ARCHAEOLOGY OF ARMENIA IN REGIONAL CONTEXT

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The Hrazdan gorge Palaeolithic project, 2008-2009

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A dearth of secure archaeological evidence, a history of research that has privileged cave sites, and a general lack of theoretical rigor hamper our current understanding of Palaeolithic settlement and subsistence in the southern Caucasus.[1] While exceptions exist (e.g., Hoffecker, Cleghorn 2000; Meshveliani et al. 2004; Golovanova et al. 2006; Adler et al. 2006; Bar-Oz et al. 2008; Bar-Yosef et al. 2011), the vast majority of Palaeolithic sites excavated over the last one hundred years confuse rather than clarify the nature of hominin occupations in the region (see Liubin 1977; 1989; Cohen, Stepanchuk 1999; Golovanova, Doronichev 2003). Numerous archaeological "Cultures" have been defined and named based on (often) minor variations in lithic technology without any understanding of the role technology plays in hunter-gatherer mobility, subsistence, or land use (e.g. Kuhn 1995), the significance of behavioral variability and its role in shaping technology (Shea 2011), or the temporal scale of technological evolution (Adler, Tushabramishvili 2004). Moreover, the foraging behaviors of Palaeolithic hominins across the entire region can only be partially reconstructed based on recent zooarchaeological and taphonomic efforts at a handful of sites; prior research was entirely palaeontological in nature and no consideration was given to the life history characteristics and behaviors of prey species or the behavioral ecology of hunter-gatherers.

Within Armenia Palaeolithic research has been conducted for many decades (see Klein 1966; Yeritsyan 1975; Liubin 1977; 1989) but until recently few sites have been excavated that can be used to address issues of hominin land use and mobility (Fourloubey et al. 2003; Dolukhanov et al. 2004; Liagre et al. 2006; Pinhasi et al. 2008; Kolpakov 2009; Gasparyan 2010).[2] Considering the strategic geographic position of

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[2] See Gasparyan (2010) for a listing of the many international palaeoanthropological projects conducted in Armenia from 1999 to the present.

this region between Europe and Asia, and the important role it played in past hominin range expansions/contractions and inter-group interactions, establishing an empirically-based account of its Palaeolithic record is of considerable importance to Palaeoanthropology. In order to contribute to these important debates we began a program of survey, excavation, chronometric dating, and geoarchaeology in the Hrazdan Gorge in 2008. The goals of this project have been to 1) establish a techno-typological archaeological sequence for the Pleistocene; 2) provide a chronometric framework for the cultural and social changes observed; 3) reconstruct Pleistocene palaeoenvironments; 4) assess Palaeolithic settlement and subsistence behaviors, and 5) reconstruct the natural processes leading to the formation of the gorge and its surroundings. The following is a preliminary accounting of our efforts thus far (2008-2009); the results of fieldwork conducted in 2010 and 2011 are not reported here.

Methods

In order to achieve the goals outlined above in any meaningful way high quality archaeological, geoarchaeological, archaeozoological, palaeoenvironmental, and chronometric data are required from secure contexts collected using the most precise instrumentation available. Specifically we have sought to identify new archaeological localities within and around the Hrazdan Gorge and collect statistically meaningful samples of lithic material to answer questions concerning long-term hominin technology and technologically-aided resource acquisition and extraction behaviors. Likewise, a large sample of well-preserved fauna is being excavated in order to address issues related to long-term hominin hunting, foraging, processing, and consumption behaviors. Such data in turn are being used to reconstruct the ecology of particular prey species and perhaps seasonal fluctuations in their availability. A variety of data related to site formation and taphonomy, and palaeoenvironment are being collected in order to deepen our understanding of sample context and the post-depositional forces affecting the final disposition of the archaeological material, and the nature and composition of the surrounding floral communities in which Pleistocene foragers subsisted. A sourcing program is designed to allow an assessment of raw material acquisition, transport, and discard behaviors, and thus mobility and land-use patterns. Finally, all of the data discussed here are being placed in a temporal framework through the application of three dating techniques: AMS, OSL, and $^{40}Ar/^{39}Ar$.

The 2008-2009 archaeological survey of the Hrazdan Gorge covered a 15 km, N-S area along both banks of the Hrazdan River and the adjacent slopes of the gorge, and resulted in test excavations at Nor Geghi 1 and Nor Geghi 2, Nurnus (open-air), Karashamb 1-5 caves, Arazaken 1 Cave, Bjni 1 Cave, and Alapars 1 and Argel 1 (open-air). The entire Hrazdan Gorge between Karashamb and Arzni (a 20 km long stretch) was walked in the geoarchaeological survey and the location and relationship of all basalt flows exposed in the gorge were mapped. All sites found during the survey were mapped with a Trimble GEOXH 2008, using Trimble GPS Pathfinder Office software. Following the survey within the Hrazdan Gorge we focused our attentions on Lusarket Cave 1 (LKT1) and Nor Geghi 1 (NG1) (Fig. 1).

During excavations at each site, but in particular at LKT1 and NG1, all finds, samples, and sections were recorded in three dimensions using a Leica laser EDM and each object was bagged accordingly. All coordinates were imported into an EDM Windows database and all graphics were produced using Newplot, an archaeologically-specific GIS program. In addition, all sediments were collected, with appropriate provenance, and wet sieved for small artifacts and biological material. All material was then transported to our laboratory in Yerevan where it was washed, labeled, bagged, photographed, analyzed, and sorted. All finds were then transported to the Institute of Archaeology and Ethnography for storage and curation.

Preliminary results

Geoarchaeological Survey. During the geoarchaeology survey of July 2009 all relevant Quaternary geomorphological features were mapped onto a 1/25,000 topographic map, while locations of vertical exposures were recorded using a Trimble dGPS. A Leica System 1200 dGPS was used to produce topographic cross sections through LKT1 and NG1, and to survey in the excavation grids of LKT1 and NG1 to the UTM coordinate system (Fig. 1). The resulting data were subsequently read into ArcGIS and have been used to plot the cross sections show in Fig. 2. The following is a preliminary interpretation of the geoarchaeological data collected in 2009 (the survey results from 2010 and 2011 are not reported).

The Hrazdan Gorge is a tectonic trough (graben) in the center of the Gegham range (horst). It is bounded to the south-east by the Hatis and the Gutanasar volcanoes and to the north-west by the Alapars volcano. Arutynunyan et al. (2007) have dated intrusive and extrusive volcanic rocks from the Gegham range using the K-Ar technique and suggest that both the Hatis and Gutanasar volcanoes formed ~700 kya, The gorge runs on a north-east to south-west axis from its origins in Lake Sevan along the southern margin of a massif that forms the northern boundary to that lake and which is comprised of Cambrian metamorphic rocks and Cretaceous limestone. At Karashamb the valley turns to run along a north-south route on which course it passes through LKT1 and NG1 as well as the city of Yerevan. The gorge is in-filled largely with basalts derived from the Alapars volcano, although Gutanasar basalts become more prominent south of the village of Argel. K-Ar dating of basaltic trachyandesite suggests that the basic lavas forming these basalts were ejected between ~500 and 70 kya - although some caution should be exercised in the local applicability of this chronology given that only one date is on Hrazdan basalt (Arutynunyan et al. 2007). Intrusive acid lavas originating from the Hatis range also occur at the base of the basalt sequence south of Argel, and also form a piedmont to the immediate west of Gutanasar. Obsidian contained within the Hatis acid lavas has been dated by fission-track techniques to 400-200 kya and obsidian from Alapars to 310-280 kya (Badalian et al. 2001). However, given that the acid lavas are intrusive these results have little chronological relevance for the basalt and sedimentary strata exposed in the Hrazdan Gorge.

Nine separate lava flows were identified in exposures in the Hrazdan Gorge between Karashamb and Arzni. Only the youngest lava (Basalt 1) appears as a continuous bed along the whole length of the valley, the remaining lavas form spatially restricted lobes. For the most part lava flows lie directly atop one another, but occasionally remnant sedimentary deposits are found between the lobes. These sediments hint at the processes that took place between volcanic eruptions. Lacustrine deposits were found in five separate locations and at a variety of elevations suggesting that lakes were a characteristic feature of the Hrazdan Gorge throughout its history of infilling. Lacustrine deposits of particular note were found beneath the uppermost lava (Basalt 1) in the "Bird Farm" section (west of the village of Nor Geghi) and between two lavas (Basalt 7 and a presently undetermined other) south of the village of Nurnus. In the former case the lacustrine sediments were capped by fluvial gravels which outcropped at a comparable elevation to the alluvial/colluvial strata at NG1 discussed below. Collectively the geomorphological and stratigraphic data suggest that a repeated cycle of landscape changes took place since the volcanoes of the Gegham range first became active and against a background of tectonic uplift. Each consecutive lava flow blocked the Hrazdan Gorge causing lakes to develop in the lea of a basalt dam. Uplift eventually caused the breaching of the dam and a change to a dominantly fluvial environment. Subsequent volcanic eruptions reinitiated the cycle. The present Hrazdan Gorge, however, represents a change to this cyclic regime. Prior to the emplacement of the most recent lava (Basalt 1), the Hrazdan River probably flowed to the west of its present course (a linear depression that is the fossilised route can be seen east of the Nor Geghi-Argel road) (i.e. through the Bird Farm site). After the final volcanic event the Hrazdan downcut through the basalt sequence to reach its present level. This process is probably the result of faulting, but is also likely to have been an adjustment to lowered base levels.

Nor Geghi 1 (NG1). NG1 was discovered during the 2008 survey and excavations were conducted there in 2008 and 2009 (Fig. 3). The site is exposed in section as a result of the construction of a narrow road in the late 1990s by the Armenian military from their base at Nor Geghi into the Hrazdan Gorge. The site is therefore located in the uppermost deposits of the Hrazdan Gorge, but of greatest significance from a chronological point of view is the fact that the artifact-bearing deposits are sandwiched between basaltic lava flows (Fig. 2). Ar/Ar dating of the basalt deposits are underway and will enable *terminae post* and *ante quem* to be calculated, while four OSL and many tephra samples have also been collected from the deposits containing the archaeological materials discussed below. Geoarchaeological research conducted at NG1 has also yielded considerable new geological data critical to our understanding of the Hrazdan Gorge's evolution. In combination with the new archaeological data we are rapidly gaining a detailed understanding of the Middle Pleistocene landscapes and environments of the region and the hominins who inhabited them.

Geology. At NG1 fine-grained alluvial and colluvial deposits containing late Middle Pleistocene artifacts outcrop at ~1375m above sea level, some 48m above the present gully base and 6m from the plateau above (Fig. 2). The fine-grained alluvial/colluvial deposits containing the archaeological materials unconformably overlie Basalt 7 of the geomorphological survey and comprise five conformable beds (Units 5-1) (Fig. 2-5). Mineralogical analysis of the fine-grained beds demonstrates that most particles are derived from basalt. Immediately overlying Basalt 7 is Unit 5, a yellowish brown, normally bedded, fine sand containing frequent boulder-cobble-sized sub-angular basalt clasts. This deposit is likely to have formed on the channel-floodplain interface, while the basalt clasts are likely to have been fluvially reworked from the basaltic lava below. Unit 4 lacks the basalt clasts of Unit 5 but contains rare sub-angular obsidian of fine pebble-size. Carbonate is present in Unit 4 as coarse, parallel, straight, continuous and discontinuous fine laminae. Unit 4 was either deposited at the channel-floodplain interface or alternatively is colluvially reworked floodplain sediment. Unit 3 is also either a primary floodplain sediment or colluvium derived from a local floodplain source. It is comprised of dark brown, silty clay containing occasional sub-angular fine pebble-sized obsidian in a single band (70 mm from the unit surface). The redder hue of Unit 3 is probably a product of clay migration down the sequence as a result of soil forming processes in overlying units. Obsidian artifacts were recovered from Units 5-3 but only in very low frequencies.

Unit 2 also likely has its origin as a floodplain sediment - which as with Units 3 and 4 may have been colluvially reworked - but which has been modified by soil forming processes. The Unit is a black organic silt comprising granular-sized soil aggregates, while there are also occasional medium-coarse sand-sized pumice fragments. A single wavy, horizontal, fine bed of pink tephra/clay is present at 90mm below the surface, but otherwise the lack of clay (except at the very base) is evidence of elluviation associated with pedogenesis. Carbonate filaments emanating from Unit 1 are further diagenetic features. The vast majority of archaeological material was recovered from Unit 2. Unit 1 is an olive grey fine sandy silt containing rare sub-angular and sub-rounded obsidian granules scattered throughout. Grains are preserved as pebble-sized, vertically oriented, prismatic aggregate blocks suggesting the operation of pedogenic processes. However, the grains are of "ashy" appearance and the unit seems to have been exposed to high temperatures. It is therefore likely that Unit 1 is the upper part of the alluvial/colluvial soil of Unit 2, except that it has been burnt during the deposition of the overlying lava. In contrast to Unit 2, there is limited organics in Unit 1, perhaps because all organics have been combusted. Unit 1 is capped first by pillow lavas and then solid basalts. As in Units 5-3 few artifacts were recovered from Unit 1.

Micromorphological study of thin sections from the fine-grained artifact-bearing sequence preserved between basalts at the top of the Hrazdan Gorge show features indicative of pedogenesis, such as weakly developed redoximorphic features, clay remobilization, root bioturbation and calcrete formation, which we interpret as evidence of a long-term polygenetic soil developed throughout Units 1-4 interspersed with pulses of sediment accumulation. Nevertheless, the palaeosol of Unit 2 is the only layer at NG1 where a stable terrestrial surface has been preserved. Later lava flow capped the alluvial/colluvial sequence, albeit burning organics in the top of the Unit 2 palaeosol, but there is no evidence for truncation and no charcoal or ash was encountered in the micromorphology samples. The lava cap of Basalt 1 has preserved the alluvial/colluvial sequence virtually intact. Given the likely low energy processes of formation of the alluvial and/or colluvial sediments and the fact that pedogenic features indicate the presence of a stable ground surface in Unit 2, the recovered artifacts from the latter at least, are likely *in situ*. In fact the absence of bedding (either macro or microscopic) or other sedimentary structures indicative of water transport or of exogenous particles indicative of high energy colluvium suggest that the depositional origin of the lithic assemblages is anthropogenic and that the artifacts were discarded by hominins on the site. Finally, the soil/sediment properties suggest that palynology and phytolith samples from Unit 2 will provide a reliable palaeoenvironmental proxy for the period of *in situ* hominin activity, while the strata also have a huge chronometric potential. In short, NG1 is an exceptional late Middle Pleistocene site, combining *in situ* evidence of hominin activity in the form artifact production, with the potential for high resolution Ar/Ar, OSL and tephrochronological dating, and reliable palaeoenvironmental reconstructions. At present no other late Middle Pleistocene locality in the region offers such analytical potential.

Archaeology. Archaeological material was discovered at NG1 in 2008 eroding from the exposed section, primarily within Unit 2, the black organic silt described above. Artifacts were also discovered on the roadbed where they had recently fallen after eroding from the section, and along the slope below the section where sediments had been bulldozed during road construction (Fig. 3-5). An excavation grid was established on the site and all artifacts remaining in the section or found on the roadbed immediately below the profile were recorded in three dimensions. All materials found along the slope were collected but not mapped; several broken artifacts found here could be refitted to pieces from the roadbed or in the section indicating that this truncated material originated from the exposed sediments. Full-scale excavations then began, the goals of which were to a) recover a statistically meaningful sample of lithic material, b) excavate units at regular intervals across the ~100 m long profile to determine whether hominin activities were restricted to particular loci or spread homogenously across the exposed sediments, c) collect a full spectrum of palaeoenvironmental and chronometric samples, and d) further investigate the geomorphology of the Hrazdan Gorge. These goals were achieved following seven weeks of intensive fieldwork while laboratory analyses remain ongoing. For safety reasons excavations along the roughly 100 m long exposure were limited to areas where the overlying basalt remained solid and intact; in most instances the excavations penetrated no deeper than 30-40 cm into the section. Nineteen excavation units were opened (Fig. 3-5) and a total of 1863 lithic artifacts were recovered, the vast majority from Unit 2 (Fig. 6-11). This sample of artifacts appears to be distributed randomly across the exposed section and excavation units, and no loci of intensive occupation were identified. Artifacts were rarely distributed more than 20cm in the vertical dimension and orientations along the long axis were normally horizontal. Still a degree of post-depositional reorientation was noted on several pieces. Surface preservation of the obsidian artifacts was black to light gray in color (penetrating <1mm), indicating post-depositional weathering, however artifact edges were generally fresh and, as has been discussed above high-energy transport is not documented. Unfortunately, faunal remains were not preserved, most likely due, as suggested by the micromorphology, to decalcification of the deposits. While the taphonomic history of these sediments remains under investigation, we conclude that the archaeological materials are all geologically contemporaneous and result from repeated hominin activity on this portion of the Hrazdan floodplain.

Preliminary analysis of the NG1 lithic assemblage (n=1589) indicates that the site dates to the Late Acheulian (late Middle Pleistocene), sometime between 400 and 200 kya. Geological samples from surrounding sediments (OSL, tephra) and basalts (Ar/Ar) are currently under analysis and will soon help verify the actual age of the site. All of the 1863 artifacts are produced on obsidian, several sources of which are found near the site (e.g., Hatis, Gutanasar). Core reduction is predominately core-on-flake, with Levallois and radial techniques also present (Fig. 6). Debordants, tranchets, and overpass flakes document variable methods of core/biface preparation and rejuvenation (Fig. 7). Hard hammer percussion dominates the assemblage, as reflected in the pronounced bulbs of percussion and generally thick, short flakes that are common to the assemblage. However, some soft hammer percussion is suggested by several of the bifaces and the scalar retouch on some of the tools. The assemblage contains a high frequency of small debitage and shatter (water-sieved material = >1200), and both flakes and blades (Levallois), the platforms of which are typically plain or faceted and often large (see Fig. 8, 9). Therefore it appears that all stages of manufacture are present at the site. Kombewa flakes are very common and are represented in a wide variety of sizes and typological forms (Fig. 10). Typologically the assemblage is dominated by denticulates, followed by notched pieces, scrapers (all varieties), bifaces (thin and ovate, thick and triangular, short and thick on kombewa), burins, and thick end scrapers (see Fig. 10, 11). Single and alternate notching is the primary form of retouch followed by truncated faceting, and scaled and stepped retouch. A brief attempt at refitting yielded two refit groups comprising 5 artifacts. Refit Group 1 includes a large proximal and distal flake fragment, with the latter modified along the break (light retouch or use damage). These artifacts were recovered from adjacent excavation units (K154 and K155) only a few centimeters apart and at the same elevation. Refit Group 2 includes three complete artifacts (dorsal-ventral conjoins) the largest of which is illustrated in Figure 9, artifact 1. Two of these three artifacts were recovered from the same excavation unit (H172) within a few centimeters of one another, and at the same elevation. The third artifact in Refit Group 2 was discovered in the bulldozed material on slope in front of the section. Both refit groups and the proximity of the finds to one another suggest that the assemblage has experienced minimal post-depositional movement.

Based on these preliminary observations the lithic assemblage appears to document a period of regional transition from biface production toward a technology focused on the production of flakes and blades, and small retouched (notched, truncated faceted) tools during the late Middle Pleistocene. The percussive forces exerted by the knappers during the production of these implements is indicated in the large bulbs of percussion and relative thickness of the blanks, perhaps reflecting locomotor and knapping techniques more attune to the reduction of denser materials that require greater force (e.g., basalt, dacite, or rhyolite) than the comparatively brittle, more easily fractured obsidian sources utilized at NG1. Continued analysis of these finds will allow us to delineate the role NG1 played in the mobility, settlement, and foraging behaviors of hominins within the Hrazdan Gorge prior to the Middle Palaeolithic in comparison to other sites within the Caucasus and south-west Asia (e.g. Liubin 2002; Barkai et al. 2005; Meignen, Tushabramishvili 2007; Doronichev 2008; Slimak et al. 2008; Taskiran 2008; Kolpakov 2009; Doronichev, Golovanova 2010; Gasparyan 2010; Gopher et al. 2010; Mercier et al. 2010; Shimelmitz et al. in Press).

Lusakert Cave 1 (LKT1). LKT1 is an exogene cave that developed within Basalt 1 (Fig. 2), and therefore both the cave and its fills must postdate the latest extensive lava flow along the Hrazdan Gorge. The cave is formed in a cliff which has been cut by the outer meander bend of a previous westerly course of the Hrazdan River (Fig. 1, 12). The Hrazdan River continued to pass beneath the cave while Middle Palaeolithic hominins used the site, but subsequent to that occupation it down cut through its bed and underlying basalts and adopted its present more easterly course. Excavations at Lusakert caves 1 and 2 (Fig. 1, 12) were first conducted between 1971-1981 and headed by B. Yeritsyan of the Institute of Archaeology and Ethnography, Armenian Academy of Sciences. At LKT1 these efforts produced over 200,000 lithic artifacts, a small vertebrate assemblage, and a presumed Neanderthal mandible fragment (Pinhasi et al. have since dated this specimen to the Bronze Age). Yeritsyan also documented eight thick lithostratigraphic units (A-H) (Yeritsyan, Korobkov 1979). Units C2 and D2 yielded Middle Palaeolithic Levallois and non-Levallois material while the upper units (B, C1) contained a Middle Palaeolithic assemblage with some Upper Palaeolithic type tools. Layers E-H are reported to contain non-Levallois flakes, rare retouched tools, and several bifaces and biface fragments (Yeritsyan, Korobkov 1979). Unfortunately, the material from these early excavations was never systematically studied or published (Yeritsyan 1975; Yeritsyan, Korobkov

1979). However LKT1 became known in the Soviet, and eventually western literature as one of the most important Palaeolithic localities in the southern Caucasus (Liubin 1977; 1989). An Armenian-French team conducted small-scale re-excavation of the Lusakert caves in the early 1990's (Fourloubey et al. 2003) but these modest efforts were limited to the exterior of LKT1 and LKT2, and only small assemblages of lithics and fauna were recovered. The AMS analysis of a single equid tooth from Unit C (Mousterian) produced an age of 26920±220 ^{14}C BP ([GRA 14949/Lyon 1006], Fourloubey et al. 2003) which we "calibrate" to 31692±190 Cal BP_{Hulu} (CalPal online calibration, 2011).

New Excavations: Geology and Archaeology. In 2007 we carried out a geoarchaeological assessment of the existing sections at LKT1 and took several samples from Unit C for OSL dating. In 2008 and 2009, test excavations were undertaken at LKT1 by Yeritsyan, Pinhasi and Adler, the goals being to locate Yeritsyan's original trenches and the French area of excavation, expose clean stratigraphic sections, collect chronometric, palaeoenvironmental, and geological samples, and investigate the potential of the site for future research.

In 2008 we focused our efforts outside the cave where Yeritsyan, and later the Armenian-French team had worked and where collapsed sections were still visible and easily accessible. We exposed new sections, clarified the original stratigraphy, collected a variety of chronometric and palaeoenvironmental samples, recovered several thousand lithic artifacts, and began a geoarchaeological assessment of the site and the formation processes that influenced its development (Fig. 13, 14). Unfortunately, faunal preservation in this area of the site is extremely poor and very few identifiable specimens were recovered. Preliminary geoarchaeological observations indicate that Units C and D (and sublayers) have morphological properties indicative of deposition in an alluvial environment, while the inclusion of occasional sub-angular basalt clasts within the otherwise predominantly silt-sized deposits might result from the collapse of the adjacent cliff. Mineralogical analysis of the sand-clay fraction demonstrates that Units B-D (and sublayers) are comprised of plagioclase, quartz, calcite and clay minerals such as kaolinite, smectite and/or illite. The first of these minerals suggests that the fine-grained sediment is probably derived primarily from a basaltic source. There are indications that the stream channel causing floodplain development became more marginal during deposition of Unit C, while the presence of quartz and possibly kaolinite in the mineral suite suggests that a component of the floodplain sediment may comprise re-deposited loess. Deposits at the base of the terrace fronting the Lusakert caves, but located 310m south-east of LKT1 (Fig. 12) suggest that fluvial gravels underlie the floodplain sequence. However this relationship has not yet been confirmed since the base of the floodplain sediments has yet to be reached at LKT1. The morphological and structural properties of Units C and D suggest a gentle depositional mechanism on the cave exterior, while obsidian artifacts in these units have an orientation parallel to the bedding plane. It would therefore appear likely that the artifacts are reworked, while the distance of transport is just the few meters between the cave mouth to the position of where the objects were encountered. Although OSL results for Unit D are pending, estimates for Unit C (OxL-1836: 36.6±2.8 kya; OxL-1837: 35.3±2.8 kya; OxL-1838: 23.9±1.9 kya) suggest a preliminary age of ~36,000 BPOSL (Fig. 14); the true age of each layer can only be assessed following completion of our dating program which remains ongoing. In contrast Units A and B appear to be of colluvial origin and comprise both sediment originating above the cliff and cliff collapse. Holocene pedogenesis has thereafter altered the properties of the colluvium and has caused the apparent differentiation of units defined by Yeritsyan. Units A and B are not *in situ* (*contra* Fourloubey et al. 2003) and there is little potential for obtaining reliable absolute dates or archaeological material from these strata.

In 2009 we deepened the excavation outside the cave and within the cave we opened a 2×2 m *sondage* where we immediately encountered *in situ*, stratified archaeological horizons rich in well-preserved lithics, fauna, microfauna, and combustion features; of the twelve quarter-meters opened only four reached a maximum depth of 125 cm in 2009 (Fig. 13, 14). The uppermost stratum, Unit 1 (2cm thick) is a fine light brownish yellow, poorly sorted silt/clay containing basalt and obsidian pebbles, and coarse charcoal laminae. It appears to have formed as a result of a complex of processes, including the recent reworking/weathering of earlier deposits through trampling and water percolation, recent use of the cave by people and animals, and the weathering of the cave walls. Palaeolithic artifacts in this layer are unlikely to be in primary context. The remaining strata exposed in the *sondage*, Units 2-6 (2-125cm) are largely derived from fine-grained alluvium (Unit D1) that had penetrated the cave interior and was there mixed with particles eroding from the walls, artifacts and waste resulting from hominin activity (e.g. bone). There has also clearly been a carbonaceous input (most likely from the decay products of animal faeces), while moderate to frequent quantities of charcoal, which in Unit 5 (70-125cm) are present as distinct fine horizontal layers, demonstrate the presence of combustion features. With the exception of clay migration associated with the incipient development of the present soil in Units 2 and 3 (2-38cm) and animal burrows within Unit 2 (2-22cm), there is limited evidence for recent (i.e. Holocene) disturbance of the underlying strata. Preliminary micromorphological study of thin sections from Units 1-4 document the formation of iron oxides and the presence of iron nodules, while the sediment mass is weakly broken into discontinuous horizontal planes. The former suggest that Units 1-4 accumulated in a humid environment, while the latter demonstrates that ice formation occurred within the sediments in winter. Therefore Units 1-4 provide evidence of recurrent wetting/drying and freeze/thaw. In contrast there is no micromorphological evidence for freezing in Unit 5, although these units appear to have suffered some bioturbation by both roots and burrowing mammals. The geoarchaeological data outlined above suggest that Units 2-5 have the best potential for the preservation of Palaeolithic artifacts, features, and faunal remains in a primary context.

Initial observations indicate that the 2008-2009 lithic assemblage (n=4127 as of 2009; Fig. 16) can be characterized as Levallois (flake and blade), with facetted and plain platforms, few cores, a moderate frequency of formal tools (denticulates, sidescrapers, burins, end scrapers; see Fig. 17-18), and a very low frequency of cortex. However given the distinct taphonomic histories and site formation processes observed between the exterior (e.g., Units C and D) and interior deposits (e.g., the sondage) (Fig. 13-14), it is necessary to treat the assemblages from these two areas separately. For example, artifact orientation (both inclination and declination of long-axis) and the distribution and degree of artifacts with edge-damage (exterior artifacts) indicate a significant difference in post-depositional processes between the two areas. Technological and typological analyses reveal that the studied sample from the exterior (n=788) includes a high frequency of flakes with notches (typologically denticulates; see Fig. 17-18); a similarly high frequency of damage on the opposite or alternate surface to the “notches” suggests that this pattern is more likely due to edge damage rather than tool manufacture. In addition, the interior assemblage (n=783; Fig. 17-18) exhibits a low incidence of retouched tools and the core:flake ratio is lower (1:0.77) than that observed in the exterior (1:0.33) assemblage.

Within the interior assemblage (Fig. 15) the predominant flaking technique is Levallois and Kombewa (or Janus flakes). The high incidence of Kombewa flaking and its application to a wide variety of artifact sizes and forms is of note given that, when present in other assemblages, the technique is typically applied much less frequently, and then usually for the primary purpose of thinning bulbs or the application of truncated-faceting (Dibble, McPherron 2006; Inizan et al. 1995). Truncated-faceting and the removal of the exterior central ridge are very common. Both techniques are typically coupled with the thinning of the dorsal surface just beneath the platform regardless of platform type. Detailed analysis of the artifacts by stratigraphic level is ongoing and inclusion of the large sample of material from the 2010-2011 excavations will help further substantiate the patterns reported here. Concerning raw material, preliminary optical inspection of these obsidian artifacts suggests multiple sources, primarily Hatis and Gutanasar. The surface preservation of the obsidian artifacts from the interior assemblage is excellent and the edges remain sharp and undamaged, therefore post-depositional weathering or transport does not appear to have impacted these finds. Water-screened sediments from the *sondage* produced very high frequencies of small lithic debris therefore all stages of reduction are represented. The presence of krotovina and microfauna indicate that certain taphonomic forces have impacted the assemblage but conjoining artifacts and well-preserved combustion features highlight the limited nature of such disturbances.

The faunal assemblage (interior and exterior) from LKT1 (n = 286, total NISP = 117 as of 2009) is heavily fragmented. Complete bone elements are nearly absent and the assemblage is essentially composed of isolated teeth and limb bone shaft fragments. Bones identified to size-class (small, medium, large ungulate) comprise about 2/3 of total NISP and include almost all of the postcranial elements. Taxonomically the assemblage is dominated by *Capra* sp. and *Equus* sp., however several bovine specimens, probably *Bison* sp., have also been identified. Percussion marks, including pits, micro-striations and conchoidal notches, were documented on many specimens, and the high frequency of long bone epiphyses with green breaks attests to the routine exploitation of long bones for their marrow. Almost half of the shaft fragments from all size class categories display fresh fractures, and nearly all shafts retain less than half of their original circumference. While some specimens exhibit probable carnivore gnaw marks, evidence of butchering and processing by hominins (e.g., cut marks, impact fractures, green breaks) is much more common. Faunal analyses are ongoing and comparisons between the content and taphonomic history of the exterior versus interior assemblages are planned. All excavated sediments were water screened and initial inspection indicates a very high frequency of microfauna in the samples from the interior; samples from the exterior are largely sterile in this regard. Numerous mineralogical, micromorphological, palynological, phytolith, tephra, AMS, and OSL samples were also collected at LKT1, and while the lithic and faunal material has undergone preliminary study, all other samples have been sent to the appropriate laboratories and are currently being prepared and analyzed.

At present LKT1 is the only Middle Palaeolithic cave site in Armenia with stratified deposits of well preserved archaeological material currently under study. As such it provides the best opportunity to conduct a variety of technical and behavioral studies in the region. For example, the quality and quantity of the faunal assemblage is allowing us to conduct detailed zooarchaeological and taphonomic analyses and to assess regional Late Pleistocene hominin foraging behaviors in a manner similar to that already attempted in Georgia (Bar-Oz, Adler 2005; Adler et al. 2006; Bar-Oz et al. 2008; Adler, Bar-Oz 2009) and southern Russia (Cleghorn 2006; Golovanova et al. 2006). Lithic analyses are providing insights into technological and processing behaviors, and the sourcing of raw materials (obsidian) is allowing us to assess patterns of mobility and land use. Palaeoenvironmental and geoarchaeological studies are providing data on the formation of the LKT1 deposits and the site's proper geomorphological and ecological contexts. Chronometric estimates are allowing us to build an absolute chronology for the site based on three independent techniques (OSL, AMS, tephra); at present only one Middle Palaeolithic site in Armenia (Pinhasi et al. 2008), and two in Georgia (Adler et al. 2008) have been chronometrically dated with any degree of reliability. The coordinated analysis of these data is allowing us to test a variety of behavioral hypotheses and compare results from Armenia with contemporaneous finds from the wider region.

Conclusions

The southern Caucasus occupies an important position in Eurasia that has served intermittently as a biogeographic refuge and an expansion/contraction corridor for Plio-Pleistocene hominins between Anatolia, the Near East, Europe and Central Asia. It is, however, a region in which relatively little modern fieldwork has been conducted, but where a very rich archaeological record documents the Palaeolithic life-ways of perhaps four different species of hominin (e.g., H. *erectus*, H. *heidelbergensis*, H. *neanderthalensis*, and H. *sapiens*). If we are to achieve a geographically unbiased, theoretically sophisticated, continental understanding of the various factors underpinning Pleistocene biological and cultural developments in Eurasia, continued research in the southern Caucasus is critical. As outlined by Gasparyan (2010) the number of high-quality

Palaeolithic excavations and palaeoenvironmental projects within Armenia has increased tremendously over the last decade. As this research progresses the southern Caucasus will play a greater role in ongoing palaeoanthropological debates than heretofore possible (but see Golovanova, Doronichev 2003; Adler, Tushabramishvili 2004; Adler et al. 2006; Bar-Yosef et al. 2006; Golovanova et al. 2006; Adler et al. 2008; Adler, Bar-Oz 2009; Golovanova et al. 2010; Gasparyan 2010; Ollivier et al. 2010). Our research in the Hrazdan Gorge is a modest contribution to this larger effort being orchestrated by the Institute of Archaeology and Ethnography, which over the last 60 years has made significant contributions to our knowledge of Armenian prehistory. The international importance of the Institute has never been greater, and it will continue to play a central role in our growing understanding of Palaeolithic life-ways in Armenia and the Caucasus.

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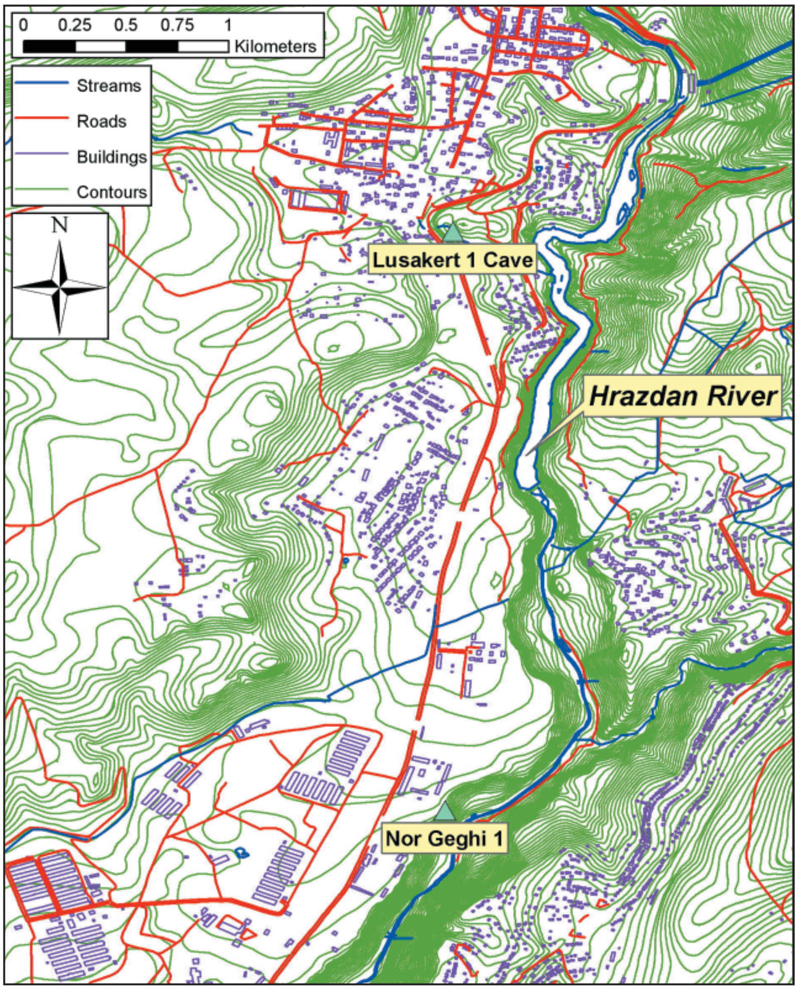

Fig. 1. View of the Hrazdan Gorge between the villages of Nor Geghi and Argel. The locations of LKT1 and NG1 are indicated. Figure produced by N. Wales.

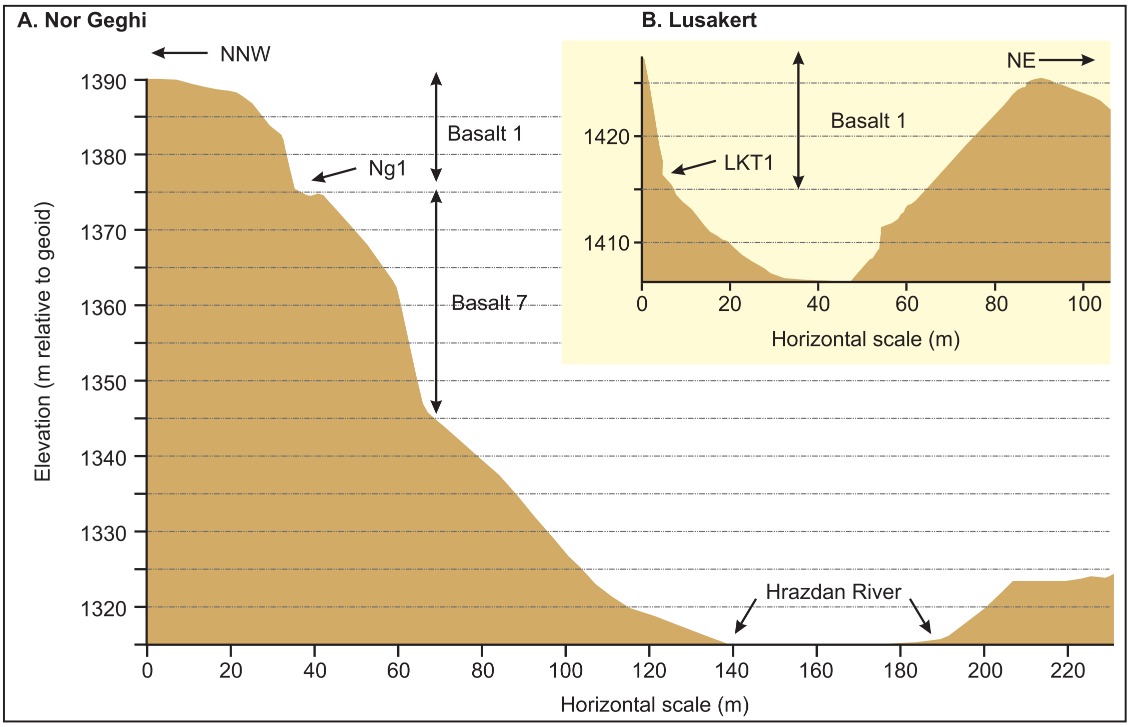

Fig. 2. dGPS derived cross sections at 2x vertical exaggeration through A. the west side of the Hrazdan Gorge at NG1 and B. the cut-off palaeochannel of the Hrazdan River at LKT1. Figure produced by K. Wilkinson.

Fig. 3. View of NG1 at the beginning of the 2009 excavation. The dark black horizon beneath the upper basalt (Basalt 1) is the soil of Unit 2, which is underlain by fine-grained alluvial/colluvial sediments, and then the lower basalt (Basalt 7).

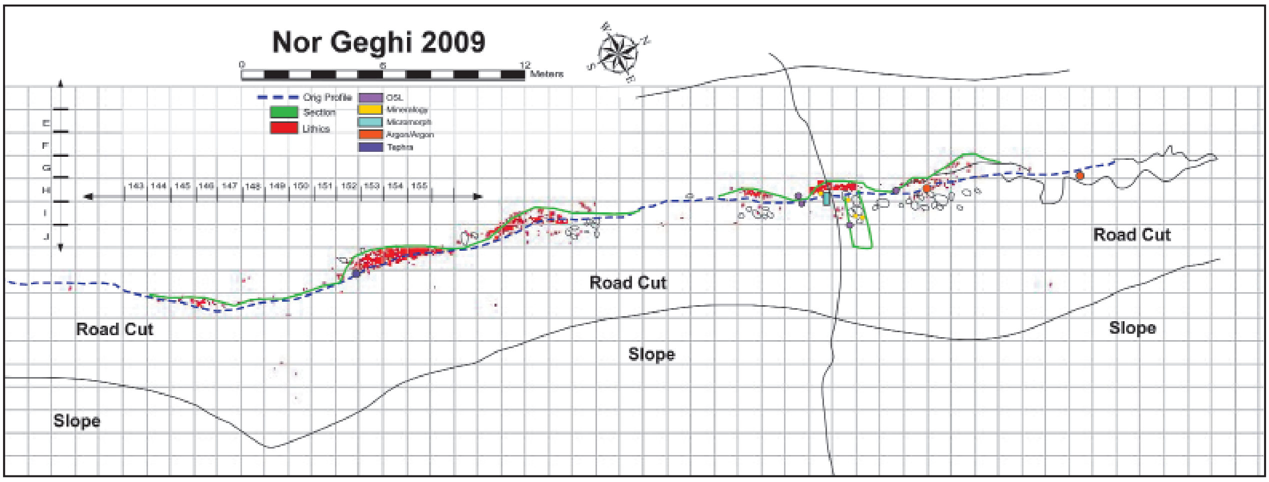

Fig. 4. Plan view of the 2008-2009 excavations at NG1. Blue dashed line: original profile; green lines: new stratigraphic sections; red dots: lithics; pink circles: OSL samples; yellow dots: mineralogy, palynology, tephra, and phytolith samples; blue rectangles: micromorphology samples; orange circles: Ar/Ar samples; purple dots: tephra samples. Figure produced by B. Schmidt and D.S. Adler.

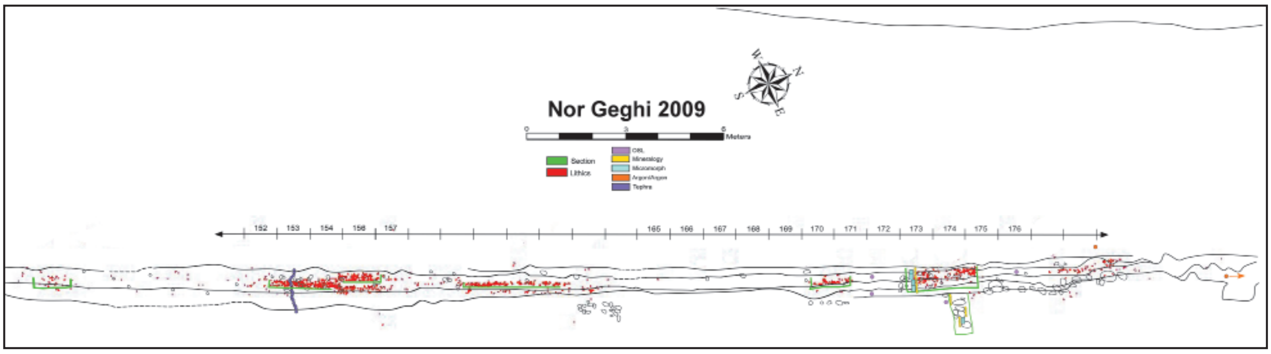

Fig. 5. Profile view of the 2008-2009 excavations at NG1. Blue dashed line: original profile; green lines: new stratigraphic sections; red dots: lithics; pink circles: OSL samples; yellow dots: mineralogy, palynology, tephra, and phytolith samples; blue rectangles: micromorphology samples; orange circles: Ar/Ar samples; purple dots: tephra samples. Figure produced by B. Schmidt and D.S. Adler.

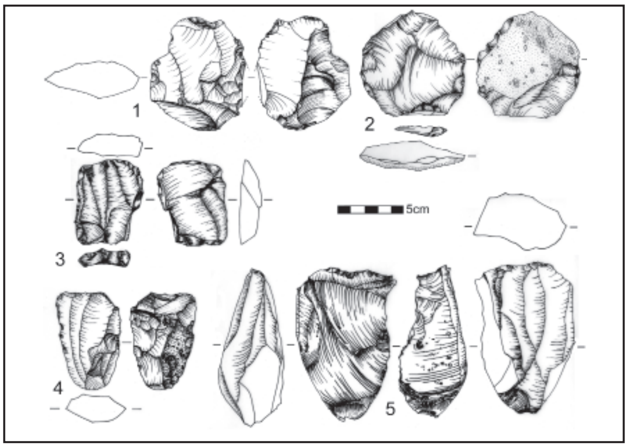

Fig. 6. Obsidian artifacts from NG1: 1) core on flake; 2) radial core-on-flake; 3) bidirectional blade core; 4) unidirectional blade core-on-flake; 5) Levallois blade core. Figure produced by D.S. Adler, artifacts 2-3 illustrated by Y. Henk, and the remainder illustrated by P. Glauberman.

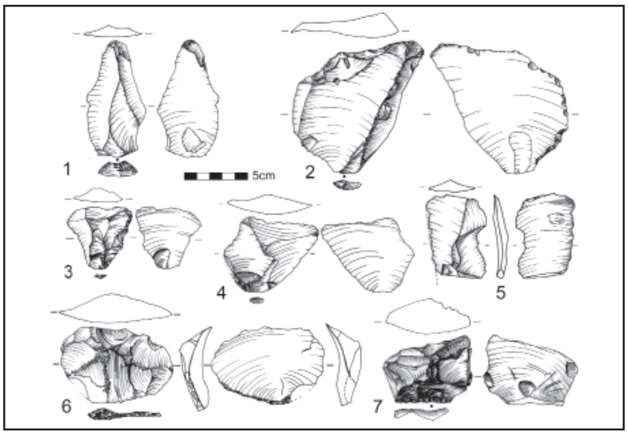

Fig. 8. Obsidian artifacts from NG1: 1) blade; 2–4, 6–7) flakes; 5) distal blade fragment. Figure produced by D.S. Adler, artifact 5 illustrated by Y. Henk, and the remainder illustrated by P. Glauberman.

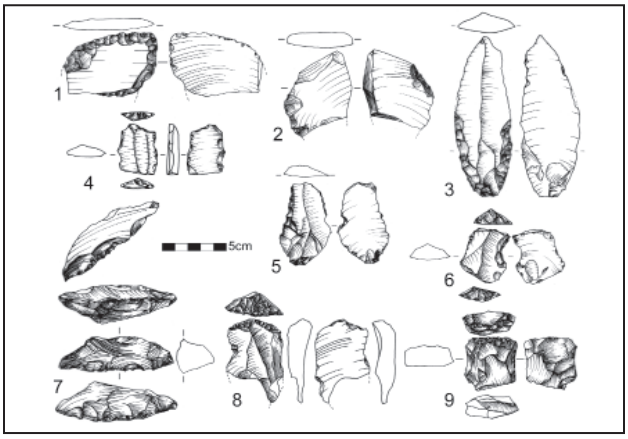

Fig. 10. Obsidian artifacts from NG1: 1) déjeté scraper; 2) denticulate on kombewa; 3) point with modified base; 4) truncated faceted piece with denticulated edges; 5) denticulate; 6) truncated faceted piece with notch; 7) bifacially reduced flake fragment; 8) distal end scraper fragment; 9) truncated faceted piece.
Figure produced by D.S. Adler, artifact 4 illustrated by Y. Henk, and the remainder illustrated by P. Glauberman.

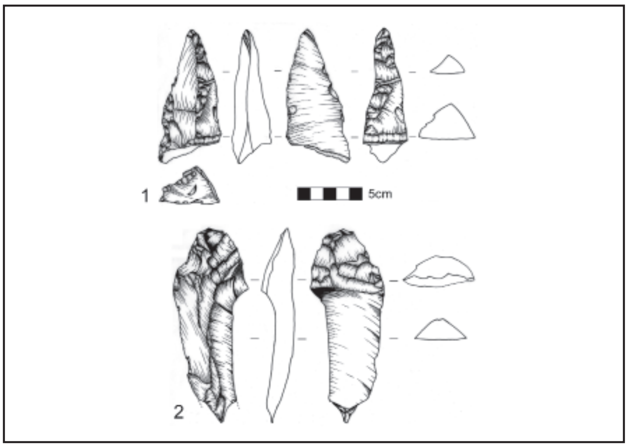

Fig. 7. Obsidian artifacts from NG1: 1) distal fragment of core trimming element; 2) overpass flake. Figure produced by D.S. Adler and artifacts illustrated by Y. Henk.

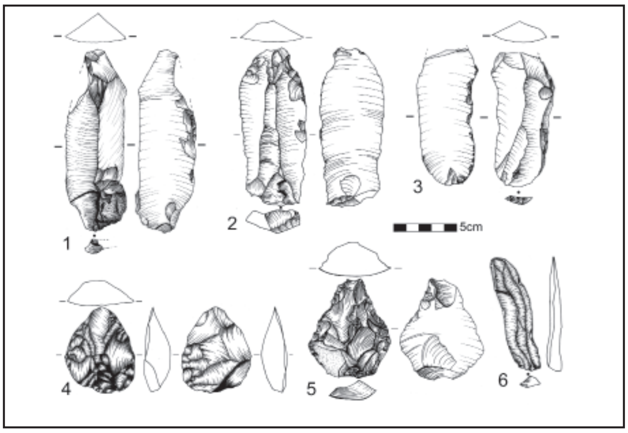

Fig. 9. Obsidian artifacts from NG1: 1) blade with edge damage (note: this artifact is one of three included in Refit Group 2); 2) blade with distal trimming; 3) blade; 4) small biface on flake; 5) thick convergent scraper with ventral damage; 6) unidirectional blade. Figure produced by D.S. Adler, artifacts 4-6 illustrated by Y. Henk, and the remainder illustrated by P. Glauberman.

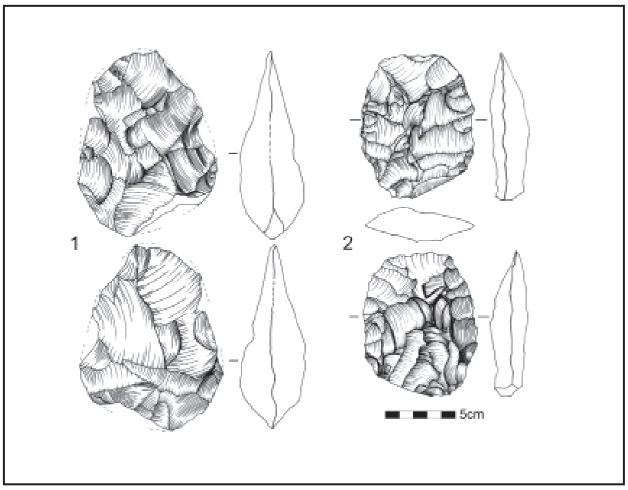

Fig. 11. Obsidian artifacts from NG1: 1-2) bifaces. Figure produced by D.S. Adler and artifacts illustrated by P. Glauberman.

Fig. 12. View of LKT1 and LKT2, with palaeo-channel of the Hrazdan River visible in foreground and in front of the caves. Photo D.S. Adler.

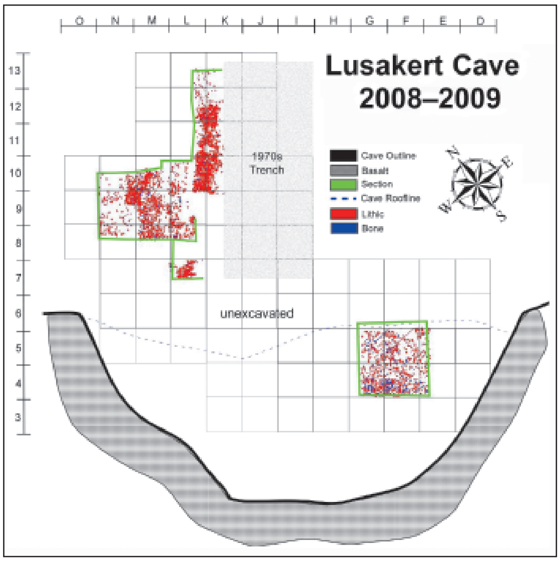

Fig. 13. Plan view of LKT1 following the 2009 season, indicating the locations of the exterior, 1970s, and interior excavations, and the distribution of lithic and faunal material recovered in 2008-2009. Figure produced by D. S. Adler and B. Schmidt.

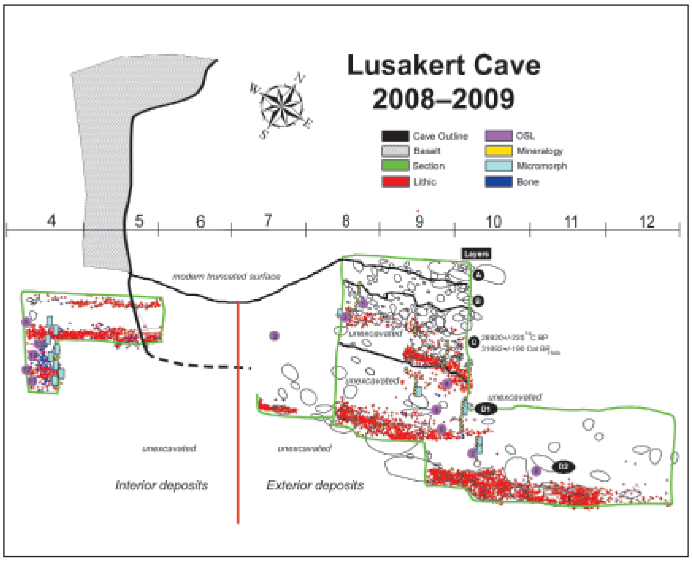

Fig. 14. Profile view of LKT1 following the 2009 season, with layer, sample, lithic, and faunal locations indicated. OSL 1–3 are located within Layer C, while the single AMS date, also from Layer C, is reported in Fourloubey et al. (2003) without an exact provenience. Figure produced by D. S. Adler and B. Schmidt.

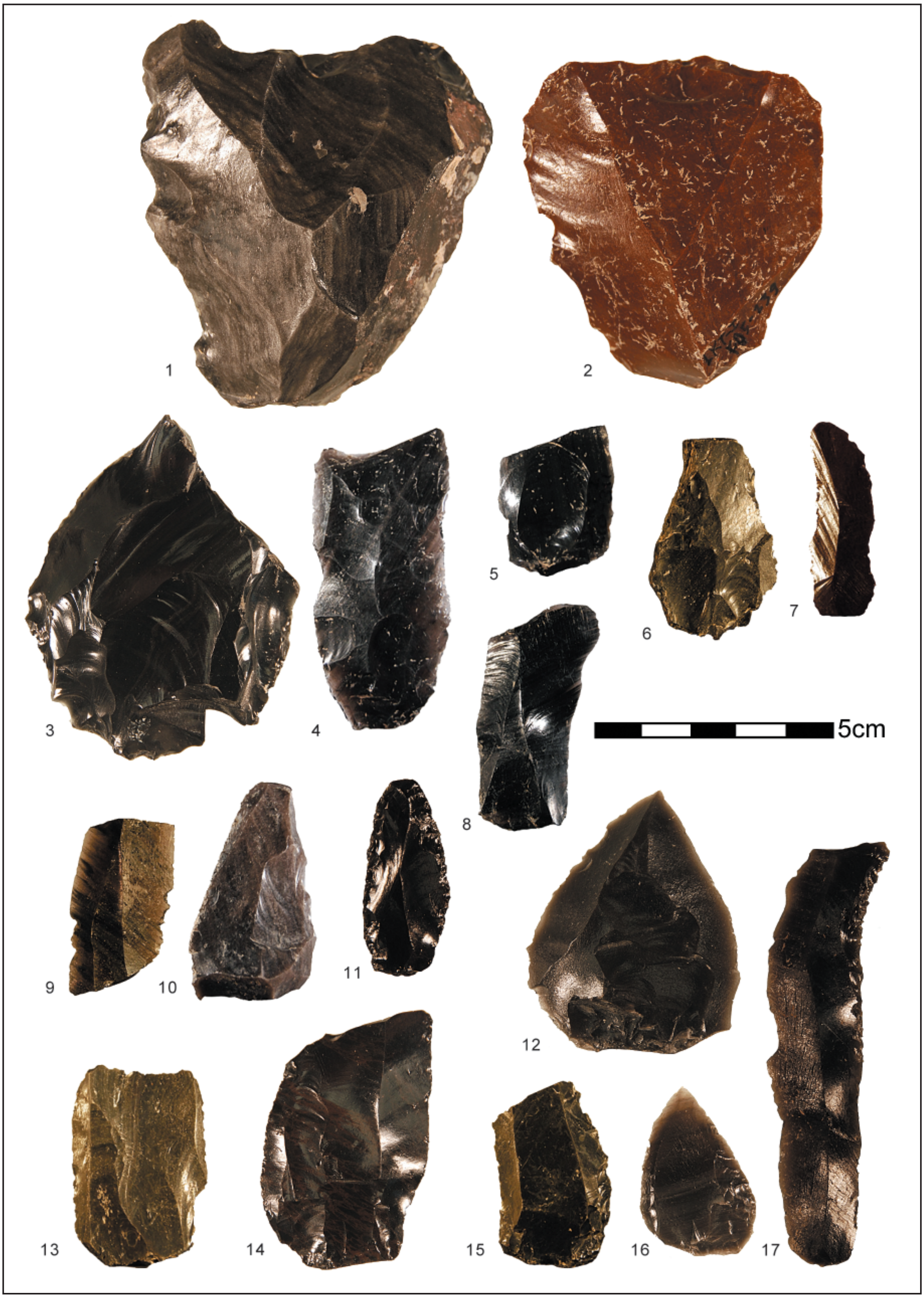

Fig. 15. Obsidian artifacts from interior excavations at LKT1 (complete unless otherwise noted): 1) Levallois core-on-flake; 2) Levallois core; 3) kombewa flake-as-core; 4) convex scraper (proximal fragment); 5-6) kombewa flake-as-core; 7) blade; 8) Levallois flake (minus distal); 9) Levallois flake (medial fragment); 10) single straight scraper; 11) convex scraper; 12) Levallois point; 13) Levallois flake; 14) Levallois flake (proximal fragment); 15) straight-convex scraper with alternate retouch (proximal fragment of Levallois flake); 16) convex scraper; 17) convex scraper on blade (minus distal). Figure produced by D.S. Adler.

	Exterior		Interior		Total	
Class	n	%	n	%	n	%
Lithic	3328	97.5	799	81.3	4127	93.9
Fauna	86	2.5	184	18.7	270	6.1
Total	3414	100	983	100	4397	100

Fig. 16. Number of artifacts recovered from LKT1 2008-2009. All of the fauna have been analyzed, while 23.7% of the exterior lithics (n=788) and 98% of the interior lithics (n=783) have been analyzed.

	Exterior		Interior		Total	
Class	n	%	n	%	n	%
Flakes	548	69.5	654	83.5	1202	76.5
Blades	38	4.8	51	6.5	89	5.7
Tools	88	11.2	21	2.7	109	6.9
Cores	36	4.6	15	1.9	51	3.2
Shatter	27	3.4	4	0.5	31	2.0
Small Debris (<2.5cm)	50	6.3	36	4.6	86	5.5
Hammer Stone	1	0.1	1	0.1	2	0.1
Manuport	0	0	1	0.1	1	0.1
Total	788	100	783	100	1571	100

Fig. 17. Number of analyzed lithic artifacts (complete and fragments) recovered from LKT1 2008-2009.

	Exterior		Interior		Total	
Class	n	%	n	%	n	%
Scraper	36	33.6	19	38.8	55	35.3
Notch/Denticulate	29	27.1	0	0	29	18.6
Endscraper	6	5.6	2	4.1	8	5.1
Burin	7	6.5	0	0	7	4.5
Truncated-Faceted	10	9.3	0	0	10	6.4
Other	19	17.8	28	57.1	47	30.1
Total	107	100	49	100	156	100

Fig. 18. Number of analyzed tools (complete and fragments) recovered from LKT1 2008-2009 (Other = unclassified retouched fragments).