Chapter 4
Lithic Assemblages Recovered from Azokh 1

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Abstract Between 2002 and 2009, renewed investigations of Units II, III, IV and V at Azokh 1 cave were undertaken following rigorous systematic methods of excavation and recording. New dates suggest an age of 184–100 ka for Unit II and ~300 ka for Unit Vm. The excavations produced a range of fossil faunas dominated by cave bears, and 387 lithic artifacts: 68 from Unit Vm, 4 from Unit III, and 315 from Unit II. Although a range of rock types was exploited for tool production, most artifacts are on siliceous rocks, with a few made from non-local obsidian. There is little evidence for the early stages of production on-site. It is possible that initial working may have occurred elsewhere, and cores, blanks and tools transported to the cave. However, given the restricted area of excavations at the rear of the cave, we cannot discount the possibility of knapping activities having occurred in other areas of the cave, the sediments of which were removed in earlier excavations. The stone artifacts from Unit II, with their Levallois component, are clearly Middle Paleolithic, and may be among the earliest evidence for Middle Paleolithic presence in the Southern Caucasus. The material from Unit Vm could be late Acheulean on the basis of dating, lack of Levallois technology, the general larger sizes of the pieces (although no bifaces have been found), and its stratigraphic position below Units II, III, and IV.

Резюме При предыдущих раскопках под руководством М.Гусейнова в период с 1960-х по 1980-е гг. было обнаружено около 6000 каменных орудий, относящихся к среднему и нижнему палеолиту, хотя сегодня аутентичность большей части “галечных орудий” из самых нижних уровней вызывает сомнение. К сожалению, сами раскопки и метод регистрации были не систематизированы, что мешает достоверно идентифицировать каменные артефакты в их пространственном и – чаще – правильном стратиграфическом контексте.

Текущие мультидисциплинарные раскопки проводятся на ограниченной по площади, но ненарушенной осадочной секвенции на верхних слоях (подразделения *I–V*), которые сохранились в задней части пещеры. Методы раскопок и система регистрации соответствуют самым строгим современным требованиям. Обнаружено относительно небольшое количество каменных орудий, но они расположены в правильной пространственной, стратиграфической и хронологической последовательности.

К настоящему времени найдено 387 каменных орудий: 68 из *V* подразделения, 4 из *III* и 315 из *II*. Их малое количество, несомненно, обусловлено ограниченной площадью отложений *in situ*, остающихся в *Азох 1*. Тем не менее, разница в количестве находок между подразделениями *V* и *II* отмечена и в раскопках М.Гусейнова, во время которых больше артефактов было найдено в горизонтах над и под подразделением *V*, чем внутри нее.

Каменные орудия *V* подразделения изготовлены из нескольких видов исходного материала. На данный момент в регионе отсутствуют геологические карты местности, которые могли бы помочь определить источники многих видов сырья, хотя большинство из них, кроме обсидиана, возможно, имеет местное

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происхождение. Детальное исследование фрагментов обсидиана поможет установлению мест залегания данной породы.

Коллекция каменных орудий из подразделения *V* включает отщепы, их фрагменты, ядрища, ретушированные пластины и манупорты. Очевидно использование техники одно- и двухсторонней редукции ядрища, но отсутствие кортекса и осколков позволяет предположить, что начальные стадии изготовления каменного орудия были за пределами пещеры. Ретушь, если она присутствует, является непрерывной и маргинальной вдоль одной или двух кромок и влияет на дорзальную поверхность. Интенсивная ретушь присутствует лишь на обсидиановых орудиях. Типологически многие артефакты являются скребками. Никаких двусторонних, галечных или с техникой леваллуа орудий не обнаружено.

Каменные орудия из подразделения *II* изготовлены из местного сырья, с включением нескольких орудий и обломков обсидиана. Коллекция включает отщепы и фрагменты, несколько лезвий, наконечников и ядрищ, являющихся результатом использования прямого удара твердым молотком преимущественно некортикального происхождения. Использование стратегии одно-, двусторонней и радиальной редукции ядра также очевидно, и изготовление искусно ограненных оснований было обычной практикой. Ранние стадии последовательности операций при изготовлении каменного орудия незаметны. Ретушь обычно представлена короткими участками на кромках, но на обсидиановых орудиях данная техника использована на значительно большей поверхности. Типологически наиболее широко представлены боковые скребки, хотя обнаруживаются и некоторые типично среднепалеолитические варианты.

Хорошо представлены орудия типа леваллуа. Для производства широких отщепов, лезвий и наконечников использованы линейная (наиболее часто встречающаяся), одно- и двунаправленная рекуррентные техники. Орудия леваллуа крупнее по размерам и тяжелее, чем другие, что указывает на отбор более крупных ядрищ для производства с использованием данной технологии. Многие заготовки с техникой леваллуа в последующем подверглись ретуши.

С учетом описанных ранее особенностей находок из подразделений *II* и *III* (Lioubine, 2002), обнаруженные в Азохской пещере среднепалеолитические каменные орудия характеризуются в рамках традиций, свойственных наиболее южным областям Кавказа и, возможно, связанных с неандертальцами. Относительно небольшое количество артефактов, обнаруженных в подразделении *II*, наряду с немногочисленными свидетельствами их изготовления на месте, свидетельствует об определенной стратегии производства орудий и кратковременном пребывании гоминид в данном регионе в эпоху среднего палеолита.

Keywords Caucasus • Middle Paleolithic • Lithic technology • Operational chain • Raw material procurement • Post-depositional surface modifications

Introduction

Azokh 1 Cave in the Lesser Caucasus has provided evidence of repeated occupation by hominin groups during the Middle to early Late Pleistocene. Following its discovery by M. Huseinov in 1960, extensive excavations conducted for more than 20 years removed most of the cultural deposits, leaving a volume of about 970 m^3 of *in situ* sediment at the back of the cave out of an estimated original 3400 m^3 (Ljubin and Bosinski 1995; Lioubine 2002; Fernández-Jalvo et al. 2010). Early excavations revealed episodes of human presence spanning Pleistocene to recent times, including Acheulean and Middle Paleolithic lithics, faunal remains, and a mandible fragment described as pre-Neanderthal (Kasimova 2001; Lioubine 2002). According to Lioubine (2002), the first 15 years of excavation lacked an interdisciplinary approach, with excavation results poorly recorded and documented. As most of the deposits were removed during that period, much information on hominin occupation episodes has been lost. The first multidisciplinary program undertaken was conducted by Azerbaijani and Russian researchers between 1975 and 1980 focusing on stratigraphy and paleoclimate (Lioubine 2002).

In 2002 renewed exploration of archaeological and fossil materials was undertaken by a multidisciplinary team of international researchers (Fernández-Jalvo et al. 2004, 2010). Current excavations have focused primarily on the undisturbed sequence of deposits in the upper levels (Units I–V) at the back of Azokh 1 (Fig. 4.1). As we have not had personal access to materials recovered from previous excavations, we have had to rely on published sources for comparative analyses. Nevertheless, the systematic recovery and detailed recording of material and application of new methodologies of the current excavations provide invaluable information on site formation, and human behavior and evolution.

While the sediments of Unit I had been extensively disturbed by recent and ancient animal burrows, various indicators suggest that the underlying Units II to V are

undisturbed (Murray et al. 2016). The association of large bear bones with small sized animals (e.g., *Capra, Dama*), together with fragmented bones, coprolites and stone tools, all suggest absence of any preferential orientation or hydrodynamic sorting or size selection due to water or sediment flow processes. There is no visible alteration of sediment type or diagenetic alteration such as that affecting the top of Unit II, and the association of stone tools and cut-marked bones suggest the context of the deposits has not been disturbed (Marin-Monfort et al. 2016). The available dates through the sequence are also consistent (Appendix). Nevertheless, artifacts in the units may have suffered from some post-depositional alterations as will be discussed later.

Large faunal remains include cervids, bovids, horses, small canids, felids, suids, rhinos, hyaenas, wolves, and hippos (Van der Made et al. 2016). Bears (*Ursus spelaeus*) are present in all levels. Among the small fauna are rodents, lagomorphs, tortoises, birds (Parfitt 2016; Blain 2016) and bats (the cave system hosts numerous colonies of bats (Sevilla 2016).

Methods of Analysis

The materials recovered between 2002 and 2009 originate from the unexcavated sediments of Units Vm, IV, III and II (Fernández-Jalvo et al. 2016) at the rear of the chamber through a combination of open-area excavation, test trenches and a rescue excavation. Excavation methods include three-dimensional recording; dry and wet sieving of all sediments to recover microfauna, lithic debitage and botanical remains; and sampling of soil, pollen, phytoliths, starch and charcoal for analyses.

Open area excavation was undertaken in Unit V between 2002 and 2009. Initial test trench exploration of Units III and II in 2003 revealed deep ash lenses interspersed with charcoal, faunal and lithic remains. Between 2006 and 2011, open area excavation of Unit II uncovered an area of about 40 m^2 remaining from previous excavations.

The morphotechnical and typological study of the lithics was undertaken using a combination of the *Logical Analytical System* (Carbonell et al. 1992; Carbonell and Rodríguez 1994; Rodríguez 2004), Anglo-Saxon, and French approaches (Bordes 1961; Laplace 1972; Clark 2001).

To gain an understanding of site formation processes affecting Azokh 1, a database of characteristics of post-depositional alterations was developed based on the work of a number of researchers (McBrearty et al. 1998; Karkanes et al. 2000; Burroni et al. 2002; Bordes 2002; Shahack-Gross et al. 2004; Thiébaut 2007). Attributes considered included: presence/absence of patina, concretion, manganese, edge rounding, edge damage, surface polish, striations, pits, mechanical cracks, fractures and chemical weathering (the latter due primarily to bat guano) (Asryan 2010). This chapter is based on results from the Master's Thesis of one of us (LA). Updated data from lithic assemblages of Azokh 1 recovered after 2009 excavation season are described in Asryan (2015).

Results

The lithic assemblages include 387 artifacts recovered from the 2002–2009 excavation seasons: 68 from Unit Vm, 4 from Unit III, and 315 from Unit II. Safety problems have hampered a proper excavation of Unit IV, but some indications of the presence of large mammals and lithic artifacts have been observed that require further study and extended excavation (see Fernández-Jalvo et al. 2016). No lithic artifacts were found in Unit Vu. The relatively low numbers of artifacts recovered from the three units is no doubt due to the restricted area of *in situ* deposits remaining in Azokh 1, and its location at the back of the cave (Fig. 4.1). Following a discussion of raw material procurement and exploitation, the lithic assemblages from each unit are discussed separately.

Raw Material Procurement and Exploitation

The type of stone on which tools are made can provide revealing insights into hominin behavior. It is strongly linked with aspects of procurement, manufacture, use, curation and discard of material. Choice may depend on a range of variables, among them: availability of stone sources, fracture mechanics of particular types of stone, quality of the edge produced, or the suitability of the resulting tool for particular functions. Determination of such choices is one of the first steps in attempting to understand initial stages of the sequence of stone procurement, production, use and discard events that form the operational chains evident in assemblages.

The lihics recovered from all units in Azokh 1 are primarily on chert. Basalts and obsidian are also present in Units Vm and II, as are, to a much lesser degree, quartzite, agate, and limestone. There are a few examples of hornfels in Unit Vm, an obsidian piece in Unit III, and sandstone and jasper in Unit II (Table 4.1). There are no regional geological maps that we can access to help determine original

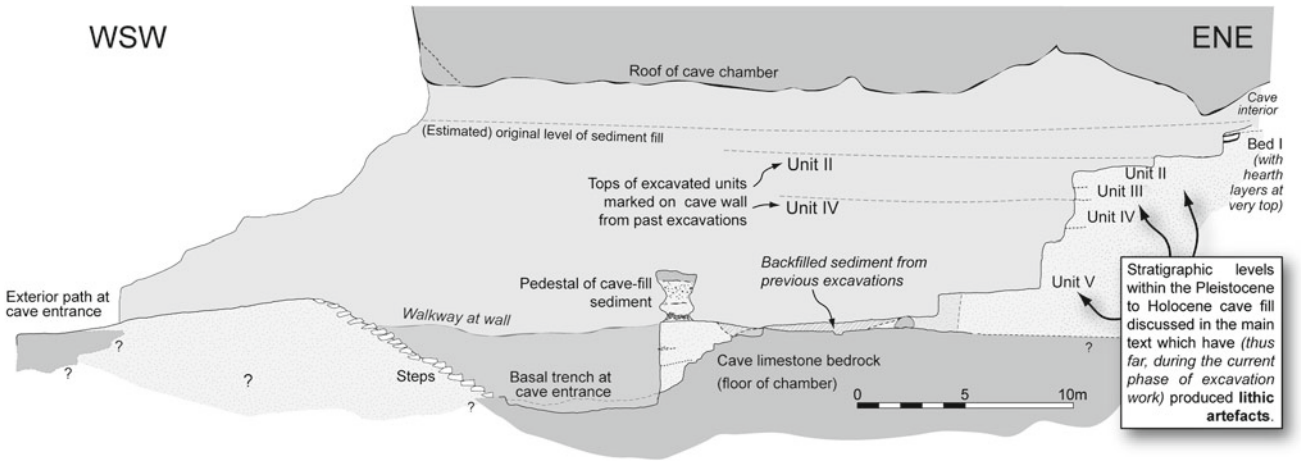

Fig. 4.1 Cross section through Azokh 1 chamber (facing NW). Adapted from Murray et al. 2010 (used and modified with permission of J. Murray and the *Irish Journal of Earth Sciences*)

Table 4.1 Raw materials present in Units Vm, III and II (percentages not given for Unit III due to the small number of pieces recovered)

Raw material	Unit V No. present	Unit V % of total	Unit III No. present	Unit II No. present	Unit II % of total
Chert	40	58.8	3	190	60.3
Flint	6	8.8	–	65	20.6
Basalt	15	22.1	–	36	11.4
Obsidian	3	4.4	1	9	2.9
Limestone	1	1.5	–	5	1.6
Jasper	–	–	–	3	1
Sandstone	–	–	–	2	0.6
Tuff	–	–	–	2	0.6
Quartzite	1	1.5	–	2	0.6
Agate	1	1.5	–	1	0.3
Hornfels	1	1.5	–	–	–
Total	68	100	4	315	100

Fig. 4.2 Sites mentioned in the text and obsidian sources in Armenia

sources of most raw materials found at Azokh 1. However, it is possible that much of the stone comes from reasonably local sources within a 5 km radius of the cave. The host bedrock of the region is Mesozoic limestone with chert deposits present at several levels within the limestone and within the cave system (Murray et al. 2010). Basalt outcrops occur in Azokh village and within 10 km of the village and thus, are of local as well as regional (within a 5–20 km radius of the site) occurrence. Our observations in Ishkhanaget River (5 km from the cave) revealed fragments and also some pebbles of siliceous rocks, quartzite, basalts, sandstones and limestones in the river valley.

At present, the only known obsidian sources in Nagorno Karabakh are Mt. Kelbadjar and Ketchaldag/Merkasar in the Shahumyan region (Blackman et al. 1998) about 150–180 km from Azokh (Fig. 4.2). Numerous obsidian sources are known in Armenia, many of which were exploited during the Pleistocene, but characterization studies of the Azokh 1 obsidian remain to be undertaken. The closest, and possibly most likely source of obsidian is on the high plateau of the Zangezur mountain range in southeast Armenia which is more than 80 km from Azokh (Liagre et al. 2006; Cherry et al. 2008).

Unit Vm: Lithic Assemblage

The Unit Vm lithic assemblage is small, consisting of 68 pieces, made on a range of raw materials but primarily on chert and basalt. The assemblage consists predominantly of flake fragments, that is flakes without a striking platform but on which it is possible to distinguish dorsal and ventral surfaces (n = 27). There are some broken flakes that have a striking platform or butt but have lost part of their distal or lateral edges (n = 8). There are also unretouched flakes

Table 4.2 Units Vm and II: composition of the lithic assemblages

Category	Unit V assemblage		Unit II assemblage	
	No. present	%	No. present	%
Manuport	–	–	3	0.9
Core	3	4.4	8	2.5
Unretouched flake	11	16.2	51	16.2
Retouched flake	7	10.3	11	3.5
Broken flake (with platform and bulb)	8	11.8	57	18.1
Flake fragment (having distal or lateral segments but no platform or bulb)	27	39.7	126	40
Fragment	12	17.6	59	18.7
Total	68	100	315	100

(complete flakes, n = 11), and retouched flakes (flakes that have been modified, n = 7), three cores (nodules exploited to obtain products, whether for direct use i.e. flakes, or for subsequent configuration or exploitation, i.e. retouched flakes and flake-cores). Finally, there are non-diagnostic fragments consisting of angular waste, chunks and pieces without clear ventral and dorsal surfaces or that cannot be clearly identified technologically or typologically (n = 12). No knapping debitage less than 2 cm in size or with clear signs of percussion has been recovered from Unit Vm (Table 4.2).

Cores form 4.4% of the total assemblage from Unit Vm. They show no systematic approach in their exploitation for the production of flakes, nor any evidence for the use of centripetal or prepared core/Levallois technology. The simple technology of core production is also evident in the flake industry (including retouched and unretouched pieces which form 26.5% of the assemblage), as there is no evidence of striking platform preparation, no facial hierarchy, and often, but not always, no patterning of removals. Flakes are predominantly non-cortical (71.2%), and comprise a range of morphologies and dimensions (Table 4.3 and Fig. 4.3). Dorsal surfaces generally indicate at least two previous

Table 4.3 Units Vm and II: maximum, minimum and average dimensions of cores and whole flakes

Dimensions	Unit V		Unit II	
	Cores	Whole flakes	Cores	Whole flakes
Length (mm)				
Max	75	102	65	90
Min	48	31	44	18
Average	62	52.87	50.25	49.71
Width (mm)				
Max	65	85	56	63
Min	30	12	33	9
Average	50	39.5	45.5	32.08
Thickness (mm)				
Max	45	28	30	24
Min	21	4	13	1
Average	31	13	22.37	7.81

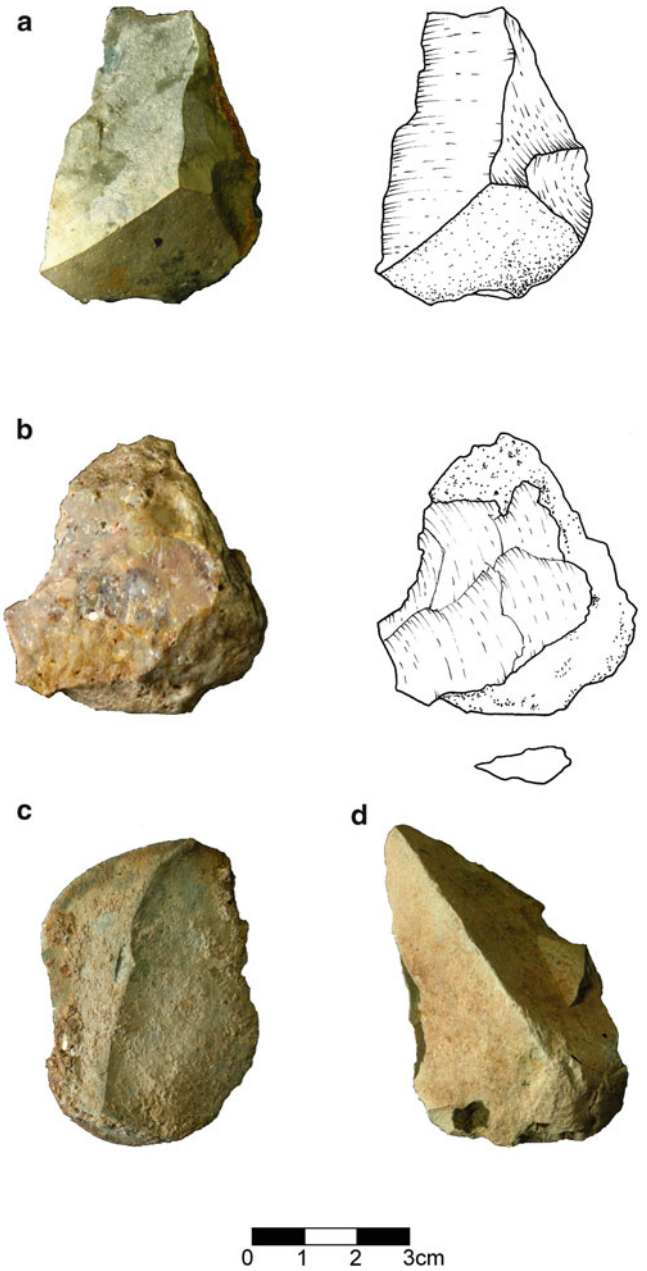

Fig. 4.3 Unit Vm unretouched flakes: **a** (Az1'03 un V, D42 – 14), **c** (Az1'03 un V, G42 – 2) and **d** (Az1'09 un V, H41 – 27) on basalt, and **b** (Az1'03 un V, F41 – 11) on chert (illustrations by J. Vilalta)

removals which tend to be unidirectional, although bi-directional and multi-directional removals are evident on some pieces. Seven pieces (10.3% – 4 chert, one each of obsidian, hornfels and basalt) have been modified by retouch that is primarily partial and marginal along one edge, affecting the dorsal surface at a simple or semi-abrupt angle (Table 4.2 and Fig. 4.4). One notable exception is an intensively retouched obsidian piece. Retouched artifacts are generally on medium-sized blanks (46–75 mm long) and typologically most are side scrapers. The general lack of

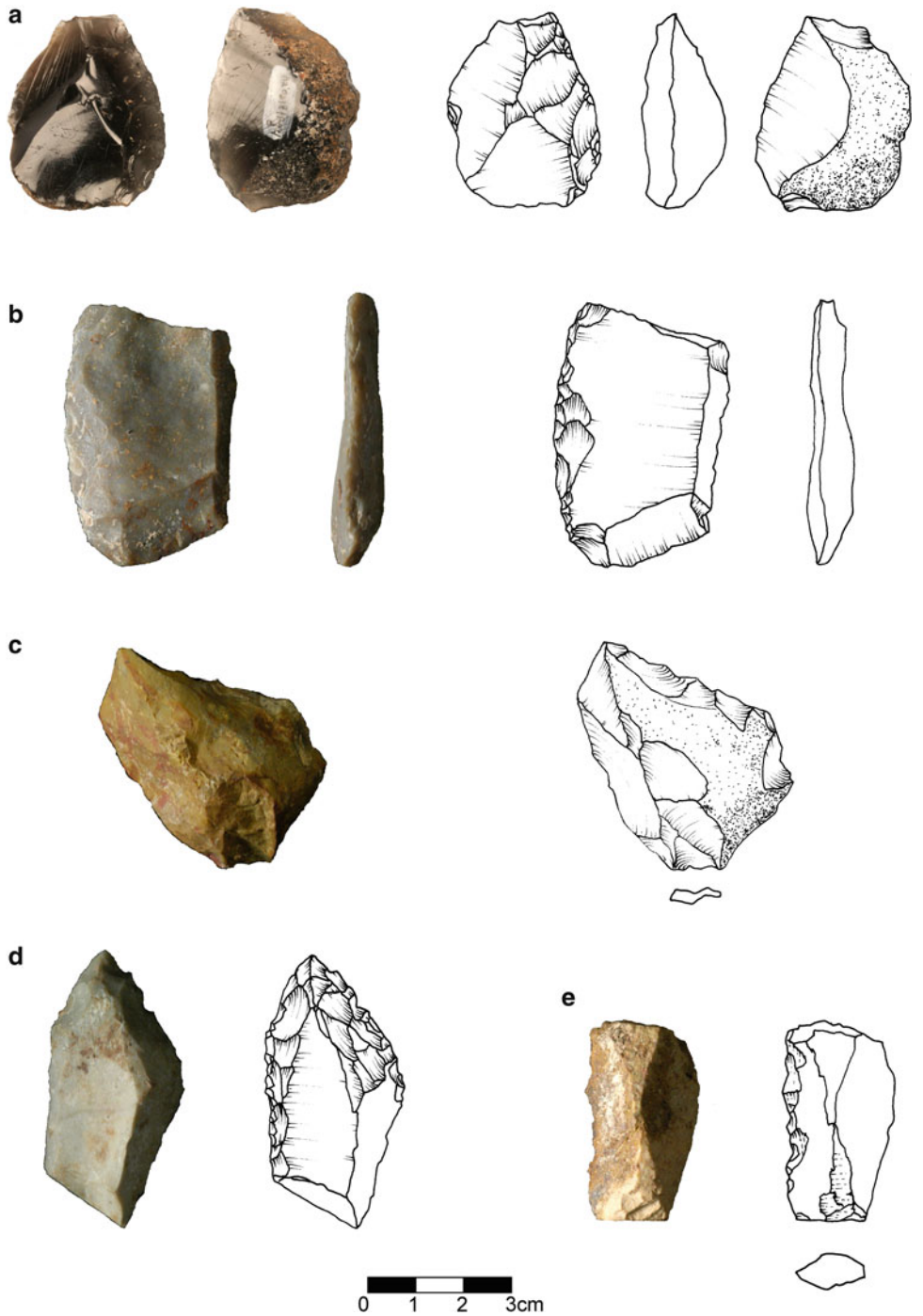

Fig. 4.4 Unit Vm retouched flakes: **a** (Az1'03 un V, F42 – 3) side-scraper on obsidian, **b** (Az1'09 un V, E40 – 2), **c** (Az1'09 un V, H41 – 10) side-scraper on flint, **d** (Az1'09 un V, I42 – 42) point on chert and **e** (Az1'09 un V, I42 – 43) side-scraper on chert (illustrations by J. Vilalta)

cortex on retouched and unretouched flakes combined with a lack of debris suggests that initial stages of the operational chain did not occur at this location. The refitting of three flakes forming a single blank could be interpreted as a result *in situ* knapping, but it could also be the result of post − depositional processes. At the moment these hypothesis can neither be confirmed nor refuted.

Unit III: Lithic Assemblage

Three flake fragments (two chert and one obsidian) with dorsal scars indicating prior working of the stone) were recovered from Unit III. Retouch, present only on the ventral surface of one chert piece, is continuous and profound. Likewise, there is one example of a striking platform (on the

obsidian flake) which is unifaceted (having a single knapping plane). Two pieces show post-depositional alteration.

Unit II: Lithic Assemblage

The Unit II industry consists of 315 pieces recovered from an area of 40 m^2. Siliceous materials (chert and flint) dominate the range of raw materials present (Table 4.1). The assemblage is characterized by a high number of flake fragments (n = 126), and it also includes broken flakes (n = 57), unretouched (n = 51) and retouched flakes (n = 11), cores (n = 8), some knapping debris (n = 4), and non-diagnostic fragments (n = 55) (Table 4.2). Levallois technology is well represented, forming 27.6% of the assemblage (Table 4.4). The percentage of retouched pieces and cores is low (3.5% and 2.5% respectively).

The eight cores listed above include five on siliceous materials and three on basalt. Most are fully exploited (i.e. exhausted) with mean dimensions of 51 × 50 × 19 mm. (Table 4.3). They are primarily bifacial and show clear facial hierarchy. Five cores are Levallois (two of which are on basalt), with evidence for opposed bipolar and centripetal working; two have preferential removals. The three non-Levallois cores have unipolar removals (i.e. struck from one direction) (Fig. 4.5).

Flakes are mainly small (26–45 mm) to medium (46–75 mm) in size (Table 4.3) and dominated by trapezoidal and triangular forms. A range of morphologies is represented (Fig. 4.6), with many (75.4%) having multifaceted (i.e. with two or more knapping planes) and bifaceted platforms, with two convergent knapping planes. Levallois and retouched flakes, which form 32.9% and 3.4% of the flakes respectively, were made on good quality raw material, primarily siliceous including obsidian, but some are on basalt (Fig. 4.7). Levallois flake techniques include radial, bidirectional and at times unidirectional removals. Retouch tends to be direct, marginal and continuous along one edge at an angle of between 35º and 75º. However, two obsidian pieces show intensive, stepped retouch on the dorsal face. Typologically, retouched pieces are simple side scrapers, but also include two end scrapers on flakes. A substantial number of flakes (69.3%) show pseudo retouch and edge damage caused, we believe, by post-depositional processes discussed below. Given the small extent of cortex on flake surfaces combined with the limited presence of knapping debris, we suggest that initial stages of the operational chain did not occur at this location of the cave.

Table 4.4 Unit II: Levallois component

Category	No. present	% whole assemblage	% Levallois component
Levallois core	5	1.6	5.7
Levallois flake (whole and broken flakes and flake frags.)	75	23.8	86.2
Retouched Levallois flakes	7	2.2	8.1
Total Levallois	87	27.6	

Post-Depositional Evidence

Post-depositional processes have affected a substantial number of pieces in Units II and Vm. While edge rounding, edge damage, fractures and high levels of patina (especially on basalt) are the most characteristic features, pits, mechanical cracks and thermal alteration are indicated too (Fig. 4.8).

Some post-depositional alterations may be related to trampling, especially in Unit II, and as some erosive processes were evident at the contact surface between Unit I (Holocene) and Unit II, we cannot reject the potential effects of erosive or sediment movement processes (Fernández Jalvo et al. 2004, 2010). However, we believe that erosion is not the primary cause of post-depositional damage; chemical weathering by bat guano is well attested, especially in Unit II, where most often it tends to affect limestone and some volcanic materials such as basalt and tuff, as well as fossils (Marin-Monfort et al. 2016; Smith et al. 2016).

Discussion of the Lithic Assemblages

As indicated at the beginning of this paper, most of the sediments from Azokh 1 Cave were removed during excavations of the 1960s–1980s. As a result, the remaining *in situ* deposits lie at the rear of the cave, some 40 m from its entrance (Fig. 4.1). It is reasonable to suppose that as the front of the cave would have been much better lit than the back, it would have been a more desirable area for hominin occupation, a factor that may account for the limited lithic evidence of occupation revealed by recent excavations.

By 2009, Unit III had only been subjected to test trench excavation as the extended areas below Unit II had not been reached. Excavations conducted in 2010 and 2011 reached the top of Unit IV. Analysis of lithic artifacts recovered from both units in 2010 and 2011 is currently ongoing. Units II and V underwent open area excavations, so that the higher number of lithics from the former is probably a valid result.

It is important to emphasize the substantial chronological time period that separates these three units and the different

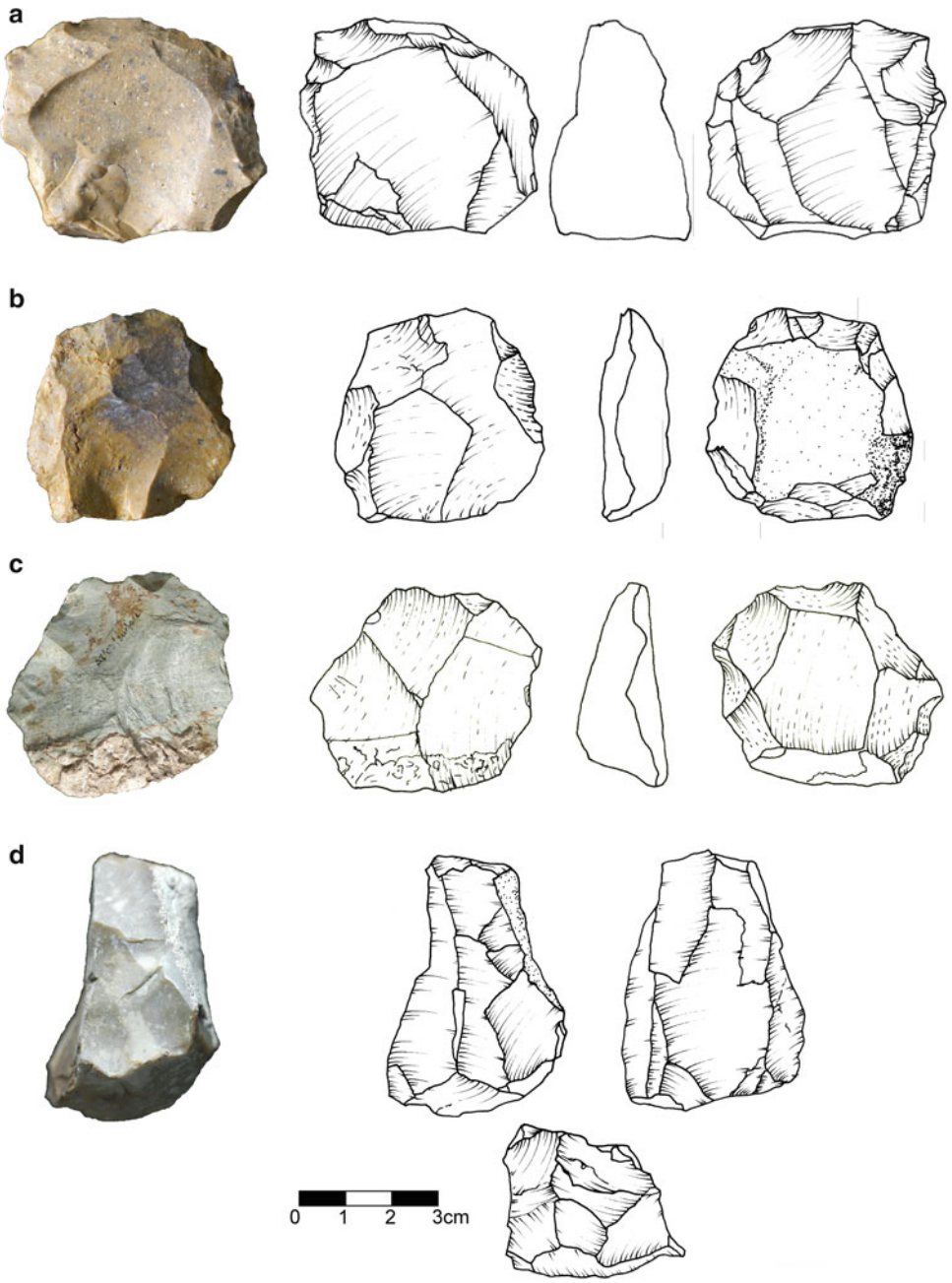

Fig. 4.5 Unit II cores: **a** (Az1'05 un II, G47 – 3) and **b** (Az1'06 un II, F48 – 139) Levallois cores on flint, **c** (Az1'03 un II, D46 – 15) Levallois core on basalt, and **d** (Az1'05 un II, E48 – 4) non-Levallois core on chert (illustrations by J. Vilalta)

Middle Pleistocene hominin species involved. The hominin species is *Homo heidelbergensis* in Unit Vm and *Homo neanderthalensis* in Unit II (King et al. 2016), having different technological and cultural traditions. Given the greater numbers of artifacts in Unit II, we are better able to consider behavioral patterns for the hominins of this unit, although there are some aspects of behavior that the evidence in Unit Vm, and arguably in Unit III, may suggest.

In all units we see a similar range of raw materials (although limited in Unit III) exploited for tool production. These are chert originating from the immediate cave vicinity, siliceous materials most likely from river gravels that today are about 2 km from the site, and basalt that may originate from the river and nearby outcrops. Raw material retrieval strategies, therefore, are predominantly local, that is less than 5 km from the site. The presence of obsidian is the only evidence of material originating from distant sources more than 80 km away from the cave, perhaps at Mt. Kelbadjar and Kechaldagh/Merkasar in Nagorno-Karabakh and near Syunik in the Zangezur mountain range (Fig. 4.2). Although the

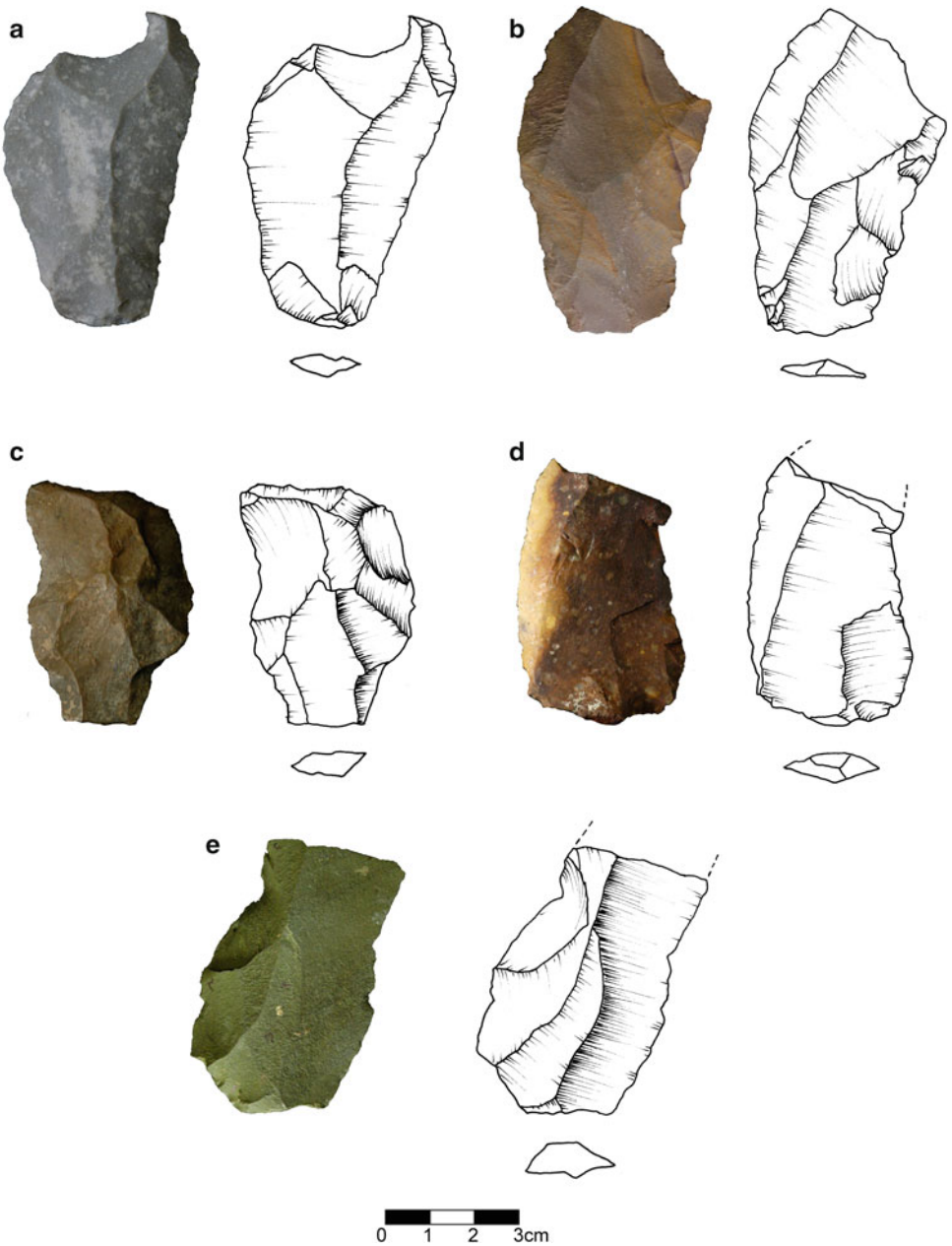

Fig. 4.6 Unit II unretouched flakes: **a** (Az1'08 un II, C50 – 9), **c** (Az1'08 un II, H50 – 2) and **d** (Az1'06 un II, G47 – 15) Levallois flakes on flint, **b** (Az1'05 un II, E48 – 17) Levallois flake on jasper, and **d** (Az1'08 un II, C46 – 41) Levallois flake on basalt (illustrations by J. Vilalta)

Zangezur mountains may be the closest source of the Azokh obsidian, their altitude at 2500 m would have restricted access to the time of year when the region was free of snow (Barge and Chataigner 2003). However, it is possible that fluvial action could have transported some obsidian to lower altitudes where it could have been available year round. While obsidian might have come from more distant sources, the distance between Syunik and Azokh is compatible with raw material procurement and network territories suggested for Neanderthals (Geneste 1991; Gamble 1999).

The proposal for small Neanderthal territories finds support in the Middle Paleolithic levels of Ortvale Klde in western Georgia (Adler et al. 2008). Here, hominins exploited local raw materials for most of their tools, while the few obsidian pieces from a source 100 km away formed less than 1% of the lithic assemblage. Similarly, a recent review of the Djruchula lithic assemblages (Meignen and Tushabramishvili 2006) indicated predominant exploitation of local raw material and minimal use of obsidian, the source of which is found at a distance of 100 km. We hope that

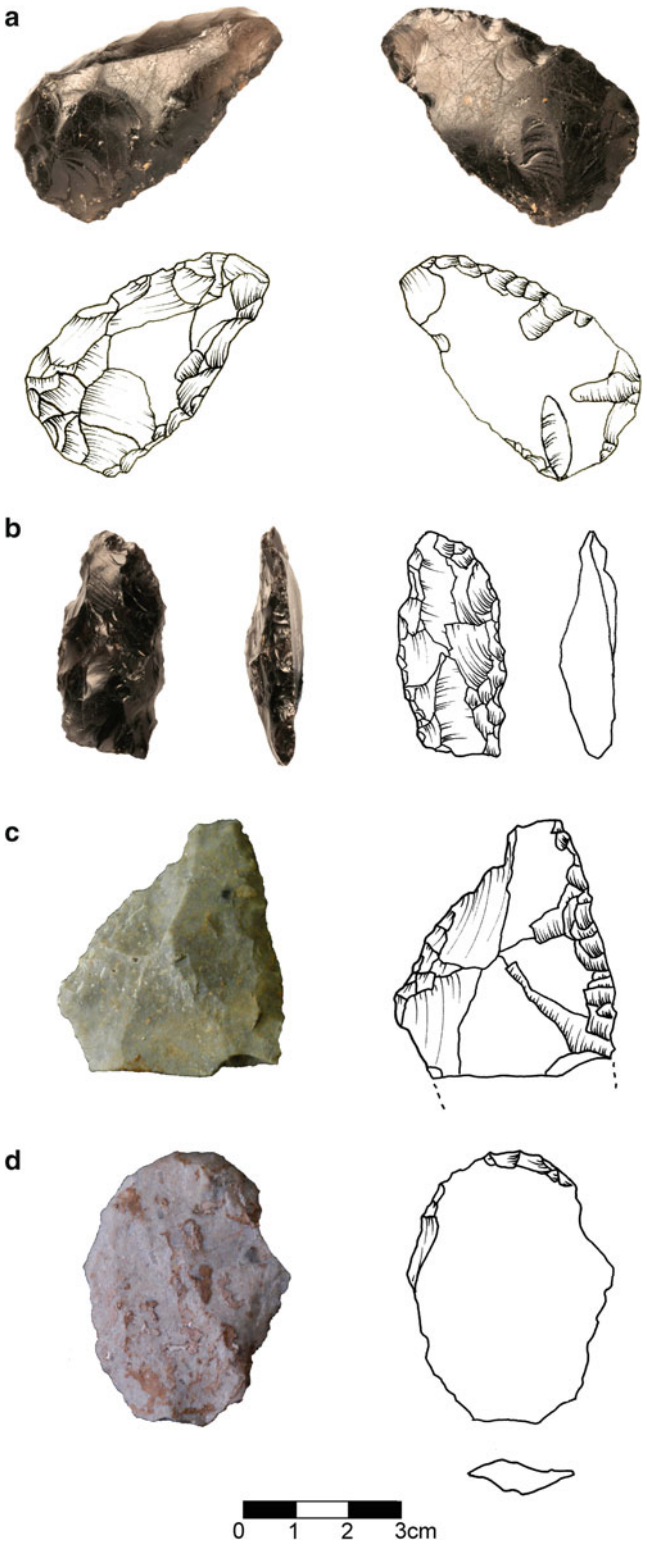

Fig. 4.7 Unit II retouched flakes: **a** (Az1'08 un II, D46 – 27) and **b** (Az1'03 un II, D46 – 141) obsidian side-scrapers, **c** (Az1'09 un II, E47 – 14) flint side-scraper, and **d** (Az1'07 un II, D51 – 49) chert end-scraper (illustrations by J. Vilalta)

future characterization analysis of the Azokh obsidian will identify its sources.

There is no evidence for the complete operational chain in any unit, and only limited indications of potential *in situ* knapping as suggested in Unit Vm where, despite the absence of knapping debris, a refit of three pieces, the largest of which is cortical, may suggest some knapping activity in the area. The presence of some debris in Unit II may indicate possible *in situ* activity. Nevertheless, the general non-cortical nature of the assemblages, the relatively high number of scars on flake surfaces in the Unit II assemblage (6% of the flake component have more than 3 prior scar removals), the predominance of small- to medium-sized flakes, and highly reduced nature of cores, all suggest that, for the most part, initial stages of reduction occurred elsewhere, and cores, blanks and tools were taken into the cave, particularly in the case of Unit II. However, given the restricted area of current excavations, we cannot discard the possibility of knapping activities having occurred in other areas inside the cave that can no longer be identified.

Retouched tools are not common in any unit. However, it is interesting to note that a few obsidian pieces from Unit II have been intensively retouched, which tentatively suggests curation of stone originating from distant sources. We have noted a difference between Unit II and Unit Vm in the presence of pseudo retouch, i.e. edge damage through use or post-depositional processes, which is much more common in Unit II. We are uncertain of why this should be so, but it may relate to greater cave bear activity in Unit II where the number of bear bones indicates denning episodes. Indeed, as with Azokh, most cave sites in the Caucasus, which have cave bear remains and which also have evidence of hominin occupation during both the Middle and Upper Pleistocene, were bear dens e.g., Matuzka Cave (Golovanova 1990), Treugol'naya Cave (Doronichev 2000), Kudaro Caves (Lioubine 2002), Tsona Cave (Tushabramishvili et al. 2007), Hovk 1 Cave (see Pinhasi et al. 2008, 2011; Bar-Oz et al. 2012), Bronze Cave (Díez Martín et al. 2009), Sakažhia (Rivals and Arellano 2010).

The presence of Levallois in Unit II clearly indicates Mode 3 technology. At present, however, it is not possible to describe a specific technological mode for Units III and Vm. The small assemblage studied in Vm is flake-based with no indication of Levallois technology, but there is also no indication of large bifacial working that might suggest Mode 2/Acheulean technology. Given the chronological difference between Units Vm and II (see Appendix ESR), it might be tempting to assign the material from Unit Vm to the late Acheulean, based on the older date of the Unit of ~300 ka, or alternatively to the early Middle Paleolithic, based on the

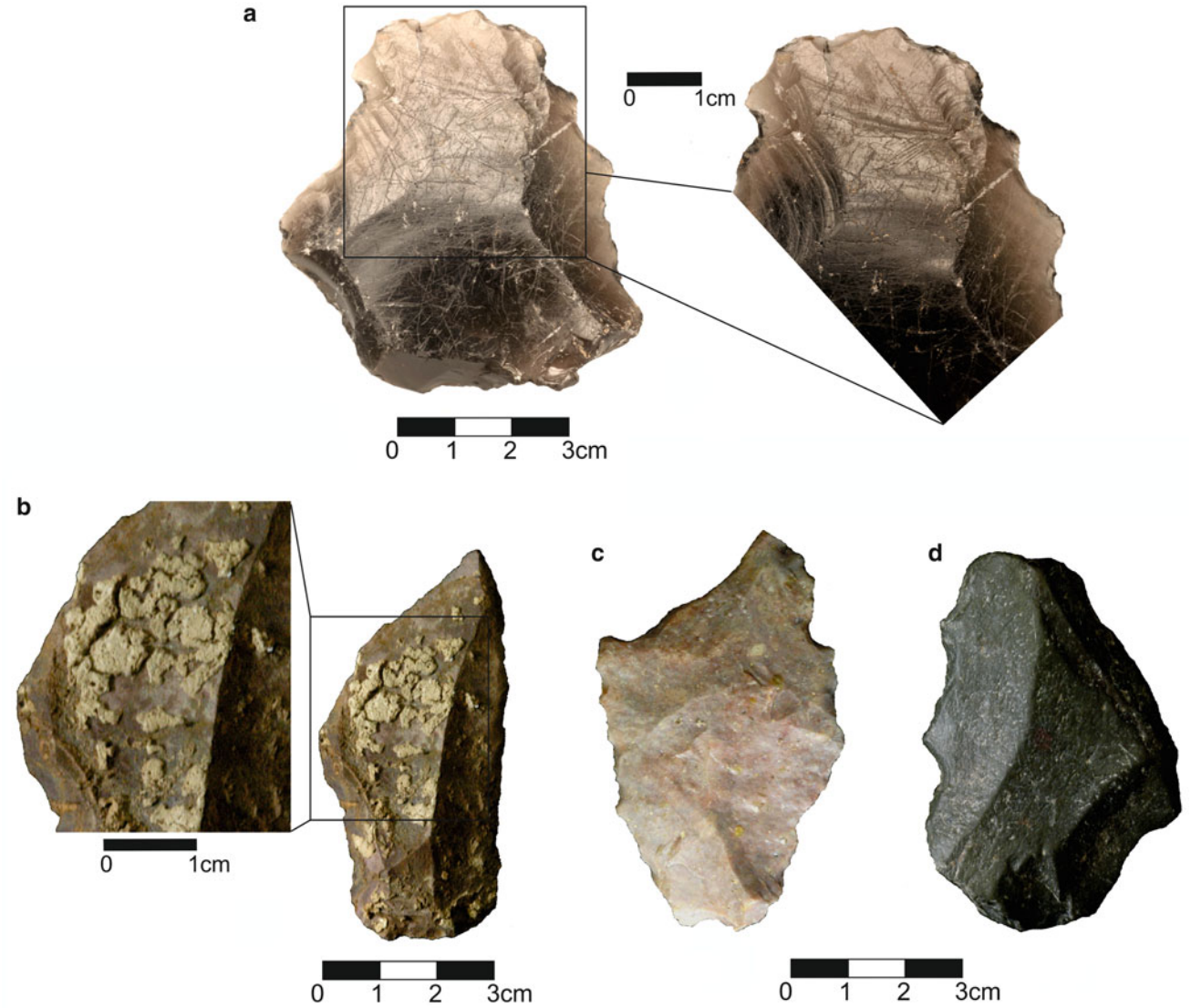

Fig. 4.8 Units Vm and II post-depositional alterations: **a** (Az1'08 un II, I49 – 3) striations and edge damage on an obsidian piece, **b** (Az1'05 un II, E48 – 2) evidence of chemical weathering, and **c** (Az1'08 un II, C50 – 7) & **d** (Az1'03 un II, D46 – 12) ridge and edge rounding and edge damage on flint and basalt flakes

younger date of ~260 ka, but at present we have no secure basis to support either hypothesis. However, chronology alone does not indicate technological mode.

Use of stone tools for butchery purposes is indicated by animal bones bearing stone tool cut marks that have been found in all units of the Upper Sequence (Units V–I). In Units II, III and Vm they form 6.38%, 11.9% and 3.78% of the faunal assemblage respectively (Marin-Monfort et al. 2016), and cut marks are associated generally with activities relating to meat and marrow removal, primarily from large- and small-sized large mammals, including the cave bear *Ursus spelaeus*. Further food-related activities might be suggested by the spatial association of lithics and bones. However, given the quantity of bear bones recovered from Unit II, we must take into consideration the effect of probable post-depositional movement of materials, including lithics, caused by bear behavior in preparation for hibernation (Stiner et al. 1996). None of the tools show signs of hafting to use as spears similar to that seen in other Middle Paleolithic sites, for example at Starosele in the Ukraine (Hardy et al. 2001) or Umm el Tlel in Syria (Boëda et al. 2008). Therefore we cannot, as yet, propose methods of meat acquisition. However, the number of bear bones with cut marks indicating hominin activity suggests exploitation of hibernating bears, or bear carcasses encountered in the cave. Use wear studies of Unit II lithics are currently in progress,

and they may indicate other materials on which tools were used, how they were used e.g., cutting, slicing, pounding actions, and direction of use, thus increasing our understanding of hominin activities in the cave.

At present, the small number of stone tools, the predominant exploitation of local raw material sources, lack of evidence for extensive knapping episodes, and limited evidence of intensive retouching of pieces, suggest expedient strategies of tool production relating to short term, sporadic occupations of the cave. The potential exploitation of meat from hibernating bear carcasses may also support such an interpretation. Notwithstanding, we must keep in mind the location and small area of our excavations which may bias interpretation. A number of sites with small lithic assemblages in the Caucasus have been interpreted as short stay occupations in which lithics were introduced into the site in their final form. It is evident at these sites that earlier stages of the operational chain are missing and must have occurred elsewhere as is indicated at Matuzka (Baryshnikov et al. 1996), Hovk 1 (Pinhasi et al. 2008) and Double Cave (Díez Martín et al. 2009). In such a context, the most recent assemblages from Azokh Units Vm and II are not unusual in their limited evidence for *in situ* knapping activities.

Comparison of Assemblages from the Earlier and Current Excavations

As we have not been able to study the lithic materials recovered from M. Huseinov's excavations, we have had to rely on information provided primarily by Huseinov (1985), Lioubine (2002), Golovanova and Doronichev (2003) and Doronichev (2008). These sources indicate an assemblage of 289 pieces recovered from the designated Layer V of the earlier excavations, considered by them to be Acheulean, and also a larger assemblage of 3039 pieces from Layer III, considered to be Middle Paleolithic. Although units Vm, III and II of the current excavations may not correspond entirely with layers determined in earlier excavations, the relative numbers of recently recovered lithics also indicate a Middle Paleolithic assemblage of 315 pieces from Unit II positioned stratigraphically above the 68 pieces from Unit Vm. While we are more confident in comparing the Middle Paleolithic assemblages, a comparison of the assemblages from the earlier level is rather more difficult, but it is useful, nevertheless, to attempt such an exercise.

Apart from numerical differences (far fewer pieces were recovered from Huseinov's Layer V and our Unit Vm than from the Middle Paleolithic layers), assemblage composition from both excavations is similar. The most notable difference lies in the presence of macro/heavy duty tools in Layer V of the earlier excavations, which include choppers, chopping tools, and a few Acheulean bifaces (Huseinov 1985; Lioubine 2002; Doronichev 2008), and their absence from the recently excavated Unit Vm. While debitage is well represented in the Middle Paleolithic layer of the earlier excavations, it is markedly limited in the current assemblage. The higher frequency of debitage waste and cores recovered from the earlier excavations may support the hypothesis that knapping occurred in other, possibly better lit areas of the cave. However, there is no spatial mapping of the previous excavations to confirm such an hypothesis. Three macro/heavy duty tools were recovered during the earlier investigations of the Middle Paleolithic layers but no similar pieces have been recovered in recent excavations. An interesting point to note is the important presence of denticulates and notches documented in the earlier excavations. As discussed above, current post-depositional studies have highlighted the problem of pieces which display pseudo retouch which potentially could have been considered typologically as denticulates or notches.

Azokh Lithic Assemblages in the Context of the Caucasus Region

While the geographic location of the Caucasus might be perceived as a barrier to hominin movement, the number of Paleolithic sites in the region contradicts such an assumption. Hominin presence in the Caucasus at 1.77 Ma is evidenced by the rich assemblage of physical and cultural remains found at Dmanisi, Georgia (Gabunia et al. 2000, 2001; Rightmire et al. 2006). Other Lower, Middle and Upper Paleolithic sites attest to hominin activity throughout the Middle Pleistocene. Nevertheless, differences in Middle Paleolithic assemblages between the northern and southern regions suggest that the Caucasus mountain chain hindered hominin movement between these two regions during the Middle Paleolithic (Meignen and Tushabramishvili 2006). Differences in Acheulean assemblages with and without bifaces may indicate different origins of the Acheulean complex (Doronichev 2008).

The size of lithic assemblages recovered from cave sites in the Caucasus is variable: large (>1000+ pieces) for example at Mesmaiskaya Cave (Golovanova et al. 1999), Ortvale Klde (Adler et al. 2006), Djruchula (Meignen and Tushabramishvili 2006); and small (<1000 pieces) such as seen at Matuzka (Golovanova 1990; Baryshnikov et al. 1996; Hoffecker and Cleghorn 2000), and Kudaro (Lioubine 2002), and Double Cave (Díez Martín et al. 2009). The small size of the recently excavated Azokh Unit Vm and Unit II lithic assemblages is not, then, unusual in the context of the Caucasus.

While we cannot confidently place Unit Vm in a particular cultural, techno-complex, we can consider the Unit Vm assemblage in light of others in the region which potentially are comparable chronologically. Doronichev (2008) suggests that the Acheulean in the southern Caucasus occurs only after 350 ka. Given the older date of ~300 ka for Azokh Unit Vm, we might review the assemblage to determine whether it includes elements comparable with Acheulean assemblages in the region. Doronichev (2008) proposes two variants of the Acheulan complex in the southern Caucasus on the basis of raw materials, technology and assemblage composition. One variant, which he terms "Kudarian", relates to those lithic assemblages that are generally on siliceous materials, are flake-based, include a good proportion of side scrapers among retouched tools, have few Acheulean bifaces, and lack Levallois technology. He suggests that examples of this "Kudarian" variant are found in Kudaro I, III (Doronichev 2008, Figs. 14–17) and Azykh (sic) Layer VI and V (lithics from the early excavations). The second Acheulean variant is characterized by the use of volcanic rocks, with numerous bifaces, a laminar element and Levallois technique.

Some elements of the Azokh Unit Vm assemblage discussed here, small though it is, may support its inclusion in Doronichev's Kudarian complex. This is based primarily on the use of siliceous rocks, on flake production, the predominance of side scrapers among the limited number of retouched tools, the lack of bifaces, the absence of Levallois technology, and its dating to ~300 ka.

In terms of Middle Paleolithic assemblages in the region (Fig. 4.2), the geographic tripartite division of the Caucasus, presented in the introduction is also reflected in techno-typological characteristics of lithic industries (Beliaeva and Lioubine 1998; Golovanova and Doronichev 2003). European Micoquian affinities are indicated in the bifacial technology and tool types evident in many assemblages in the northwest Caucasus in both open air and cave sites such as Mezmaiskaya and Il'skaya I and II (see also Golovanova et al. 1999, Fig. 3; Golovanova and Doronichev 2003, Figs. 8 and 9). The Kudaro-Djruchula tradition, in which some Middle Paleolithic assemblages of southern central Caucasus have been placed, is characterized by the presence of scrapers, denticulates, notches and Levallois products, while variation is evident in the extent of facetting and Levallois techniques. The medium and large Levallois flakes, blades and points that are present in many sites, for example Djruchula, Tsona and Kudaro caves, and possibly also Hovk 1, show affinities with those Levantine industries which have long triangular or sub-quadrangular blanks produced by Levallois technology (Meignen 1994, Figs. 2, 6, 7; Golovanova and Doronichev 2003, Figs. 23–25; Meignen and Tushabramishvili 2006, Figs. 3–6; Tushabramishvili et al. 2007, Figs. 5, 6; Pinhasi et al. 2008, Figs. 4, 5; Mercier et al. 2010; Pinhasi et al. 2011). Characteristics such as uni- and bi-directional Levallois technology, use of the truncated-faceted technique (ventral surface preparation prior to dorsal thinning, mainly of the proximal but also the lateral areas) and a high percentage of retouched pieces present in industries in the southernmost part of the Lesser Caucasus, link them to the Zagros Middle Paleolithic (Beliaeva and Lioubine 1998; Golovanova and Doronichev 2003). Similar characteristics are present in western Iranian sites such as Warwasi rockshelter (Dibble and Holdaway 1993, Figs. 2.3–2.6) and Bisitun (Dibble 1984, Figs. 3–5).

Evidence for raw material strategies indicates a general pattern in the Middle Paleolithic of the Caucasus for the predominant use of local sources, with rare exploitation of stone from distant sources. Many later (i.e. younger than 50 ka) Middle Paleolithic assemblages of the Lesser Caucasus share some or all of the following characteristics: presence of Levallois flakes, points and blades, use of facetting in platform preparation, use of the truncated-faceted technique as a thinning mechanism, and a high percentage of Levallois and Mousterian points. The obsidian assemblages of Yerevan 1 in Armenia are characterized by frequent use of the truncated-faceted technique, particularly on a range of points, and some use of Levallois. At the nearby site of Lusakert 1, Levallois production is prevalent in the obsidian assemblages from most levels, which also include some truncated-faceted pieces (Fourloubey et al. 2003, Figs. 3, 5–7; Golovanova and Doronichev 2003, Fig. 29). The industry from Taglar Cave in Nagorno-Karabakh has been likened to Yerevan 1 with the presence of truncated-faceted pieces and points, although the Taglar assemblage differs in its greater number of Levallois products (Golovanova and Doronichev 2003, Fig. 9). Liagre et al. (2006) note similarities between the small surface assemblage of Angeghakot 1, Armenia, and the later levels of Yerevan 1, particularly in the presence of points and use of the truncated-faceted technique (Liagre et al. 2006, Fig. 9). However, while there are similarities between many assemblages, variability is seen in the relative degree of presence of particular characteristics or tools, and in the presence of distinct technologies; for example a microlithic element that is evident at Lusakert 1 and Angeghkot 1.

The Unit II Middle Paleolithic assemblage from Azokh 1 shares similarities with many other sites of the region that have been included within the lithic traditions of the Zagros Middle Paleolithic. These include raw material strategies based on local sources, use of Levallois technology to produce large and small flakes, regular use of faceting in platform preparation, and a range of scrapers. It is evident that such characteristics are insufficient to confidently place the Azokh Unit II assemblage within the Zagros Middle Paleolithic tradition; in particular the truncated-faceted technique which is often an element of other assemblages is absent.

Furthermore, it should be stressed that the dates for Azokh Unit II indicate it to be between 50 and 100 ka older than sites attributed to the Zagros Middle Paleolithic, so that such comparisons are not particularly compelling.

Comparison with assemblages from the earlier Middle Paleolithic, such as the Djruchula assemblage, are worth considering. This is characterized by the production of long Levallois blanks, often retouched into points, and regular use of facetting. Typologically, apart from a few side scrapers, there are limited numbers of cores, debitage and other Middle Paleolithic tool types (Meignen and Tushabramishvili 2006; Mercier et al. 2010). It has been suggested that the small assemblage from the older (c. 104 ka) levels of Hovk 1 shares techno-typological similarities with the Kudaro-Djruchula group (Pinhasi et al. 2011).

While Levallois and facetting are well represented in the Unit II assemblage described here, there are few of the elongated products that are important in the Djruchula assemblage, and as such, the characteristics of the Azokh Unit II assemblage do not provide much support for affiliation with the Kudaro-Djruchula tradition. However, a preliminary review of materials from our later 2010 and 2011 excavations indicates a greater presence of elongated pieces that may give cause for a re-evaluation of the situation. If we take into consideration the Middle Paleolithic assemblage from Azokh 1 described briefly by Lioubine (2002, 38), we note that it includes a range of scrapers, elongated pieces, facetting and a few scrapers with thinning of their ventral surface (*amincis*). Such characteristics could support its inclusion in the Zagros tradition, or conversely in the Kudaro-Djruchula tradition. At present, we cannot confidently place the Unit II assemblage discussed here in a particular regional, cultural tradition.

Chronology

Formerly, much of the chronological framework for the Lower and Middle Paleolithic of the Caucasus relied heavily on techno-typological associations, a combination of OIS correlations and some chronometric dates. Recent work in the region has provided additional dating information, particularly with regard to the Middle Paleolithic (Adler et al. 2006; Liagre et al. 2006; Pinhasi et al. 2008; Fernández-Jalvo et al. 2010; Mercier et al. 2010; Le Bourdonnec et al. 2012). The published dates indicate three Middle Paleolithic phases for the region:

- sites that are dated between 250 and 128 kyr and corresponding to OIS 7-6 (Early Middle Paleolithic), e.g., Djruchula Cave (Layers 1 and 2), Kudaro (Layer 5), Tsona (Layers 1 and 2); Azokh 1 (Unit V);
- sites that are dated between 128 and 71 kyr and correspond to OIS 5 (Middle Middle Paleolithic) such as Hovq 1 (Unit 8), Azokh 1 (Unit II on the basis of the younger date of 100 ka), Il'skaya 1;
- and sites that are between 70 and 35 kyr corresponding to OIS 4 and partly also to OIS 3, among them Lusakert 1, Yerevan 1, Mezmaiskaya, Ortvale Klde.

The dates of 184–100 ka for Azokh 1 Unit II (Appendix ESR) potentially place hominin occupation in the Early Middle Paleolithic and as such it may be among the earliest evidence of a Middle Paleolithic presence in the area. Unit Vm with dates around 300 ka may indicate Late Acheulean occupation, or as with Unit II, Early Middle Paleolithic.

Conclusions

1. Between 2002 and 2009 renewed investigations of Units II, III and Vm at Azokh 1 cave were undertaken following rigorous systematic methods of excavation and recording that are the norm in present-day excavations. New dates suggest an age of 184–100 ka for Unit II and ~300 ka for Unit Vm. The excavations have produced fossil faunas with an important cave bear component, and three different lithic assemblages of 315 pieces from Unit II, four from Unit III, and 68 from Unit Vm.
2. Hominin raw material procurement strategies in Units Vm, III and II indicate exploitation of a range of local materials but with an emphasis on chert of local origin. Evidence for the use of non-local rock can be seen in the few obsidian pieces found in all levels. The closest known obsidian sources are 80–150 km away. This distance falls within the range of Neanderthal network territories suggested by Geneste (1991) and Gamble (1999).
3. Technological differences are noted between the lithic assemblages of Units Vm and II. The lithics in Unit V were manufactured using a simple flake technology in which there is no evidence for core preparation. The assemblage consists of retouched and unretouched flakes, flake fragments, a few cores and some undiagnostic elements. The stone artifacts from Unit II, with their Levallois component, indicate the use of prepared core technology and are unquestionably Middle Paleolithic. Both units have been affected by post-depositional processes and show an elevated presence of pseudo retouch, especially in Unit II. Of the few clearly retouched pieces in both units, most can be classed typologically as side scrapers.
4. The limited presence of cortex and the paucity of knapping debris suggests that the early stages of

knapping did not take place at our excavation area towards the back of the cave. Initial knapping activities may have occurred in other parts of the cave or in locations (unknown) outside the cave, with the products transported to the back of the cave. Given the greater area excavated between the 1960s and 1980s, it is possible that some knapping activities took place within the cave proper in areas that are now impossible to determine.

5. The current assemblages recovered from Units V and II, although fewer in number, are technologically similar to those from earlier excavations, but typologically the earlier assemblages are more diverse. However, current post-depositional studies indicate substantial presence of pseudo retouch, a factor that may also relate to the earlier assemblages.
6. The Unit II lithic assemblage may indicate Early Middle Paleolithic presence in the Southern Caucasus, and may form part of the earliest chronological group of the Middle Paleolithic of the Southern Caucasus. The material from Unit Vm may be late Acheulean on the basis of dating, lack of Levallois, the general larger size of the pieces (although no bifaces have been found), and its stratigraphic position below Units II, III, and IV. Alternatively, it could also represent an Early Middle Paleolithic occupation.
7. Azokh 1 is one of numerous cave sites in the Caucasus, often in karstic areas, that have evidence of hominin occupation during both the Middle and Upper Pleistocene. Many of these sites contain a range of fauna, among which cave bear is often common. Indeed, as with Azokh, most sites with bear remains were bear dens.
8. The small sizes of the recently excavated Azokh Unit Vm and Unit II lithic assemblages are not unusual in the context of the Caucasus. Nevertheless, the Middle Paleolithic assemblage from the earlier excavations indicates a larger assemblage, so that the present small assemblage may reflect the limited size and location of the recent excavations. However, the difference in artifact numbers between Units II and V is also seen in the materials from the earlier excavation and therefore may reflect real disparity in assemblage size or length of human occupation.
9. A number of sites in the Caucasus that have yielded small lithic assemblages, missing earlier stages of the operational chain, have been interpreted by other authors as short stay occupations. The limited evidence for *in situ* knapping activities in the most recent assemblages from Azokh Units Vm and II could also fit with short human occupations, at least at the rear of the cave.
10. The future of Paleolithic research in the Caucasus is encouraging. The rigorous methodology that is standard today, coupled with increasingly sophisticated techniques of excavation and analysis, serve to further knowledge of Early and Middle Paleolithic occupation of the region and contribute towards a greater understanding of hominin behavior during the Middle Pleistocene, both within and beyond the geographic boundaries of the Caucasus and adjacent areas.

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