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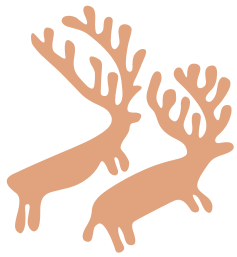

Modes de contacts et de déplacements au Paléolithique eurasiatique

Modes of contact and mobility during the Eurasian Palaeolithic

Marcel OTTE & Foni LE BRUN-RICALENS

(COORD.)

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The Upper Paleolithic settlement of the Armenian Highlands

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Abstract: Excavations in 2009 and 2010 at Aghitu–3 Cave in the Syunik Province of southern Armenia yield new insights into the Upper Paleolithic settlement of the Armenian Highlands. The site is situated at an elevation of 1601 m in a side valley of the Vorotan River. The river cuts down through Pleistocene basalt flows and provides a corridor for the movement of people and game through the region. Sediments that accumulated in this basaltic cave are composed mainly of silt, clay minerals and volcanic ash. The archaeological layers preserve evidence of periodic human occupations dating to ca. 35–27 000 cal BP. Caves from the Upper Paleolithic were not previously known in Armenia, although contemporaneous sites exist in neighboring Georgia and Iran.

The lithic industry at Aghitu–3 is laminar with a strong focus on the production of bladelets made of obsidian and chert. While completely backed pieces are rare, the majority of tools are represented by finely retouched bladelets. The choice of raw material did not affect the desired end products. Our preliminary interpretation is that this distinctly Upper Paleolithic toolkit was oriented towards the production of hunting equipment and was technologically stable over an extended timeframe.

The lower assemblage dates to ca. 35–31 000 cal BP and suggests sparse occupation of the cave. Lithic artifacts are few and cluster near small combustion features. The poorly preserved faunal remains of the lower layers do not appear to be associated with the lithic remains. The bones often appear to be gastrically etched, suggesting accumulation by large carnivores such as wolves. On the other hand, the upper assemblage dates to ca. 29–27 000 cal BP and indicates more frequent occupation by humans. In these finely stratified layers, lithic artifacts are numerous, and combustion features are common. The well preserved, but highly fragmented faunal remains from the upper layers exhibit more indications of carcass processing, such as green breaks and impact fractures. Wild sheep and wild goat dominate the faunal assemblage, with horse and hare also present.

Combining the faunal identifications with ecological data gained from microfauna, pollen and charcoal, a mosaic landscape comes into focus: grassland on the level basaltic plateau, interrupted by a steep rocky valley sloping down to the Vorotan, where a riparian environment prevails. The data also suggest an environment that was cooler and moister than today, a picture echoed by preliminary micromorphological results showing cycles of freezing and thawing. Thus we interpret these data as evidence for increasing occupation of Aghitu–3 Cave, which served as a temporary hunting camp. While it is clear that the older occupations of the cave were ephemeral, during the time leading up to the last glacial maximum, occupation became more frequent.

1 INTRODUCTION

The Tübingen-Armenian Paleolithic Project (TAPP) began in 2008 as a joint endeavor of the Institute of Archaeology of the National Academy of Sciences of the Republic of Armenia and the Heidelberg Academy of Sciences and Humanities (co-directed by B. Gasparyan and A. Kandel). TAPP's main focus is to examine the Paleolithic settlement of the Vorotan River Basin in the Armenian Highlands. The Vorotan flows southeast to join the Arax River along the border with Iran (**figure 1**). The valley of the Vorotan represents a significant axis for movement through the region because high mountain ranges rising above 3800 m surround the basin on both sides, channeling the movement of game and early humans through the steeply incised Vorotan valley. The Vorotan basin enjoys a cool temperate climate and contains a mosaic landscape suitable to early human settlement.

During TAPP's initial season in June 2008, the team conducted survey around the town of Sisian in the Syunik region of southern Armenia (**figure 1**). In Aghitu, a village about 5 km east of Sisian, the team observed seven caves around the base of a basalt massif rising 25–30 m above the surrounding landscape. The flat-topped massif is situated near the terminal end of several basalt flows that emanated from Mt. Bugdatapa at 126–111 ka (Ollivier *et al.* 2010). Archaeological remains atop the massif date to the Middle Bronze Age, Hellenistic and Medieval periods (Kroll 2006; Cherry *et al.* 2007). In 2003 a French mission surveyed and tested the seven caves around the base of the massif, but found no Paleolithic finds in a 2 by 2 m test pit excavated to a depth of 1.5 m at Aghitu–3 Cave (N39°30'50.5", E46°4'54.5"). Named according to local convention, the cave is 11 m deep, 18 m wide, 6 m high and situated at an elevation of 1601 m above sea level, about 115 m above the Vorotan River. During our field survey in 2008, we observed obsidian artifacts and mineralized bones on the surface, suggesting that this cave had potential for excavation. In June 2009 and again in July 2010, the TAPP team conducted further excavation at Aghitu–3 Cave.

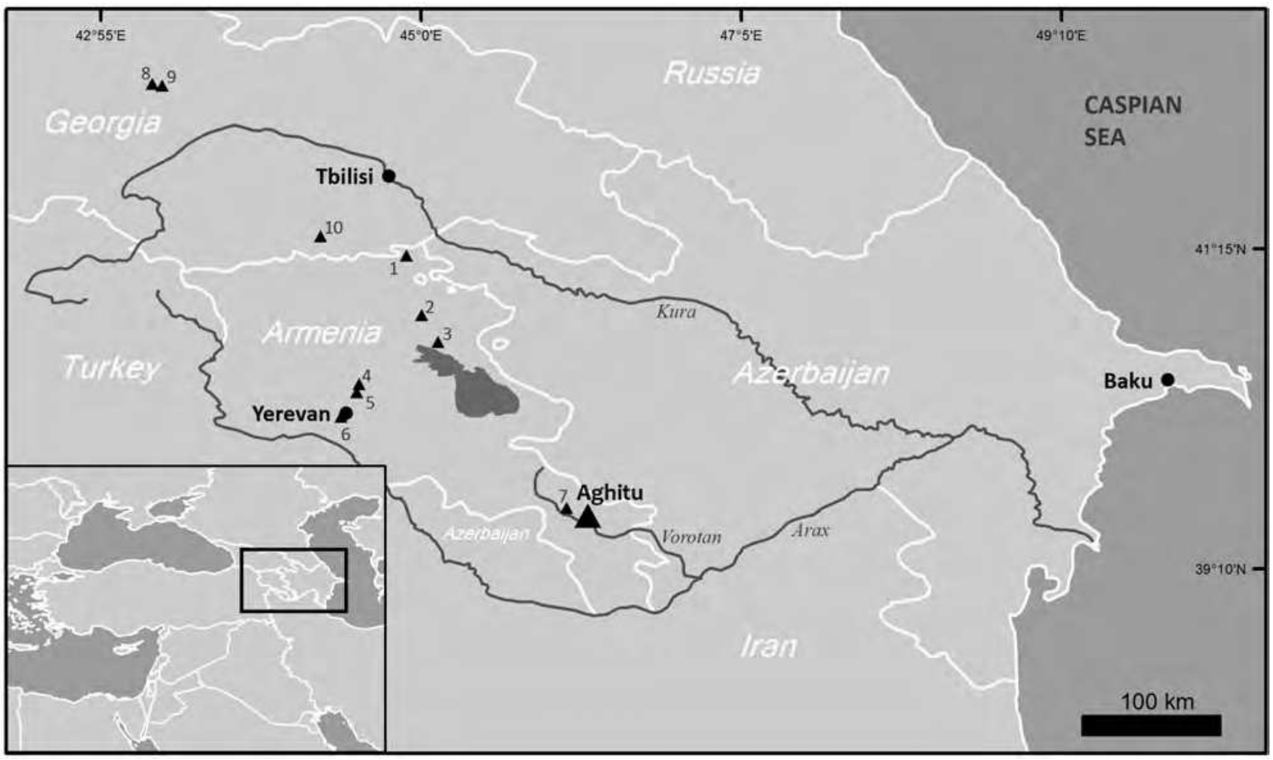

FIGURE 1 (Aghitu-3 Cave) – Reference map of the Caucasus region showing Aghitu in the Vorotan River valley and other sites mentioned in the text. Legend: 1. Debed river sites; 2. Hovk; 3. Kalavan; 4. Lusakert; 5. Nor Geghi; 6. Yerevan; 7. Angeghakot; 8. Ortvale Klde; 9. Dzudzuana; 10. Dmanisi (Map: Geraldine Quénéhérve).

2 BACKGROUND

While our knowledge about the Paleolithic settlement of the Caucasus has grown in the past decades, the archive of excavated and dated sites remains relatively small. The Georgian Early Pleistocene site of Dmanisi established the region as a focal point for research into the earliest human migrations out of Africa at about 1.8 Ma (Gabunia *et al.* 2000; Lordkipanidze *et al.* 2005; Ferring *et al.* 2011). Continued research programs at several Georgian sites, such as Ortvale Klde and Dzudzuana Cave, has vastly improved our understanding of the Middle to Upper Paleolithic transition of this region (e.g. Nioradze & Otte 2000; Bar-Oz & Adler 2005; Bar-Yosef *et al.* 2006, 2011; Adler *et al.* 2008; Moncel *et al.* 2012).

However, compared to Georgia, the picture in Armenia is just emerging. Lower Paleolithic settlement is documented mainly by open-air sites with Oldowan-like and Acheulean industries (Klein 1966; Golovanova 2000; Doronichev 2008; Kolpakov 2009; Gasparian 2010). In northern Armenia, researchers are investigating the Middle Pleistocene of the Debed river valley (Egeland *et al.* 2010, 2011), while others are examining the Dzoraget river valley in the region of Lori (Dolukhanov *et al.* 2004; Presnyakov *et al.* 2012). In central Armenia, Middle Paleolithic localities with late Mousterian occupations are known through excavations at Yerevan (Yeritsian 1970) and Lusakert (Yeritsian 1975) caves, but the dating of these sites remains unresolved. Recent work at Angeghakot–1 (Liagre *et al.* 2006), Hovk–1 Cave (Pinhasi *et al.* 2008, 2011; Bar-Oz *et al.* 2012) and Kalavan–2 (Ghukasyan *et al.* 2011) yielded three new Middle Paleolithic localities. Meanwhile, ongoing excavation projects led by Adler, Yeritsyan & Gasparyan in the Hrazdan River Gorge, including Nor Geghi and renewed work at Lusakert, is shedding light on the nature of the Armenian Lower and Middle Paleolithic (Adler *et al.* 2009, 2012).

Despite this improved effort to study the Paleolithic, stratified Upper Paleolithic sequences are extremely rare in Armenia, represented by a single Late Upper Paleolithic open-air site, Kalavan–1, dated to 17–16,000 cal BP (Chataigner *et al.* 2012). Thus, the discovery of the Upper Paleolithic site of Aghitu–3 has significance not only for the settlement of the Armenian Highlands, but also the Caucasus region.

3 FIELD METHODS

In 2009 the field crew began its systemic excavations, orienting the measuring grid to the 2 by 2 m test pit excavated by a French team in 2003. The team designated the coordinate system using letters for the x-axis and numbers for the y-axis (**figure 2**). A datum point hammered into the rear wall of the cave along the 9 m north line served as the zero point for measuring depth. In 2009, we deepened the French team's test pit to a depth of about 4 m and excavated a 1.5 by 5 m trench directly south of it, resulting in an L-shaped excavation. In 2010, we excavated the 2 by 4 m area immediately west of the French team's test pit and enlarged the L-shaped excavation by incorporating the 2 by 3 m area to the east. Additionally, we excavated a 2 by 2 m area just outside of the rock wall that runs more or less parallel to the dripline of the cave. At the end of both field seasons, the team drew the main profile walls of the excavation (**figure 3**).

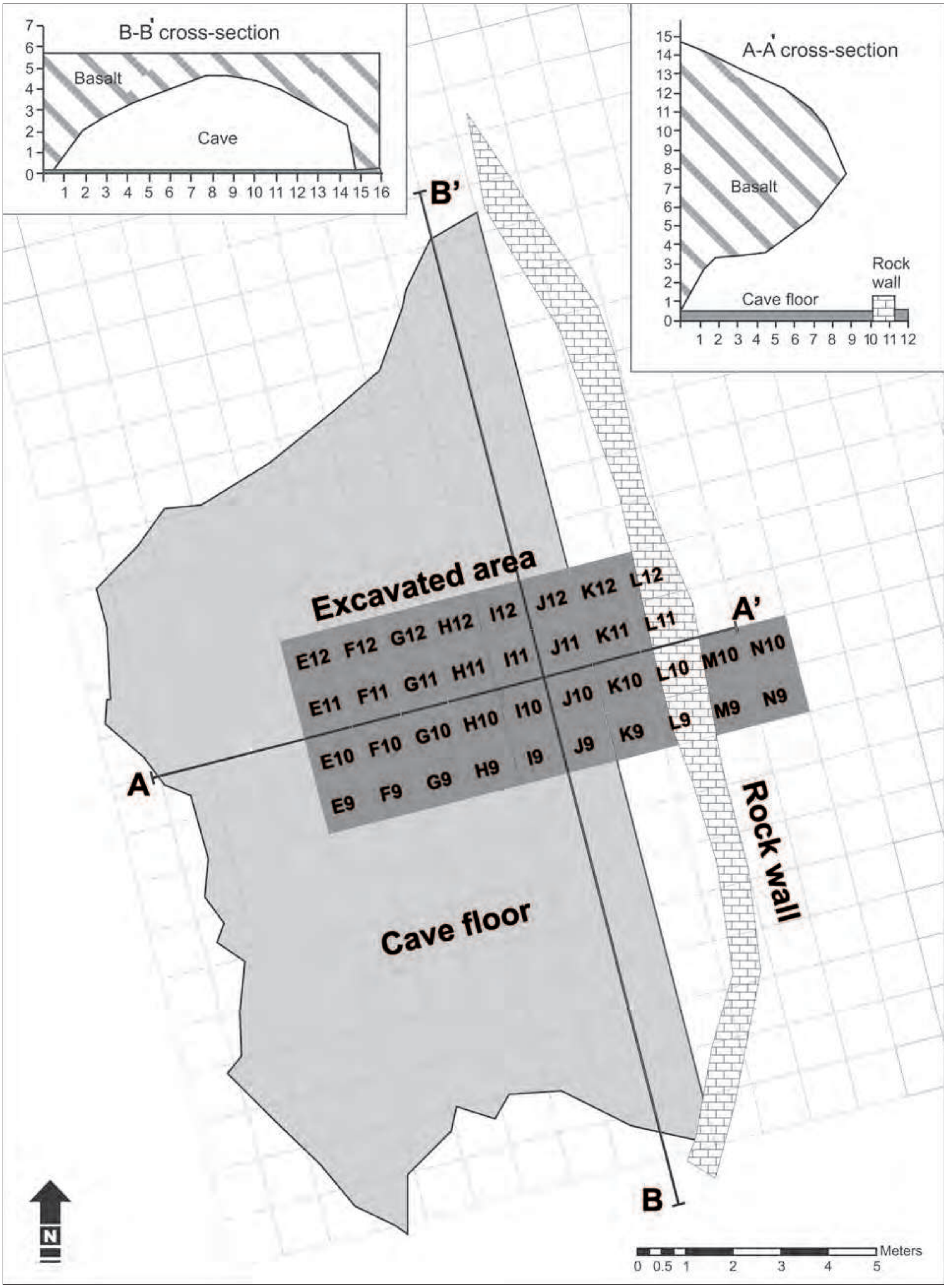

FIGURE 2 (Aghitu-3 Cave) – Site plan showing square designations of area excavated. Rock wall runs more or less along the dripline of the cave (Plan: Dmitri Arakelyan).

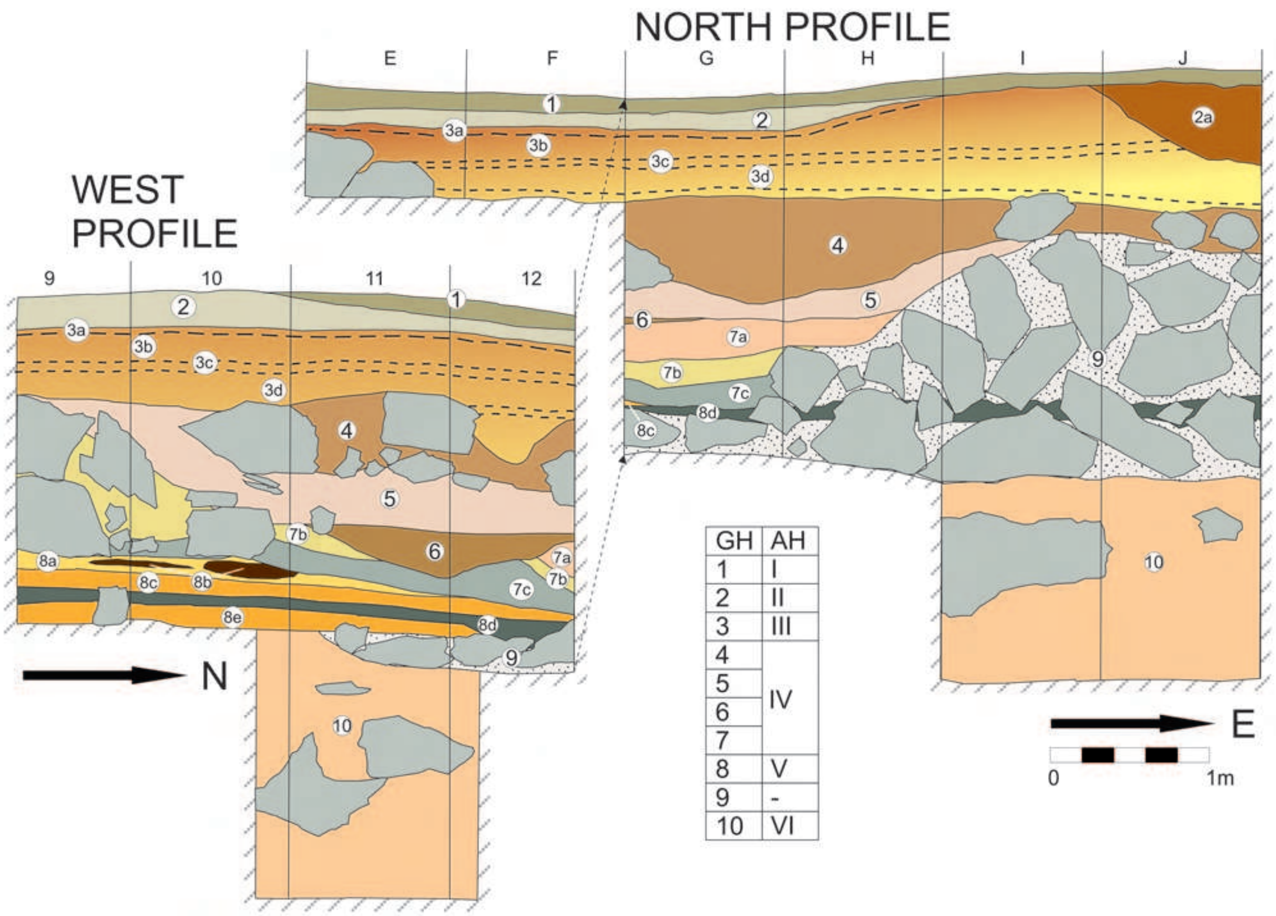

FIGURE 3 (Aghitu-3 Cave) – Digitized drawings of the west and north excavation profiles depicting geological layers (GH) and their corresponding archaeological horizons (AH).

As we explored the geological stratigraphy during the first field season, excavation proceeded in spits of 10–15 cm in units of one square meter. All finds were collected in one bag. The excavated sediment was searched by hand for smaller finds, with an effective recovery of about 5 mm. During the second season we modified this strategy because we encountered higher find densities. Starting in 2010 we excavated in spits of 2–3 cm thickness in units of one quarter meter. We piece-plotted single finds larger than 2 cm using meter sticks within the squares and a line level to measure depth. The team used screens of 5 and 2 mm to sieve the sediment and collected finds in a single bag. This increased the recovery of smaller lithic artifacts, faunal remains, small bird bones, microfauna and charcoal.

During excavation we encountered many large basalt blocks with maximum dimensions up to 1.5 m. Removal of these large blocks necessitated coarser methods. First the team broke the blocks using a sledge hammer, breaker bar, chisel and pick. Then the basalt debris was removed, so that controlled excavation could continue.

4 GEOLOGICAL RESULTS

At the end of the 2010 season we refined our geological understanding of the site. After studying the profiles, the team expanded the six geological horizons (GH) identified in 2009. The resulting ten lithostratigraphic units are described below and correlate with six archeological horizons (AH) (**figure 3**). Using the Tübingen tradition, we assign Arabic numbers for GH and Roman numerals for AH.

4.1 Stratigraphy

4.1.1 GH 1/AH I

The surface layer consists of a 10–15 cm of very loose, dry, dusty, light gray, organic-rich, clayey silt with occasional angular fragments and rounded basalt cobbles up to 10 cm. GH 1 has a completely anthropogenic character, rich in modern refuse, animal dung and charcoal. The base of GH 1 consists of very compact dung layers with white mineral laminations that will be the subject of future sedimentological analyses. The surface layer yielded a few obsidian artifacts, some mineralized bone fragments and occasional ceramic sherds.

4.1.2 GH 2/AH II

The next layer consists of a 10–20 cm thick, uniform, compact, dry, grayish-brown silt with frequent angular basalt fragments up to 15 cm. AH II yielded surprisingly little modern refuse, and is anthropogenic in origin. Below this level, modern debris and ceramic finds are infrequent. AH II contained a few obsidian artifacts, rare mineralized bone fragments and some ceramic sherds.

4.1.3 GH 3/AH III

The transition to the underlying 60–80 cm thick layer is very distinct, and the sediment changes from dry to moist. GH 3 is a geogenic yellowish-brown, finely laminated, clayey silt containing abundant fragments of weathered platy basalt up to 30 cm. Large boulders in parts of GH 3 appear to represent a phase that we refer to as the "upper rockfall". Finds from AH III included plentiful obsidian artifacts, ample charcoal and well preserved, dark, mineralized bone fragments coming from four occupation horizons designated from AH IIIa at the top to AH IIId at the bottom. Several intact combustion features consisted of a reddish-brown compact layer, underlying a black layer containing charcoal, and topped by a white ashy layer. Block samples taken from these features were collected for laboratory studies of the micromorphology of the sediment.

4.1.4 GH 4–7/AH IV

We subdivided the former GH 4 into four new geological layers which we renamed GH 4–7. AH IV can be regarded as archaeologically sterile despite the presence of a few finds. This layer yielded good samples of micromammals.

4.1.5 GH 4

The transition to this 15–30 cm thick layer was clear and marked by a brown, finely laminated, clayey silt with some sand. GH 4 contained some weathered basalt fragments 5–15 cm in size, but fewer large boulders than GH 3. This layer yielded a few lithics and some well-preserved faunal remains.

4.1.6 GH 5

The transition to this 10–20 cm thick layer was clear and marked by a light brown, finely laminated, clayey silt with some sand. GH 5 contained some basalt fragments, but no large boulders. This layer yielded no lithics or faunal remains.

GH 6 **4.1.7** The transition to this 5–10 cm thick layer was clear and marked by a brown, finely laminated, clayey silt with some sand. GH 6 contained some basalt fragments, but no large boulders. This layer yielded no lithics or faunal remains.

GH 7 **4.1.8** The transition to this 20–25 cm thick layer was clear. Based on changes in the amount of basalt debris, we subdivided GH 7 into three parts (**figure 3**). This layer yielded no lithics or faunal remains. The three finer subdivisions were GH 7a–7c:

- GH 7a–light olive brown silt with little angular basalt debris, 10 cm thick
- GH 7b–light olive brown silt with frequent angular basalt debris, 5–10 cm thick
- GH 7c–light olive brown silt with little angular basalt debris, 5–10 cm thick.

GH 8/AH V **4.1.9** The transition to this 20–30 cm thick, fine grained deposit is very distinct. Based on changes in color and grain size, as well as increased moisture content, we subdivided GH 8 into five easily recognized parts (**figure 3**). GH 8 yielded a few obsidian artifacts, yellowish-brown moderately preserved faunal remains, and abundant charcoal. The five finer subdivisions were named GH 8a–8e:

- GH 8a–light gray sand layer, 2–4 cm thick
- GH 8b–reddish brown clayey silt with abundant charcoal, 3–5 cm thick
- GH 8c–yellowish brown clayey sandy silt, 10 cm thick
- GH 8d–reddish brown clayey silt with less charcoal than GH 8b, 3–5 cm thick
- GH 8e–variably thick, distinct dark gray sand layer, 3–10 cm thick.

GH 9 **4.1.10** Large, angular basalt boulders up to 1.5 m represent a phase that we refer to as the "lower rockfall". The spaces between these boulders are filled with a sandy silt matrix. This layer appears to thicken towards the dripline of the cave, reaching a maximum thickness of about one meter. This layer is sterile, yielding no lithics or faunal remains.

GH 10/AH VI **4.1.11** The transition to GH 10 is distinct (**figure 3**). This 180 cm thick layer was marked by the predominance of fine sediment, mainly silt, with varying amounts of clay and sand. The organic content of the sediment appears to increase, as does moisture. AH VI yielded many obsidian artifacts, much charcoal and numerous yellowish-brown, moderately preserved faunal remains. GH 10 reached its maximum depth at 414 cm below datum, or about 350 cm below the ground surface. A few intact combustion features consisted of a reddish-brown compact layer, underlying a black layer containing charcoal, and topped by a white ashy layer. Block samples taken from these features were collected for micromorphological studies.

4.2 Radiocarbon dating

From the 2010 season, five samples from AH III were sent to Kiel for radiocarbon dating using accelerated mass spectrometry. The new results from two bone and three charcoal specimens show uncalibrated dates ranging from ca. 24–22 000 BP for the upper find horizon AH III (**figure 4**). Four samples analyzed in 2009 resulted in uncalibrated dates of ca. 30–27 000 BP for the lower find horizons of AH V and VI (Kandel *et al.* 2012). Using OxCal version 4.1.7 (Bronk Ramsey 2009), the radiocarbon dates calibrate between ca. 35–27,000 cal BP (Riemer *et al.* 2009), placing the dates firmly in the early part of the Upper Paleolithic.

AH	Z	CATEGORY	IDENTIFICATION	LAB ID	^{14}C UNCAL BP	^{14}C CAL BP (1 σ)	^{14}C CAL BP (2 σ)
IIIA	−1,09	CHARCOAL	*Populus* or *Salix*	KIA-43242	22900 ± 180	28036 – 27060	28163 – 26895
IIIB	−1,19	CHARCOAL	*Populus* or *Salix*	KIA-43241	22630 ± 300	27779 – 26905	28066 – 26300
IIIC	−1,31	BONE	Sheep/goat metatarsal	KIA-43238	23140 ± 130	28174 – 27786	28470 – 27647
IIID	−1,37	CHARCOAL	Indeterminate	KIA-43243	23880 ± 150	28955 – 28421	29280 – 28253
IIID	−1,48	BONE	Equid radius R	KIA-43240	23960 ± 120	29024 – 28530	29265 – 28391
VB	−2,38	CHARCOAL	*Populus* or *Salix*	KIA-39640	27110 + 170/ −160	31235 – 31455	31138 – 31588
VI	−2,77	BONE	Wolf radius L	KIA-39642	27120 ± 170	31240 – 31459	31140 – 31595
VI	−3,50	BONE	Wild sheep or goat femur	KIA-39643	28680 ± 200	32814 – 33442	32249 – 34087
VI	−4,04	CHARCOAL	Indeterminate	KIA-39641	30210 + 180/ −170	34665 – 34934	34570 – 35094

FIGURE 4 Aghitu-3 Cave. Summary of AMS radiocarbon dating results from the Leibniz Laboratory in Kiel, Germany showing provenience, materials dated, lab numbers, as well as uncalibrated (uncal) dates and calibrated (cal) age ranges before present (BP).

4.3 Botanical remains

Ten samples of loose sediment from GH 8 and GH 10 were analyzed for palynological remains (Kandel *et al.* 2012). Wood charcoal was observed in seven of the samples. While the four samples from GH 8 contained no pollen, five of six samples from GH 10 yielded small quantities of pollen from the genera *Pinus* (pine), *Betula* (birch), *Quercus* (oak), and *Centaurea* (knapweeds), as well as the chicory subfamily (Cichorioideae). The presence of *Botryococcus*, a water dwelling species of green algae, was confirmed in three samples from GH 10, suggesting the presence of standing water nearby.

Charcoal remains are abundant in many of the excavated layers and 118 discrete samples were collected during excavation, with many additional samples collected during sediment screening. While a detailed study of the charcoal is under way, identified samples include only those sent for radiocarbon dating. The identified samples suggest that people brought poplar or willow (*Populus*/*Salix*) to the cave as fuel for burning (**figure 5**). These riparian species likely grew nearby in the Vorotan valley.

5 ARCHAEOLOGICAL RESULTS

In the following section we limit our discussion to finds collected in 2009 and 2010 coming from the Paleolithic layers AH III, IV, V and VI. We excluded finds from AH I and AH II because these layers include modern debris and appear mixed. We also exclude collected finds resulting from profile cleaning or collapse if these finds spanned more than a single AH. Here we present the results of 2216 finds, including 1970 chipped stone artifacts and 128 large mammalian remains (**figure 5**).

FIND CATEGORY	III	IV	V	VI	N	%
LITHICS						
Blank	891	2	4	95	992	50,4 %
Retouched tool	196	2	4	34	236	12,0 %
Core	18	--	--	2	20	1,0 %
Angular debris (chunks)	80	--	--	9	89	4,5 %
Small debitage (chips)	594	--	--	39	633	32,1 %
LITHIC subtotal	1779	4	8	179	1970	100 %
Tool index (excluding chips)	16,5 %			24,3 %		
FAUNA						
Small mammal (SC1)	3	5	--	5	13	10,2 %
Small-medium mammal (SC2)	14	7	2	58	81	63,3 %
Large-medium mammal (SC3)	12	2	4	8	26	20,3 %
Large mammal (SC4)	2	--	1	2	5	3,9 %
Canis lupus	--	--	1	2	3	2,3 %
FAUNA subtotal	31	14	8	75	128	100 %
CHARCOAL	93	4	12	9	118	
TOTAL FINDS	1903	22	28	263	2216	

FIGURE 5 Aghitu-3 Cave. List of main find categories with break-down of lithics, fauna and charcoal by archeological horizon.

Stone artifacts 5.1

The entire lithic assemblage from AH III-VI consists of 1970 chipped artifacts, but for the purpose of this analysis, we do not consider the 633 chips, or 32 % of the lithic artifacts smaller than 10 mm. Furthermore, this analysis highlights and compares data from the two main find horizons, AH III and VI. For completeness, we present data from AH IV and V, but these assemblages are too small to provide meaningful interpretations about behavior.

Raw material 5.1.1

The two main raw materials present in the assemblages are obsidian (85.2 %) and chert (14.4 %). The remaining raw materials (0.4 %) include dacite and an unknown stone (**figure 6**). The sources of these raw materials are presently under study. It is interesting to note that obsidian is much more common in AH III (88 %) than in AH VI (57 %). Accordingly, AH VI contains a greater proportion of chert artifacts.

The obsidian used by the inhabitants of Aghitu–3 is of extremely high quality. It is variable in color, ranging from glassy translucent to smoky gray, and some variants are matte gray or opaque red. Banding, streaking and speckling are common features of all obsidian varieties. The diversity in color and texture suggests several sources for the obsidian. The closest known primary source of obsidian is represented by the volcanoes of the Vorotan Group about 30–40 km northwest of Aghitu (Fouloubey *et al.* 2003; Liagre *et al.* 2006; Cherry *et al.* 2010). Secondary sources of rounded obsidian pebbles likely stem from deposits in the Vorotan valley and are documented by the presence of brown cortex on 13 % of the obsidian finds.

The chert also has excellent knapping characteristics, with a uniform microcrystalline structure and glossy texture. The chert exhibits a high variability in color, ranging from dark brown, red and orange through yellow, beige, gray, white and green.

LITHIC RAW MATERIAL	III	IV	V	VI	N	%
OBSIDIAN						
No cortex	907	4	8	78	997	87,5 %
Cortex (< 50 %)	140	--	--	2	142	12,5 %
Cortex (> 50 %)	--	--	--	--	0	0 %
OBSIDIAN subtotal	1047	4	8	80	1139	100 %
FLINT						
No cortex	101	--	--	58	159	82,8 %
Cortex (< 50 %)	26	--	--	2	28	14,6 %
Cortex (> 50 %)	5	--	--	--	5	2,6 %
FLINT subtotal	132	0	0	60	192	100 %
Dacite	2	--	--	--	2	
Unknown	4	--	--	--	4	
TOTAL	1185	4	8	140	1337	
Obsidian index	88,4 %			57,1 %	85,2 %	
Flint index	11,1 %			42,9 %	14,4 %	
Cortical index	14,4 %			2,9 %	13,1 %	

FIGURE 6 Aghitu-3 Cave. Frequency of lithic raw materials showing distribution of cortical pieces and cortical index by archeological horizon.

The sources of the chert are presently unknown, but unpublished geological studies indicate outcrops 8 km west of Aghitu near Brnakot, and also near Goris, about 25 km to the east. Secondary sources of chert likely stem from pebbles deposited in the Vorotan valley and can be identified by the presence of cortex on 17 % of the chert finds.

5.1.2 Blank production and technology

The chipped lithic assemblage is strongly oriented towards the production of laminar products on volumetric cores. Blanks come mainly in the form of bladelets with widths less than 10 mm, and to a much lesser degree, blades with widths greater than 10 mm (**figure 7**). Of the blanks 62 % in AH III are laminar, while the tendency in AH VI is even more pronounced with 78 % laminar blanks. An even higher proportion of formal tools are made on laminar products, with 84 % in AH III and 97 % in AH VI. These data clearly document a lithic reduction strategy focused on making laminar blanks that are overwhelmingly bladelets.

The presence of angular debris comprising about 7 % of the entire assemblage, and especially the 633 chips smaller than 10 mm indicate that stone knapping took place at Aghitu–3. The argument for on-site reduction is further strengthened by the presence of cortical surfaces on 13 % of obsidian and 17 % of chert artifacts. However, of those artifacts with cortex, the vast majority are covered by less than 50 % of cortex. This illustrates that later stages of decortification, as represented by the artifacts with less than 50 % cortex coverage, occurred on-site. Thus, the early stages of reduction must have occurred elsewhere. A notable difference in the presence of cortex on artifacts can be seen when comparing the assemblages of AH III and AH VI. In AH III cortical pieces comprise 14 % of the assemblage, but only 3 % in AH VI. This difference seems to indicate a change in reduction strategy between these phases of occupation, or possibly differing lengths of occupation.

Lithic technology	III	IV	V	VI	n	%
Core	18	--	--	2	20	1,5 %
Flake	367	--	2	26	395	29,5 %
Blade	149	1	1	6	157	11,7 %
Bladelet	496	2	3	93	594	44,4 %
Core tablet	1	--	--	--	1	0,1 %
Preparation flake	44	1	--	3	48	3,6 %
Crested blade primary	7	--	1	--	8	0,6 %
Crested blade secondary	3	--	--	--	3	0,2 %
Burin spall	20	--	1	1	22	1,6 %
Angular debris	80	--	--	9	89	6,7 %
TOTAL	1185	4	8	140	1337	100 %

Lithic blanks	III	IV	V	VI	n	%
Laminar blanks	675	3	6	100	784	63,8 %
Non-laminar blanks	412	1	2	29	444	36,2 %
TOTAL	1087	4	8	129	1228	100 %
Laminar blank index	62,1 %			77,5 %		

Lithic tool blanks	III	IV	V	VI	n	%
Flake	25	--	--	1	26	11,0 %
Blade	19	--	--	1	20	8,5 %
Bladelet	146	2	4	32	184	78,0 %
Angular debris	3	--	--	--	3	1,3 %
Heat spall	1	--	--	--	1	0,4 %
Core	2	--	--	--	2	0,8 %
TOTAL	196	2	4	34	236	100 %
Laminar tool index	84,2 %			97,1 %		

FIGURE 7 Aghitu-3 Cave. Overview of lithic technology focusing on blank selection in tool production by archeological horizon.

So far 18 cores from AH III (**figure 8**) and two cores from AH VI (**figure 9**) have been recovered, most of which are small, highly reduced, single platform bladelet cores (**figure 10**). While the remaining cores have double or multiple platforms, they are also aimed at producing bladelets. The predominance of platform cores mirrors the prevalence of laminar blanks in the assemblage, although the length of the blanks appears to be much longer than the cores themselves. The presence of crested blades, core tablets and other preparation debris in both layers confirms that core preparation and maintenance occurred, although the smaller assemblage of AH VI contains fewer examples. As excavation continues we expect that the sample size will increase.

Of the 709 blanks with proximal preservation (complete flakes and proximal fragments), plain striking platforms are most common, followed in frequency by indeterminate, shattered, punctiform and faceted butts (**figure 11**). In AH III pronounced bulbs of percussion are visible on 7 % of blanks, while the incidence of shattered bulbs is 7 % and bulbar scars are present on 28 %.

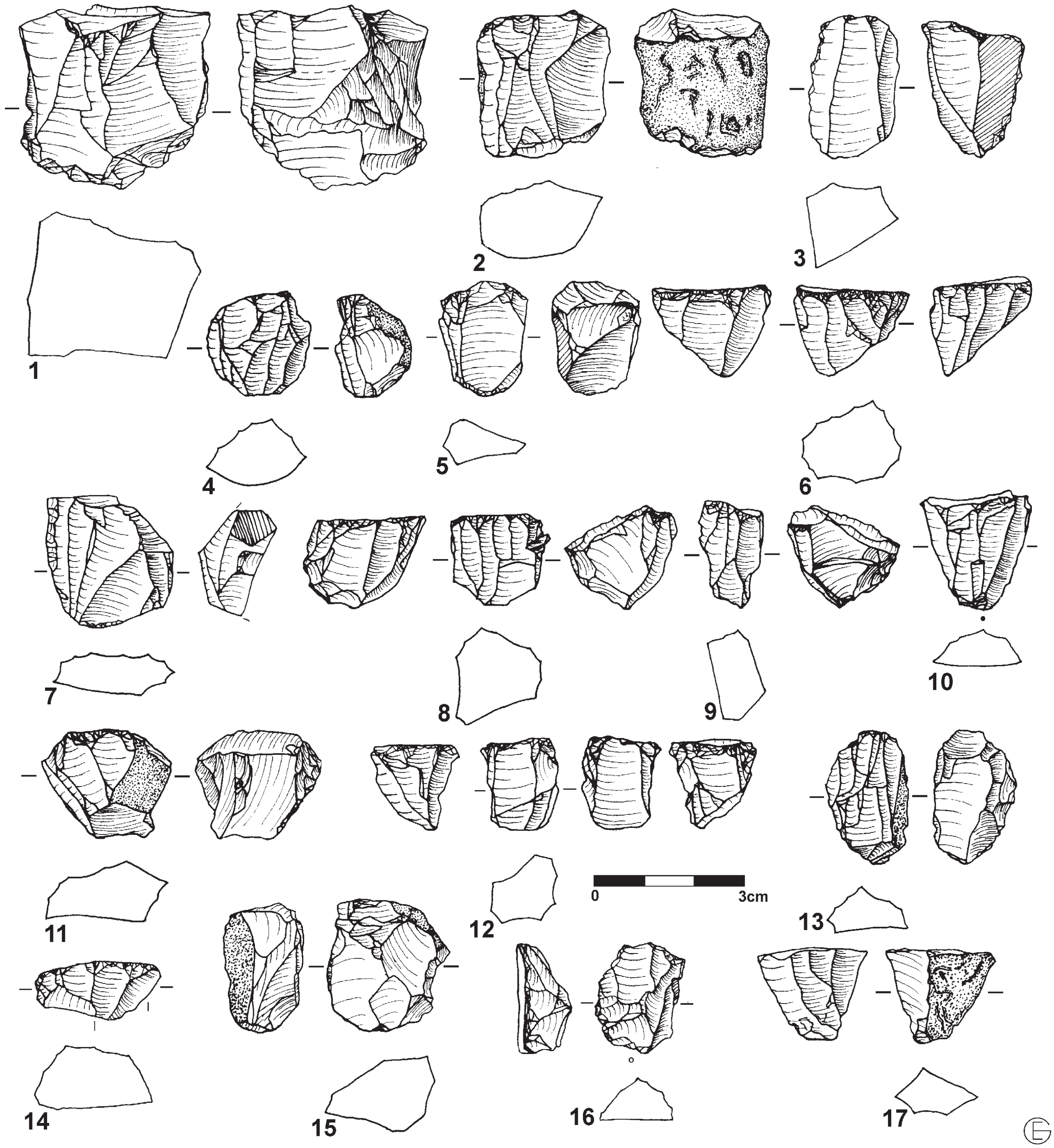

FIGURE 8 (Aghitu-3 Cave, AH III) – Platform cores (1–6, 8–13, 15–17), core fragment (7) and scraper on broken core (14). Raw material: chert (1, 10, 14–15); obsidian (2–9, 11–13, 16–17) (Illustration: Elham Ghasidian).

In AH VI, pronounced bulbs of percussion were observed on 5 % of blanks, while shattered bulbs were seen on 3 % and bulbar scars on 12 %. Together, these characteristics suggest a lower striking intensity for AH VI compared to AH III. These data are consistent with the presence of overhanging lips, which were observed in 15 % of blanks in AH III, contrasted to 33 % in AH VI. The trend shown by overhanging lips confirms that AH VI not only shows a lower striking intensity, but also the possible use of diffuse force. Another difference can be seen in the degree of dorsal reduction, which was observed in 33 % of artifacts in AH III, but only 14 % in AH VI. This suggests that knapping in AH VI produced blanks that required less preparation than in AH III.

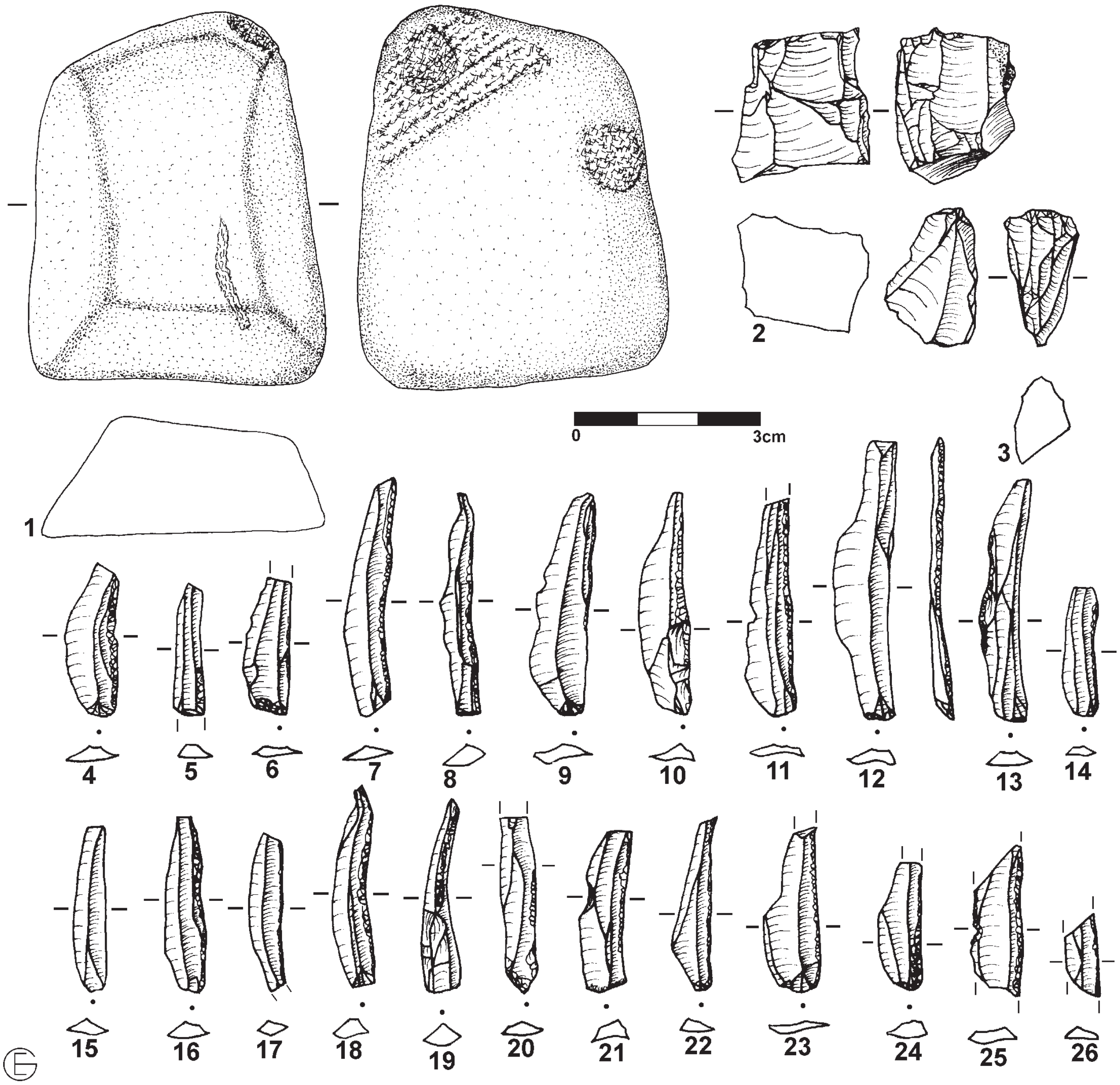

FIGURE 9 (Aghitu-3 Cave, AH VI) – Polishing stone (1), platform cores (2–3), laterally retouched bladelets (4–14, 16–18, 20–26) and unretouched bladelets (15, 19). Raw material: metamorphic (1); chert (2, 4, 6–8, 10–11, 13, 15–16, 18–19, 21–23); obsidian (3, 5, 9, 12, 14, 17, 20, 24–26) (Illustration: Elham Ghasidian).

FIGURE 10 (Aghitu-3 Cave. Distribution of core types by archeological horizon.

Lithic core type	III	IV	V	VI	n	%
Single platform	14	--	--	1	15	75 %
Double platform	3	--	--	1	4	20 %
Multiple platform	1	--	--	--	1	5 %
TOTAL	18	0	0	2	20	100 %

Lithic blank preservation	III	IV	V	VI	n	%
Complete	378	1	1	62	442	36,0 %
Proximal	236	2	2	27	267	21,7 %
Medial	246	--	--	28	274	22,3 %
Distal	227	1	5	12	245	20,0 %
TOTAL	1087	4	8	129	1228	100 %
Proximal index	56 %			69 %		

Lithic butt	III	IV	V	VI	n	%
Plain	255	2	--	52	309	43,6 %
Previous negative	18	--	--	2	20	2,8 %
Fracture plane	3	--	--	--	3	0,4 %
Punctiform	46	--	--	4	50	7,1 %
Faceted	48	--	--	2	50	7,1 %
Cortical	7	--	--	1	8	1,1 %
Shattered	64	1	1	7	73	10,3 %
Indeterminate	173	--	2	21	196	27,6 %
TOTAL	614	3	3	89	709	100 %

Lithic striking attribute	III	IV	V	VI	n
Bulb of percussion	7,2 %	--	--	4,5 %	48
Shattered bulb	6,5 %	--	--	3,4 %	43
Bulbur scar	28,0 %	--	--	12,4 %	185
Lip	14,8 %	--	--	32,6 %	120
Dorsal reduction	32,9 %	--	--	13,5 %	215

FIGURE 11 Aghitu-3 Cave. Review of blank preservation, as well as butt and striking characteristics by archeological horizon.

In summary, the data suggest that the striking intensity in AH VI was lower than in AH III, but neither assemblage appears to be produced solely by hard hammer. Based on the striking attributes, both assemblages appear to result from the application of diffuse force, such as soft hammer or indirect percussion. Nonetheless, the knapping characteristics of AH III suggest the use of a more forceful technique compared to AH VI.

5.1.3 Retouched tool typology

Retouched tools constitute a sizable proportion of the assemblage from AH III (17 %) and even more so in AH VI (24 %) (**figure 5**), keeping in mind that the percentage of tools excludes the 633 chips smaller than 10 mm. As mentioned before, the vast majority of retouched pieces were made on laminar blanks, 84 % in AH III and 97 % in AH VI (**figure 7**). The manufacture of laminar blanks, or more precisely bladelets, was the single most important aspect of lithic reduction, and based on their high degree of retouch, these bladelets were clearly geared towards the production of tools (**figure 12**).

In both AH III and AH VI the most common tool forms are bladelets that are finely retouched on one, or sometimes both, lateral edges (**figures 9** and **13**). The bladelets are often twisted to the right, but this attribute was not observed systematically during analysis, so that the nature of twisting must remain a hypothesis for now. The intensity of retouch is very fine and shows a consistent pattern. The degree of retouch is high, ranging from 50–100 % of a given lateral edge and can therefore be described as continuous.

FIGURE 12 Aghitu-3 Cave. Frequency of tool types by archeological horizon.

Lithic tool type	III	IV	V	VI	n	%
Laterally retouched tool, fine	119	1	4	27	151	64,0 %
Laterally retouched tool, semi-abrupt	33	1	--	4	38	16,1 %
Laterally retouched tool, backed	9	--	--	1	10	4,2 %
End retouch	4	--	--	--	4	1,7 %
Scraper	15	--	--	--	15	6,4 %
Tanged point	1	--	--	--	1	0,4 %
Burin	5	--	--	--	5	2,1 %
Notch	6	--	--	1	7	3,0 %
Denticulate	1	--	--	--	1	0,4 %
Splintered piece	3	--	--	1	4	1,7 %
TOTAL	196	2	4	34	236	100 %
Fine lateral retouch index	60,7 %			79,4 %		

This similarity in the character of the retouch suggests that the tools were created on laminar blanks in a standardized fashion for a similar purpose. However, use wear studies have not yet been conducted, so that we cannot discern the intentions of their makers.

A very low proportion of the bladelets show more invasive forms of modification such as semi-abrupt retouch and rare examples of backed pieces (**figure 12**). Nonetheless, these forms are much less common. These more invasive methods of retouch may indicate an alternate form of use or hafting, or may simply represent a part of the full spectrum ranging from fine retouch through semi-abrupt to fully backed pieces. Finally, other tool forms are rare, but include various scrapers, notches and burins, among other types (**figures 8** and **9**).

5.2 Large mammalian fauna

The finds excavated from Aghitu–3 include 128 large mammalian remains (**figure 5**). For now, the specimens have not been identified to genus or species level. Rather we used a preliminary classification system based on the live weight of an animal (e.g. Brain 1974; Klein *et al.* 1991) to establish four animal size classes: (SC1) 5–20 kg, small fauna, hare to fox size; (SC2) 20–100 kg, small-medium fauna, wild sheep and wild goat size; (SC3) 100–300 kg, large-medium fauna, equid size; and (SC4) 300–1000 kg, large fauna, aurochs size. We used these size classes to establish a picture of the distribution of the assemblage as a whole.

The results show that SC2 predominates with 63 % the assemblage, and most specimens come from AH VI. The next most frequent size class is SC3 with 20 %, and most examples are found in AH III. Remains of SC1 (10 %) and SC4 (4 %) correspond to much smaller proportions of the assemblage. The presence of wolf (*Canis lupus*) (2 %) in AH V and VI indicates that carnivores were active at the site.

Most of the fauna are moderately well preserved with good surface preservation. Preliminary taphonomic observations from AH III show three bones broken in a fresh state (green break), and two bones appear to be burned. Much of the fauna from AH III consists of well mineralized and well preserved shaft fragments of long bones that could not readily be identified. The size classes in AH III are also more evenly distributed, and together these characteristics suggest a fauna that was accumulated by humans. In AH VI, on the other hand, four bones show evidence of biting or chewing by carnivores, and 30 appeared etched, possibly by the gastric juices of a carnivore.

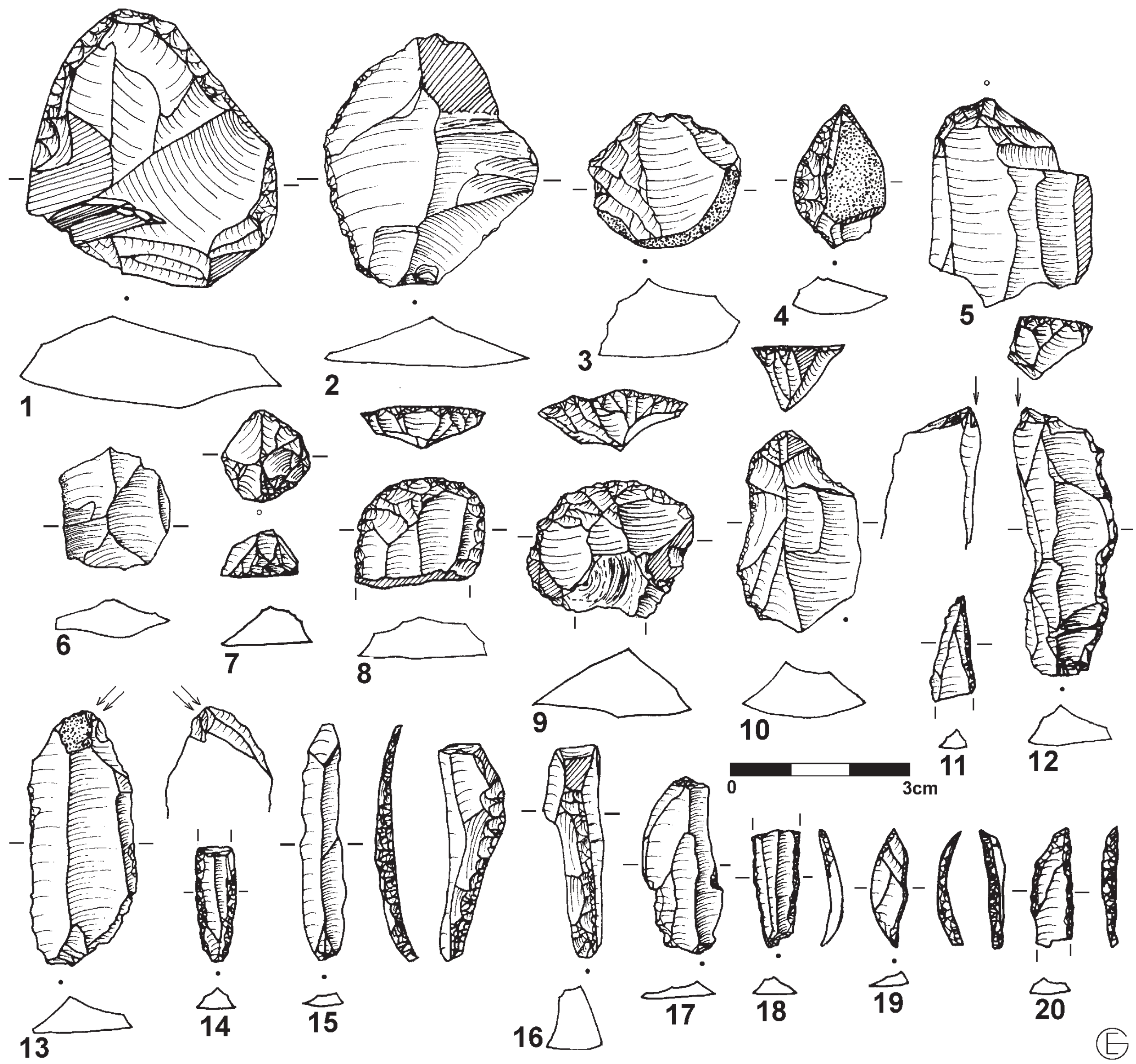

FIGURE 13 (Aghitu–3 Cave, AH III) – Retouched tools including scrapers (1–2, 4–5, 7–10), splintered piece (6), burins (12, 13, 17) and laterally retouched bladelets (11, 14–15, 18–20), platform core (3) and core trimming element (16). Raw material: obsidian (1–4, 6–7, 10–11, 13–16, 18–20); dacite (5); chert (8–9, 12, 17) (Illustration: Elham Ghasidian).

The fauna from AH VI includes many etched but otherwise complete small bones, such as phalanges, patellae and vertebrae. Furthermore, the fauna from AH VI appear skewed towards smaller (SC2) mammals. This preservation combined with the size class distribution suggests a fauna accumulated by carnivores.

Thus, our first impression of the fauna from Aghitu–3 is that humans and carnivores played different roles in accumulating the assemblages. While the fauna from AH III appears to be accumulated by humans, carnivores were more involved in the collection of fauna in AH VI. As the excavation continues, we plan to conduct thorough zooarchaeological analyses, including detailed taphonomic studies, to identify the species present and further assess the degree of anthropogenic and biogenic modifications.

FIGURE 14 Aghitu-3 Cave. Summary of identified microfaunal remains divided into two main stratigraphic groups based on archeological horizon (MNI = minimum number of individuals).

COMMON NAME	MNI (AH I-III)	MNI (AH IV-VI)
Pika	3	14
Vole	1	18
Migratory hamster	1	1
Water vole	--	5
Golden hamster	4	14
Mole vole	1	5
Jerboa	3	5
TOTAL	13	62

5.3 Micromammals, birds, fish and amphibians

The finds excavated from Aghitu–3 include a well preserved sample of 441 microfaunal specimens belonging to small mammals, birds, fish and amphibians. The microfaunal samples collected from Aghitu–3 were identified at the Zinman Institute for Archaeology at the University of Haifa and compared to collections at the Natural History Museum in Vienna. The seven genera of identified micromammals included pika, voles, hamsters and jerboa (**figure 14**). To gain a more detailed chronological view, we separated the assemblage into two groups from AH I-III and AH IV-VI. The composition of micromammalian species suggests that the climatic conditions of the Upper Paleolithic were generally cooler than at present. This is based on the high abundance of voles in the lower part of the sequence in comparison to their rarity in the upper part (**figure 14**).

More than 30 specimens of bird are present including bone and eggshell, but these have not yet been analyzed. On first glance, the avian fauna appear to be composed of small species that may have nested on the roof of the cave, just as swallows do today. In addition, one fish mandible (*Salmo trutta*) and four specimens of amphibians have been identified.

5.4 Post-Paleolithic

Here we provide a brief overview of the post-Paleolithic layers to complete the picture (Kandel *et al.* 2012). Up until now, our discussion of AH I and II has referred to inside the cave, where these layers average 20–30 cm in thickness. But outside of the cave, these layers extend to a depth of over 2 m and contain more pottery. While the pottery assemblage as a whole consists mostly of non-diagnostic body fragments, some diagnostic pieces are present, including rim, neck-rim, wall-rim, shoulder, base and body-base fragments. The analysis of these sherds represents the best means to examine the post-Paleolithic history of the site.

The typological distribution of the vessels includes goblets, jars, bowls and pots, with one example of household ceramic (oven/tile). The majority of pottery fragments can be attributed to Medieval times (IV-XIII centuries AD) when, according to the 13^{th} century Armenian historian Stepanos Orbelyan, Aghitu was a flourishing town. Two sherds are typical of the Achaemenid to Hellenistic period (VIII century BC-III century AD), and the oldest sherd is represented by a single fragment dating to the Early Bronze Age (first half of the III millennium BC) belonging to the Kura-Araxes culture. We attribute these remains to the settlements situated on the massif above the cave (Cherry *et al.* 2007), which likely made use of the caves underlying the massif.

6 DISCUSSION AND CONCLUSION

The dating of layers AH VI to ca. 35–31 000 cal BP, AH V to ca. 31 000 cal BP and AH III to ca. 29–27 000 cal BP places occupation of Aghitu–3 firmly within the early part of the Upper Paleolithic. Although Upper Paleolithic artifacts have been documented at other sites in Armenia (e.g. Fourloubey 2003), the age of these sites remains unknown. Therefore, the well stratified and dated assemblages of Aghitu–3 are unique in Armenia.

Since raw material resources are not located at the site, we expect a conservative approach to knapping at Aghitu–3. With primary raw material sources located 30–40 km away, the presence of cortex on some pieces indicates that secondary sources such as Vorotan river gravels were also exploited. However, the low frequency of cortical pieces in the assemblage and the low degree of cortex covering those pieces indicate that primary reduction began elsewhere, perhaps at the raw material sources or other occupation sites within the settlement system. Despite this generally conservative approach, diachronic trends show a flexibility in behavior. For example, the proportion of obsidian and chert is more evenly distributed in AH VI, but obsidian dominates the younger AH III. This variability may reflect changes in preference or indicate connections to different parts of the landscape.

The conservative approach to knapping is also reflected in the continuity observed in the lithic assemblages over time. From the bottom of AH VI to the top of AH III the lithics appear standardized in terms of their typology and technology. People consistently manufactured bladelets that were finely retouched on one, or sometimes both, lateral edges. This production chain appears to be independent of raw material selection, which is not surprising given the high quality of raw materials available. Such laminar tools may represent insets that were hafted as arrowheads, although use wear studies will be necessary to confirm this hypothesis. This straightforward approach enabled the people who lived at Aghitu–3 to produce a standardized toolkit. The paucity of cores further supports the hypothesis that both obsidian and chert were used judiciously, as does the small and highly reduced nature of the cores. In fact, many of the laminar blanks are longer than the cores, underlining the efficient approach to knapping.

A surprising aspect of many Paleolithic sites in Armenia is their high elevation, and Aghitu–3 (1601 m) is no exception. Many Armenian sites are situated above 1000 m, such as Lusakert–1 and 2 (1417 m), Kalavan–2 (1630 m), Angeghakot–1 (1800 m) and Hovk–1 (2040 m). Thus high elevation sites do not preclude settlement. Situated around 40°N latitude, southern Armenia has a temperate climate today. Water resources are plentiful, and the volcanic nature of the soils makes them productive for plant life. Preliminary data from Aghitu–3 suggest that this environmental backdrop also extended into the past. Judging from the diversity of species identified so far, the setting was ideal for humans and fauna alike.

Paleoenvironmental studies of the fauna from Aghitu–3 are still underway, but preliminary data indicate that a small but varied sample of fauna accumulated on site. Taphonomic analysis suggests that both humans and carnivores acted as accumulators. The relatively low quantity of fauna suggests that humans lived at the site for short periods, perhaps seasonally. The presence of carnivore remains, small nesting birds and ample microfauna also supports the hypothesis that human activities in the cave were not too intense and did not last too long.

The micromammal assemblage can be considered characteristic of the steppic Armenian Highland region as described by Vereschagin (1959). All of the taxa present in the assemblage can be considered typical of steppe environments (Nowak 1999). They can also be associated with the Southwest Asian mammalian complex that is dominant in the Lesser Caucasus today. Similar assemblages in terms of the taxonomic composition have also been described recently by Hashemi *et al.* (2006) from a number of Upper Paleolithic cave sites in northwestern Iran and support a close environmental and faunal affinity of the two regions during the Upper Paleolithic. Furthermore, the distribution of micromammals indicates that the climate of ca. 35–31,000 cal BP was cooler than today.

Aghitu–3 appears to have parallels with other Caucasian sites, most notably 350 km to the northwest in Georgia. The well-studied sequence of Dzudzuana Cave is typologically and chronologically the closest companion to Aghitu–3 (Bar-Yosef *et al.* 2006, 2011), and layers D (ca. 34–32 000 cal BP) and C (ca. 27–24 000 cal BP) are its best analogs. The Upper Paleolithic sequence of Ortvale Klde provides another favorable comparison with layers 4c (ca. 38–34 000 cal BP), 4b (ca. 32–28 000 cal BP) and 3 (ca. 26–25 000 cal BP) (Adler *et al.* 2008). Further afield in Russia, layer 1a (ca. 34–32,000 cal BP) of Mezmaiskaya shows a diverse array of bone tools and personal ornaments (Golovanova *et al.* 1999, 2010). In Iran the upper sequence (ca. 30 000 cal BP) of Yafteh (Otte *et al.* 2011) can also be invoked. These sites show similar trends in chronology, technology and typology which will be further examined to test the hypothesis of regional links among these assemblages.

This glimpse of Aghitu–3 adds to our archaeological knowledge of the Caucasus region and supports our hypothesis that small and highly mobile groups returned to the site repeatedly over a period of at least 8 000 years. Such short, low intensity occupations hint that Aghitu–3 served as a temporary seasonal camp used by hunter-gatherers. The results from the field seasons of 2009 and 2010 give us reason to believe that continued research at Aghitu–3 will provide answers to questions about the first modern inhabitants of Armenia and add to the growing spectrum of knowledge about the origins of the Early Upper Paleolithic.

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