked clay surface (FIG. 3). The two ^{14}C dates obtained from Unit 1002 suggest that the storage vessels were in use at the same time as Units 1003 and 1004 were

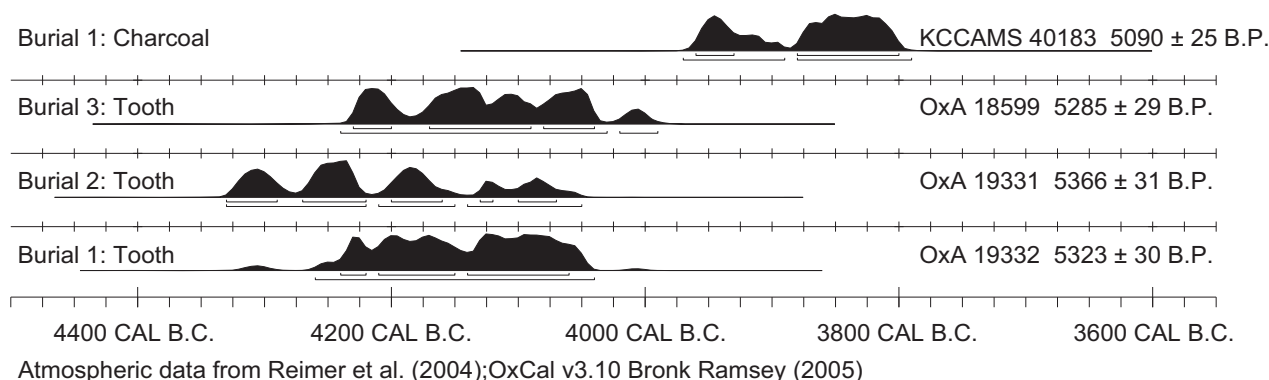


Figure 6 Comparison of AMS ^{14}C dates on human crania in Units 1003–1004 and charcoal from Unit 1003. Drawing by K. Wilkinson.

accumulating at 4230–3790 CAL B.C. In other words, while part of Unit 1002 overlies and is therefore later than Unit 1003, other parts of Unit 1002 are contemporary with both Units 1003 and 1004. The plant remains from the ceramic containers were similar to those discussed from Trench 2 below, but it is worth pointing out that in Trench 1 they include walnut (*Juglans regia*), an important find given that so little is known about the timing and location of the domestication of this taxon. Zohary and Hopf (2000) report finds of *J. regia* dating to the late Iron Age in Europe and have suggested Turkey, the Caucasus, or northern Iran as the most plausible areas of domestication. The data from Areni-1 appear to confirm the latter hypothesis. If further studies indicate that the walnuts recovered from the site are domesticated, the ^{14}C dates quoted above would demonstrate that walnuts had been domesticated in the southern Caucasus at least as early as the early 4th millennium B.C.

Whereas the stratigraphy in Trench 1 was relatively simple, that in Trench 2 was highly complex. The complexity seems to be the result of the accumulation of sediments in Trench 2 through regular household activities. Thus, in contrast to Trench 1 where four tabular units comprised the entire Chalcolithic stratigraphy, units excavated in Trench 2 included a variable mixture of ash (derived from hearths, several of which were encountered in the excavation), dung of caprids/ovids, plant remains, and artifacts, all combined in an aeolian sand/silt matrix. The stratigraphy of Trench 2 comprises a series of tabular cultural deposits and hearths, penetrated by pits containing trash and/or in which storage vessels had been placed. Unlike the rear gallery sampled in Trench 1, there is evidence from Trench 2 for medieval activities, which occasionally truncated the Chalcolithic archaeological levels.

At the base of Trench 2, 1.6 m below the ground surface, Early Holocene–Late Pleistocene brecciated silts and sands (Unit 2009) are overlain by the earliest archaeological layer (Unit 2008) (FIG. 4). Unit 2008 is a very dark brown (7.5 YR 2.5/2) silt/clay containing disarticulated ovid/caprid bones, ceramic fragments, and obsidian flakes and has been cut by a pit 1.1 m deep and surrounded by preserved wooden stakes, perhaps suggesting an associated superstructure. The pit was filled with further ashy deposits containing obsidian flakes and blades (Unit 2010) and a broken ceramic vessel containing the disarticulated remains of a human sub-adult cranium. Unlike the crania found in Trench 1, the sub-adult remains in Unit 2010 were deposited in a casual fashion and amongst domestic debris comprising sheep/goat and cattle bones, charred *Celtis* sp. (hackberry) and *Elaeagnus angustifolia* (oleaster) stones, *Capparis spinosa* (caper) seeds, and cereal grains (*Hordeum vulgare*, *Triticum*

cf. *aestivum*). A pit of almost identical properties and surrounded by stakes was found in the northeastern corner of the trench. The latter pit seems to have been lined with reeds and may have been used for storage prior to its secondary use for trash disposal. Evidence for trash disposal includes a mixture of disarticulated caprid bones, grinding stones, and obsidian flakes, as well as a range of plant material including desiccated *Prunus* sp., *Celtis* sp., and *Cerasus incana* (cherry) stones, *Daucus* cf. *carota* subsp. *carota* (wild carrot) and *Vicia* sp. (vetch) seeds, and charred *Hordeum vulgare* sp. (naked barley) and *Triticum* cf. *aestivum* (bread wheat) grains that were found in its fill (Unit 2013).

Additional spreads of cultural debris (Units 2004–2006) covered the pits, although Unit 2004 was itself truncated by two other pits in the eastern part of the trench into which storage vessels had been placed (FIGS. 3, 4). The larger of these was located in the northern corner of the trench, had a circular plan with a 0.7 m diameter, and was 1.05 m tall. Both fills (Units 2007 and 2011) of the vessel contained broken ceramics, disarticulated ovid/caprid bones, desiccated plant remains including *Celtis* sp. stones, Cucurbitaceae gen. spp. seeds, *Polygonum* sp., *Anchusa* sp., *Buglossoides* sp. (gromwell) nutlets, *Aegilops* sp. (goatgrass) spikelets, *Vitis* sp. pips, and a variety of different *Prunus* sp. stones and fruits, as well as charred *Hordeum vulgare* grains. A broken pot containing denser concentrations of domestic debris and disarticulated human juvenile/infant remains similar to those in Unit 2010 was found within the upper fill (Unit 2007). The second storage vessel placed within a pit in Unit 2004 was packed with grass either to protect or insulate the pot. A ^{14}C date on these grass stems indicates that the pot was interred in 3970–3800 CAL B.C. (TABLE 1), meaning that Units 2004 and those below must be of this age or earlier. In other words, most of the occupation activity in Trench 2 is contemporary with the use of the storage vessels (Unit 1002) and the skull ritual (Unit 1003) documented in Trench 1.

Strata overlying Unit 2004 were recorded as two composite units (2001 and 2002) because of the difficulty in differentiating individual layers while excavating in dusty conditions and poor light. Once exposed in section, it became obvious that Units 2001–2002 comprised a series of hearths and ashy deposits of medieval date (FIG. 4). A pit emanating from Unit 2002 penetrated the Chalcolithic stratigraphic sequence previously described and was lined at its base with *Gossypium* sp. (cotton) (Unit 2014). A bud of the latter was ^{14}C dated and suggests that the pit was dug around CAL A.D. 1290–1400 (TABLE 1). Culm fragments resulting from cereal processing, *Celtis* sp. stones, *Panicum* sp. (millet) grains, and *Vitis* sp. (grape) pips, as well as *Vitis* sp. seeds,

pedicels, and fruits were also found in Unit 2014 suggesting that different plants were exploited—and in the case of millet and cotton, introduced—during the medieval period compared to the Chalcolithic.

Discussion

Although a key element in the definition of the KA culture is material culture, the prehistoric ceramic assemblages recovered from Areni-1 are heterogeneous, consisting of distinctive contemporary groups that differ significantly from one another in their clay composition, the method of forming the vessel, surface coloration, firing, vessel shapes, and decoration. Laboratory examination of the pottery suggests that four ceramic groups are present in the Late Chalcolithic strata as follows.

Group 1. Thick-walled vessels of all sizes of a style typical of the southern Caucasus and comprising chaff- and grit-tempered fabrics of a yellowish-brown, orange, gray, and black color (FIG. 7: 1–4).

Group 2. Thin-walled vessels made from fabrics with minimal sand, occasional organic and very rounded granular tempering that have not previously been found in the region. These vessels are highly burnished, occasionally painted with ochre, and fired to high temperatures resulting in reddish yellow and gray coloration (FIG. 7: 5–6).

Group 3. Thick-walled vessels made of fabrics similar to Group 1, but with forms that are closer to those of KA vessels, and burnished surfaces (FIG. 7: 7–9).

Group 4. “Classic” KA pottery. Although often fragmented, small drinking cups and shallow bowl-plates with black burnished external and red-to-orange internal surfaces are recognized with such diagnostic features as semi-globular handles and horizontal openings. Group 4 is typologically comparable with ceramics found in the early KA contexts from Kyul Tepe I, Norabats, in the lowest building horizons of Mokhra Blur, Talin, and Khizanaant Gora (FIG. 1) sites dated to the second half of the 4th millennium B.C. (FIG. 7: 10) (“EB I” sensu Kushnareva 1997: 53–54).

In Trench 2 it is notable that the proportion of sherds with KA characteristics increases from the bottom of the sequence to the top. Moreover, the stratigraphic properties of the later prehistoric sediments in both trenches suggest that human activity was continuous and that there were no significant hiatuses in human activity within the Late Chalcolithic stratigraphic sequence. The ¹⁴C chronology supports this interpretation and suggests that people employing KA artifacts, including “classic” ceramic types (Group 4), used Areni-1 over a 10–280 year period between 4070 and 3790 B.C. (at the 86.3% confidence level). Such a chronology would suggest that Areni-1 is, by a margin of several centuries, the oldest known site with evidence for KA ceramics, and may suggest that the

origin of specific components of this culture lies in the late 5th and early 4th millennia B.C. Although it is dangerous to argue on the basis of a single site, the evidence from Areni-1 lends support to Kushnareva’s (1997: 49) hypothesis that the KA culture developed in the present border areas of Armenia, Turkey, and Nakhichevan, albeit significantly earlier than was previously supposed.

Despite the significance of the chronology of human activity at Areni-1, a potentially more interesting aspect of the site is the perspective it provides on life in the Late Chalcolithic southern Caucasus. Previously excavated Chalcolithic–Early Bronze Age settlement sites in the region are either lowland tepes or stone-built types in the mountains (described above). Although conclusions can be drawn from such sites that pertain to the arrangement of dwellings, the nature of domestic architecture, the economy, and how all these change through time, organic remains tend not to survive and temporal resolution of the strata is poor. Areni-1 is neither typical nor representative of the Late Chalcolithic of the southern Caucasus as a whole, but it nevertheless provides an unusual and exciting opportunity to broaden our understanding of the time period. Owing to the dry conditions, desiccated buds, fruits, parenchymous tissue, and even leaves are frequent finds in Chalcolithic levels at Areni-1 alongside the charred seeds and wood fragments that have previously been encountered from Neolithic–Bronze Age sites in the region (e.g., Hovsepyan and Willcox 2008). As a result, not only can the products of human activity be studied in intimate detail, but by ¹⁴C dating annual plants associated with human actions, the chronology of events in the cave can be reconstructed with unparalleled precision for the southern Caucasus and Near East.

Although the 2007 excavation trenches represent a relatively small sample, the material recovered from Areni-1 suggests that three groups of activities took place in the cave over a period of decades or centuries at the end of the 5th and beginning of the 4th millennia B.C. The zooarchaeological remains as well as the desiccated dung and wool found in Trench 2 (but not Trench 1) indicate that the inhabitants of Areni-1 were probably pastoralists keeping goats and a few sheep. It is likely on the basis of the structural remains found in Trench 2 as well as midden deposits in that location that they lived in the front gallery together with their animals. Evidence of butchery marks on animal bones suggests that young and prime adult goats, sheep, and cattle were exploited for their meat. Burned animal bones and charred plant remains were associated with hearths in Trench 2 suggesting that they are waste from cooking. While plant remains were placed in the rear of the cave, pits and large pots in the cave mouth also seem to have

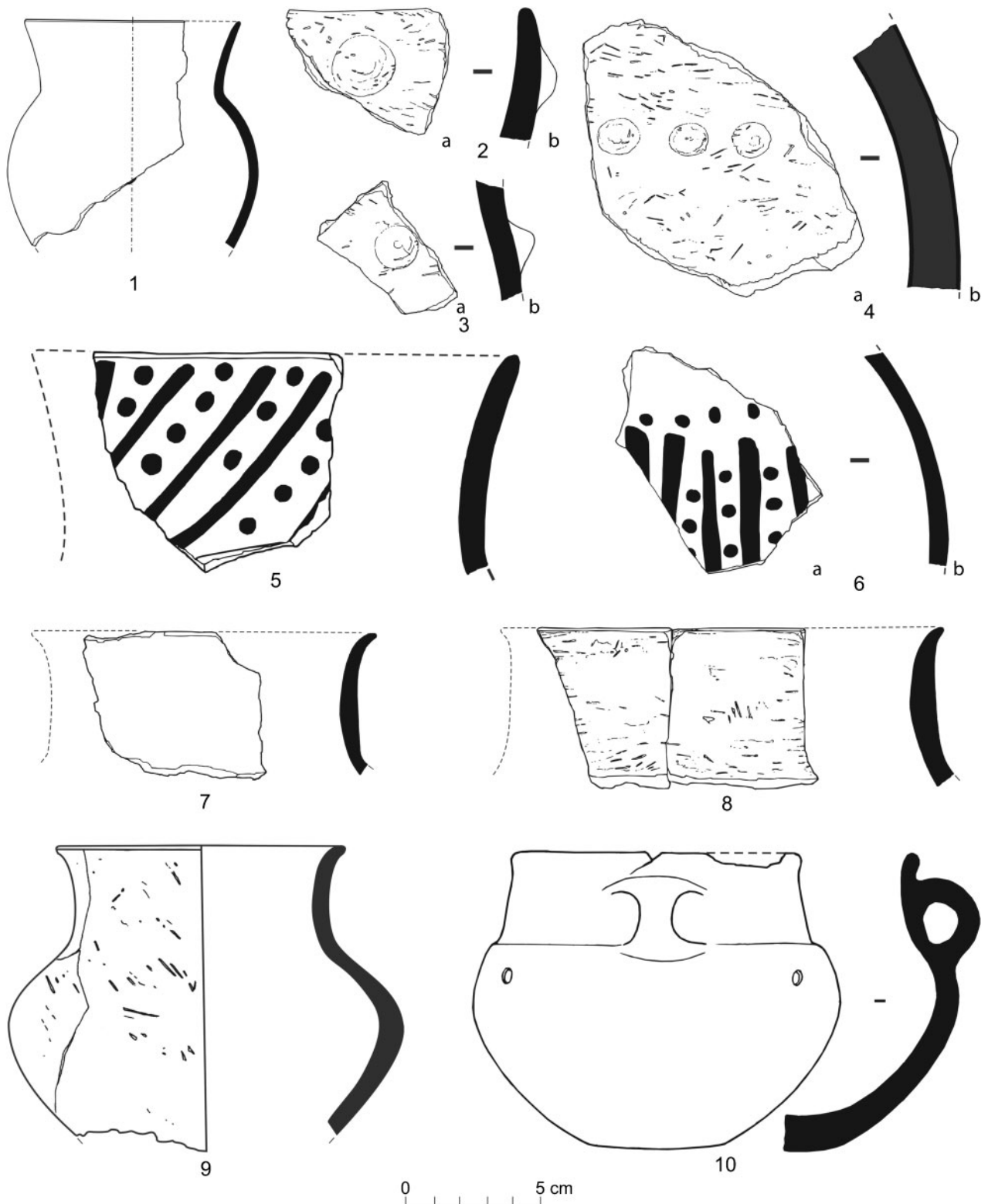


Figure 7 Examples of ceramics from Areni-1. Group 1: 1) Thin-walled vessel from Unit 2004; 2–4) Fragments with relief decoration (“knobs”) from Units 1002 and 1005. Group 2: 5) Neck of a red and black painted jar; 6) Body sherd of a thin-walled painted vessel. Group 3: 7–8) Cylindrical necks from Units 2004 and 2002, respectively; 9) Goblet from Unit 2004. Group 4: 10) Goblet with a lug handle from Unit 1002. Drawings by Narine Mkhitarian.

initially been used to store plant remains. Unlike ceramic vessels in rear galleries of the cave, the pits and large pots excavated in Trench 2 were reused for waste disposal, again suggesting that this area was used for habitation. It is of particular interest that human juveniles/infants were discarded in the trash pits of Trench 2 and were thus presumably considered

to be rubbish. Not all waste was placed in pits, as broken pots, butchery and cooking waste, and human bones were scattered in the rear of the central gallery where they were rapidly buried probably by wind-blown sediment entering through the mouth of the cave. Despite the domestic rubbish at the rear of the cave, the same area was also used for storage and/or

ritual purposes; it is possible that the “stored” plant remains in the rear gallery were offerings. A wide variety of plant foods had been placed in the large ceramic vessels set in a baked clay floor on the eastern side of the rear gallery. The exact nature of the use of the western side cannot be determined with certainty, but the activities are likely to have ritual connections. Crania of juveniles that had either been curated for 20 to 360+ years or were extracted from earlier burials were placed in the top of ceramic vessels and covered by plaster spheres. The vessels were left on the cave floor, but apparently no other activity took place in this part of the cave other than the disposal of pottery and bones. The presence of the latter material suggests that the ritual significance of the pot burials was not compromised by the deposition of waste around the vessels. It could be argued that the so-called waste may even be part of a feasting ritual associated with the placement of the skulls (Pollock 2003). There is of course an alternative explanation, namely that there is a temporal discontinuity between the placement of the vessels and rubbish disposal, but this sequence of events is unlikely given the contemporaneity of the pot ritual and storage activity suggested by the ^{14}C chronology.

The interment of human crania in pots as part of a ritual has not previously been reported from the Chalcolithic and Early Bronze Age Caucasus, and is rare in the wider Near East, although it is attested at Tell Arpachiyah in northern Iraq (Hijara 1978; Oates 1978) where four skulls were found buried inside separate pots. These skull burials were associated with high quality painted Halafian pottery and are thought to date to ca. 5300 CAL B.C. (Campbell 2000). The archaeological evidence indicates that the Tell Arpachiyah site was a religious center and the suggestion has been made that the pot burials were restricted to high status individuals (Hijara 1978). Of course Tell Arpachiyah predates Areni-1 by a millennium and the two sites are ca. 1000 km apart so any similarity between Areni-1 skull burials and those seen in Iraq is most likely coincidence. Nevertheless, there is one known link between the Mesopotamian Halaf and the Late Neolithic and Chalcolithic cultures in the Caucasus, viz. a Halaf pot found at Kyul Tepe I and associated with a ^{14}C date of 4830–4370 CAL B.C. (Kushnareva 1997: 22–24). The origin of the skull burial is likely to be indigenous and while the meaning of the ritual cannot be determined on the basis of available data, it is probably some form of veneration of previous generations.

Conclusions

The results of excavations undertaken at Areni-1 Cave extend the date for the first appearance of

KA-type artifact assemblages to 4100–3800 CAL B.C., several hundred years before the previously accepted earliest date (Kushnareva 1997: 49; Kiguradze and Sagona 2003: 38–94; Kohl 2007: 86–104). Areni-1 can therefore be placed in the putative hiatus between the Late Chalcolithic Sioni and the fully developed KA culture (Kohl 2007: 69–70). Taking this view, however, ignores the implications of the material culture recovered from the Areni-1 site. The ceramic data, albeit at an early stage of analysis, suggest that cultural boundaries are more blurred than indicated in previous literature.

Data collected during the 2007 excavations of Areni-1 Cave enable the story of a Late Chalcolithic–Early Bronze Age population to be told in greater detail for the southern Caucasus, primarily because of the excellent state of preservation of artifactual and biological remains. The material evidence reflects a community carrying out daily tasks such as gathering fruits, cooking, making tools, and even corralling sheep and goats in the front of the cave. Alongside such activities, which are common among other Old World Chalcolithic communities, is evidence peculiar to the site. The use of rear areas of the cave for ritual purposes is not uncommon, but the burial in pots of crania of juveniles is very unusual in later prehistory. How this ritual relates to the adjacent storage area is also of great interest. The storage containers and their perfectly preserved, desiccated plant contents may be viewed in purely functional terms: the rear areas of the cave were used as a primitive refrigerator in which otherwise perishable foods were preserved following their harvest. It is also possible that these features were not for storage at all, but are rather containers filled with offerings in supplication and/or celebration of some deity and therefore the rear gallery was used for a votive purpose. Were such a hypothesis proven correct, the sociocultural interpretation of the group of people living in the cave and their activities might have to be revised. For example, if the stored plant remains were indeed offerings, perhaps based on their composition when compared to that from standard settlement sites, Areni-1 might be better interpreted as a cult site where people from surrounding communities went to commune with their gods. Unfortunately, the archaeobotany of Late Chalcolithic settlement sites is too poorly understood at present to make such comparison.

Postscript

In 2008–2010, continuing excavations at Areni-1 were focused in the area north of Trench 2 (FIG. 3A) and resulted in the discovery of multiple walled subdivisions of the cave, a possible defensive wall enclosing the cave entrance, and a large assemblage of artifacts including the earliest preserved leather shoe known

anywhere in the world (Pinhasi *et al.* 2010). The chemical analysis of residues on two Chalcolithic ceramic sherds recovered in the 2008 excavations indicates that wine was consumed on the site (Barnard *et al.* 2011). Post-excavation analyses are ongoing on the considerable collections of artifacts and biological materials that have been recovered.

Acknowledgments

Funding for the 2007 Areni-1 excavations was provided by the Armenian branch of the Gfoeller Foundation, the Department of Anthropology, Roehampton University, and the Department of Archaeology, University of Winchester. We thank Dana Challinor for identifying charcoal used for ¹⁴C dating, and Tom Higham and Erv Tylor for facilitating the AMS ¹⁴C dates at the Research Laboratory for Archaeology, University of Oxford and the W. M. Keck Carbon Cycle Accelerator Mass Spectrometry Laboratory, University of California, Irvine, respectively. We are grateful to Tamara Bagoyan (of the Institute of Archaeology and Ethnology, Yerevan, Armenia) for helping to extract and catalog the plant remains from Areni-1 and to Yana Tomes (University of Winchester) for help with Russian translation.

Keith N. Wilkinson (Ph.D. 1993, University of London) is a Reader in Environmental Archaeology at the University of Winchester, U.K. with research interests in the geoarchaeology of prehistoric populations in the Mediterranean basin.

Boris Gasparian (M.A. 1996, Institute of Archaeology and Ethnology of the National Academy of Sciences of Armenia) is a Researcher at the Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia and Assistant Professor at Yerevan State University. His research interests focus on the Stone Age of the Caucasus and the Near East.

Ron Pinhasi (Ph.D. 2003, University of Cambridge) is a Lecturer in Prehistoric Archaeology at the University College Cork. His research interests include the Palaeolithic of the Caucasus and the origins and spread of agriculture in the Near East, Anatolia, and Europe.

Pavel Avetisyan (Ph.D. 2003, Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia) is Director of the Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia and Associate Professor of Archaeology at Yerevan State University. His research interests include Neolithic, Chalcolithic, Bronze Age, and Iron Age archaeology of the Caucasus and the Near East.

Roman Hovsepyan (Ph.D. 2009, State Agrarian University of Armenia) is a Researcher with the Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia with research interests in archaeobotany, palaeobotany, and palaeoeconomies.

Diana Zardaryan (M.A. 2007, Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia) is a Researcher at the Institute of Archaeology and Ethnography of the National Academy of Sciences of Armenia with research interests in the Late Chalcolithic pottery of Armenia and the Caucasus.

Gregory E. Areshian (Ph.D. 1975, Institute of Archaeology of the Academy of Sciences of the USSR, Leningrad) is a Staff Research Associate with the Cotsen Institute of Archaeology and Visiting Professor of the Ancient Near East at the University of California, Los Angeles. His research interests include archaeology and history of the Ancient Near East and Eurasia from the Neolithic to the spread of Islam, social complexity, environmental archaeology, comparative mythology, nomadism, and archaeological theory.

Guy Bar-Oz (Ph.D. 2002, Tel-Aviv University) is Associate Professor of Archaeology at the University of Haifa. His research interests include the evolution of human hunting and subsistence behavior in prehistory, the development of complex economic-subsistence systems in the historic periods of the Near East, and human impact on the environment.

Alexia Smith (Ph.D. 2005, Boston University) is Assistant Professor of Anthropology at the University of Connecticut. Her research interests include archaeobotany, early social complexity, and archaeology of Mesopotamia and the Caucasus.

References

- Areshian, G. E. 2006. "Early Bronze Age Settlements in the Ararat Plain and its Vicinity," *Archäologische Mitteilungen aus Iran und Turan* 37: 71–88.
- Areshian, G. E. 2007. "From Extended Families to Incipient Polities: The Trajectory of Social Complexity in the Early Bronze Age of the Ararat Plain (Central Near Eastern Highlands)," in L. M. Popova, C. W. Hartley, and A. T. Smith, eds., *Social Orders and Social Landscapes: Proceedings of the 2005 University of Chicago Conference on Eurasian Archaeology*. Newcastle-upon-Tyne: Cambridge Scholars Publishing, 26–54.
- Avetisyan, P. 2008. "Voprosi Xronologichaskoy Interpretatsii Drevneyshix Arxeologicheskix Kompleksov Armenii (in Russian)" (Questions of the Chronological Interpretation of Ancient Archaeological Complexes of Armenia), in *By the Foot of Ararat. Exhibition Catalogue*. St. Petersburg: State Hermitage Publishers, 23–28.
- Badalyan, R., and P. Avetisyan. 2007. *Bronze and Early Iron Age Archaeological Sites in Armenia Volume 1: Mount Aragats and*

- its Surrounding Region. *BAR International Series* 1697. Oxford: Archaeopress.
- Badalyan, R., C. Edens, P. L. Kohl, and A. Tonikyan. 1992. "Archaeological Investigations at Horom in the Shirak Plain of Northwestern Armenia 1990," *Iran* 30: 31–48.
- Badalyan, R., P. Lombard, P. Avetisyan, C. Chataigner, J. Chabot, E. Vila, R. Hovsepian, G. Willcox, and H. Pessin. 2007. "New Data on the Late Prehistory of the Southern Caucasus. The Excavations at Aratashen (Armenia): Preliminary Report," in B. Lyonnet, ed., *Les Cultures du Caucase (VIe–IIIe millénaires Avant Notre Ère): Leurs Relations avec le Proche-Orient*. Paris: CNRS Éditions, 37–61.
- Badalyan, R., and A. T. Smith. 2008. "Poselenie Gekharot: Osnovnie Rezultati Raskopok 2005–2006 (in Russian)," in A. Kalantaryan, P. Avetisyan and R. Badalyan, eds., *Kultura Drevney Armenii XIV, Materiali Respublikanskoy Nauchnoy Sessii*. Yerevan: Gitutyun, 45–68.
- Barker, P. 2003. *Techniques of Archaeological Excavation*. London: Batsford.
- Barnard, H., A. N. Dooley, G. Areshian, B. Gasparyan, and K. F. Faull. 2011. "Chemical Evidence for Wine Production Around 4000 BCE in the Late Chalcolithic Near Eastern Highlands," *Journal of Archaeological Science* 38: 977–984.
- Boessneck, J. 1969. "Osteological Differences Between Sheep (*Ovis Aries*) and Goat (*Capra Hircus*)," in D. R. Brothwell and E. Higgs, eds., *Science in Archaeology*. London: Thames and Hudson, 331–358.
- Bronk Ramsey, C. 2008. *Oxcal 4*. (<https://c14.arch.ox.ac.uk/oxcal/OxCalPlot.html>).
- Buikstra, J. E., and D. H. Ubelaker. 1994. *Standards for Data Collection from Human Skeletal Remains*. Fayetteville, AR: Arkansas Archaeological Survey.
- Burney, C. 1958. "Eastern Anatolia in the Chalcolithic and Early Bronze Age," *Anatolian Studies* 8: 157–209.
- Campbell, S. 2000. "The Burnt House at Arpachiyah: A Reexamination," *Bulletin of the American Schools of Oriental Research* 318: 1–40.
- Chubinishvili, T. N. 1971. *K Drevney Istorii Yuzhnogo Kavkaza* (in Russian) (*The Earliest Culture in the Interflaves of the Kura and Araxes Rivers*). Tbilisi: Academy of Sciences of the Georgian S.S.R.
- Chubinishvili, T. N. 1971. *K Drevney Istorii Yuzhnogo Kavkaza* (in Russian) (*The Early History of the Southern Caucasus*). Volume 1. Tbilisi: Academy of Sciences of the Georgian S.S.R.
- Frangipane, M., C. M. Di Nocera, A. Hauptmann, P. Morbidelli, A. Palmieri, L. Sadori, M. Schultz, and T. Schmidt-Schultz. 2001. "New Symbols of a New Power in a 'Royal' Tomb from 3000 BC Arslantepe, Malatya (Turkey)," *Paléorient* 27: 105–139.
- Gevorkyan, A. 1980. *Iz Istorii Drevneyshey Metallurgii Armyanskogo Nagorya* (in Russian) (*The History of Ancient Metallurgy of the Armenian Highlands*). Yerevan: Armenian S.S.R. Academy of Sciences.
- Greenberg, R. 2007. "Transcaucasian Colors: Khirbet Kerak Ware at Khirbet Kerak (Tel Bet Yerah)," in B. Lyonnet, ed., *Les Cultures du Caucase (VIe–IIIe Millénaires Avant Notre Ère). Leurs Relations avec le Proche-Orient*. Paris: CNRS Éditions, 257–268.
- Greenberg, R., and Y. Goren. 2009. "Migrating Technologies at the Cusp of the Early Bronze Age III," *Tel Aviv* 36: 129–134.
- Hijara, I. 1978. "Three New Graves at Arpachiyah," *World Archaeology* 10: 125–128.
- Hovsepian, R., and G. Willcox. 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: 63–71.
- Iserlis, M. 2009. "Khirbet Kerak Ware at Bet Yerah: Segregation and Integration Through Technology," *Tel Aviv* 36: 181–195.
- Kavtaradze, G. L. 1983. *K Khronologii Epokhi Eneolita I Bronzi Gruzii* (in Russian) (*The Chronology of Chalcolithic and Bronze Age Georgia*). Tbilisi: Academy of Sciences of the Georgian S.S.R.
- Kavtaradze, G. L. 1999. "The Importance of Metallurgical Data for the Formation of a Central Transcaucasian Chronology," in A. Hauptmann, E. Pernicka, T. Rehren, and Ü. Yalçin, eds., *The Beginnings of Metallurgy. Proceedings of the International Conference 'The Beginnings of Metallurgy'*. Bochum 1995. Bochum: Deutsches Bergbau-Museum, 67–101.
- Kavtaradze, G. L. 2004. "The Chronology of the Caucasus During the Early Metal Age: Observations from Central Transcaucasus," in A. Sagona, ed., *A View from the Highlands: Archaeological Studies in Honour of Charles Burney. Ancient Near Eastern Studies Supplement* 12. Leuven: Peeters, 539–556.
- Kiguradze, T. 1986. *Neolithische Siedlungen von Kvemo-Kartli, Georgien. Materialien zur Allgemeinen und Vergleichenden Archäologie* 29. München: C. H. Beck.
- Kiguradze, T. 2000. "The Chalcolithic–Early Bronze Transition in the Eastern Caucasus," in C. Marro and H. Hauptmann, eds., *Chronologie des Pays du Caucase et de l'Euphrate aux IVe–IIIe Millénaires BC. Actes du Colloque d'Istanbul, 16–19 Décembre 1998. Varia Anatolica* 11. Paris: Institut Français d'Études Anatoliennes d'Istanbul, 321–328.
- Kiguradze, T., and A. Sagona. 2003. "On the Origins of the Kura-Araxes Cultural Complex," in A. T. Smith and K. Rubinson, eds., *Archaeology in the Borderlands: Investigations in Caucasia and Beyond*. Los Angeles: Cotsen Institute of Archaeology Press, 38–94.
- Kohl, P. L. 1995. "The Bronze Age of the Caucasus and Central Asia," in J. Sasson, ed., *Civilizations of the Ancient Near East*, Volume 2. New York: Scribners, 1051–1065.
- Kohl, P. L. 2007. *The Making of Bronze Age Eurasia*. Cambridge: Cambridge University Press.
- Kohl, P. L. 2009. "Origins, Homelands and Migrations: Situating the Kura-Araxes Early Transcaucasian 'Culture' Within the History of Bronze Age Eurasia," *Tel Aviv* 36: 241–265.
- Kuftin, B. A. 1941. *Arxeologicheskiye Raskopi v Trialeti - Popitka Datirovat Arxeologicheskiye Materiali* (in Russian) (*Archaeological Excavations in Trialeti — An Attempt to Periodize Archaeological Materials*). Tbilisi: Academy of Sciences of the Georgian S.S.R.
- Kuftin, B. A., and H. Field. 1946. "Prehistoric Culture Sequence in Transcaucasus," *Southwestern Journal of Anthropology* 2: 340–360.
- Kushnareva, K. K. 1997. *The Southern Caucasus in Prehistory: Stages of Cultural and Socioeconomic Development from the Eighth to the Second Millennium BC*. Philadelphia: University of Pennsylvania Press.
- Martirosyan, A. A. 1964. *Armenia V Epokhu Bronzy I Rannego Zheleza* (in Russian) (*Armenia During the Bronze and Early Iron Ages*). Yerevan: Armenian S.S.R. Academy of Sciences.
- de Miroschedji, P. 2000. "La Céramique de Khirbet Kerak en Syro-Palestine: État de la Question," in C. Marro and H. Hauptmann, eds., *Chronologie des Pays du Caucase et de l'Euphrate aux IVe–IIIe Millénaires BC. Actes du Colloque d'Istanbul, 16–19 Décembre 1998. Varia Anatolica* 11. Paris: Institut Français d'Études Anatoliennes, 255–277.
- Munchaev, P. M. 1975. *Kavkaz Na Zare Bronzovovo Veka, Neolit, Eneolit, Rannyya Bronza*. (in Russian) (*The Caucasus at the Dawn of the Bronze Age: Neolithic, Eneolithic, Early Bronze Age*). Moscow: Nauka.
- Munchaev, P. M. 1994. "Kura-Araksaya Kultura (Kura-Araxes Culture)," in K. K. Kushnareva and V. I. Markovin, eds., *Rannyya I Srednyaya Bronza Kavkaza, Arkheologiya*. Moscow: Nauka, 8–57.
- Oates, J. 1978. "Religion and Ritual in Sixth-Millennium BC Mesopotamia," *World Archaeology* 10: 117–124.
- Palumbi, G. 2003. "Red-Black Pottery: Eastern Anatolian and Transcaucasian Relationships Around the Mid-Fourth Millennium BC," *Ancient Near Eastern Studies* 40: 80–134.
- Palumbi, G. 2008. *The Red and Black. Social and Cultural Interaction Between the Upper Euphrates and Southern Caucasus Communities in the Fourth and Third Millennium BC. Studi di Preistoria Orientale* 2. Rome: Sapienza Università di Roma.
- Paz, S. 2009. "A Home Away from Home? The Settlement of Early Transcaucasian Migrants at Tel Bet Yerah," *Tel Aviv* 36: 196–216.
- Peterson, D. 2003. "Ancient Metallurgy in the Mountain Kingdom: The Technology and Value of Early Bronze Age Metalwork from Velikent, Daghestan," in A. T. Smith and K. Rubinson, eds., *Archaeology in the Borderlands: Investigations in Caucasia and Beyond*. Los Angeles: Cotsen Institute of Archaeology Press, 22–37.
- Philip, G., and A. R. Millard. 2000. "Khirbet Kerak Ware in the Levant: The Implications of Radiocarbon Chronology and Spatial Distribution," in C. Marro and H. Hauptmann, eds., *Chronologie des Pays du Caucase et de l'Euphrate aux IVe–IIIe Millénaires BC. Actes du Colloque d'Istanbul, 16–19 Décembre 1998. Varia Anatolica* 11. Paris: Institut Français d'Études Anatoliennes, 279–296.

- Pinhasi, R., B. Gasparian, G. E. Areshian, D. Zardaryan, A. Smith, G. Bar-Oz, and T. Higham. 2010. "First Direct Evidence of Chalcolithic Footware from the Near Eastern Highlands," *PlosOne* 5: e10984. (doi: 10.1371/journal.pone.001984)
- Piotrovsky, B. B. 1949. *Arkheologiya Zakavkazya (Archaeology of the Transcaucasus)*. Leningrad: Institute of Archaeology of the Academy of Sciences of the U.S.S.R.
- Pollock, S. 2003. "Feasts, Funerals and Fast Food in Early Mesopotamian States," in T. L. Bray, ed., *The Archaeology and Politics of Food and Feasting in Early Empires and States*. New York: Kluwer Academic/Plenum Publishers, 17–38.
- Reimer, P. J., M. G. L. Baillie, E. Bard, A. Bayliss, J. W. Beck, C. Bertrand, P. G. Blackwell, C. E. Buck, G. Burr, K. B. P. Cutler, E. Damon, R. L. Edwards, R. G. Fairbanks, M. Friedrich, T. P. Guilderson, K. A. Hughen, B. Kromer, F. G. McCormac, S. Manning, C. Bronk Ramsey, R. W. Reimer, S. Remmele, J. R. Southon, M. Stuiver, S. Talamo, F. W. Taylor, J. Van Der Plicht, and C. E. Weyhenmeyer. 2004. "Intcal04 Terrestrial Radiocarbon Age Calibration, 0–26 Cal. Kyr. BP," *Radiocarbon* 46: 1029–1058.
- Sagona, A. 1984. *The Caucasian Region in the Early Bronze Age. BAR International Series* 214. Oxford: B.A.R.
- Sagona, A. 2004. "Social Boundaries and Ritual Landscapes in Late Prehistoric Transcaucasus and Highland Anatolia," in A. Sagona, ed., *A View from the Highlands: Archaeological Studies in Honour of Charles Burney. Ancient Near Eastern Studies Supplement* 12. Leuven: Peeters, 475–538.
- Selimkhanov, I. R. 1965. "K Istorii Osvoeniya Chelovekom Metallov I Splavov Na Kavkaza. Arkheologiya I Estestvennye Nauki" (in Russian) (The History of Man's Mastery of Metals and Alloys in the Caucasus, Archaeology and the Natural Sciences). *Materialy I issledovanniya po arkheologii SSSR* 129: 138–145.
- Zohary, D., and M. Hopf. 2000. *Domestication of Plants in the Old World. The Origin and Spread of Cultivated Plants in West Asia, Europe and the Nile Valley*. Oxford: Oxford University Press.