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GOBIERNO DE ESPAÑA

MINISTERIO DE CIENCIA E INNOVACIÓN



CSIC



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NOTAS PARA LA HISTORIA RECIENTE DEL MUSEO NACIONAL DE CIENCIAS NATURALES

HOMENAJE A MARÍA DOLORES SORIA MAYOR

24

Javier Lobón-Cervía y Jorge Morales  
(comps.)



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DE CIENCIAS NATURALES

HOMENAJE A MARÍA DOLORES SORIA MAYOR

MONOGRAFÍAS

MUSEO NACIONAL DE CIENCIAS NATURALES

Consejo Superior de Investigaciones Científicas

El presente libro está dedicado a la memoria de Dolores Soria, paleontóloga, amiga querida por todos, que durante más de treinta años desarrolló su carrera científica en el Museo Nacional de Ciencias Naturales, CSIC. Como homenaje hemos reunido cerca de una veintena de trabajos que intentan aproximarnos a la historia reciente del Museo, entre la Guerra Civil española y la actualidad. Esta parte de la historia del Museo es poco conocida, incluso por muchos de los que trabajan en él. Con esta idea pensamos que las contribuciones presentadas en este volumen generarán un mejor conocimiento de lo que hoy en día es el Museo. Muchas de ellas inciden en un tema interesante y complejo, las colecciones del Museo. Creemos que las colecciones de Historia Natural o de Ciencias Naturales, como se prefiera, son la razón de ser (el alma) de los museos de Ciencias Naturales, y esto también vale para nuestro Museo, a pesar de las dificultades que han encontrado para desarrollarse. Asimismo, se abordan otros temas que raramente se investigan: ¿cómo era el Museo hace treinta años?, ¿quiénes trabajaban en él?, ¿qué fue del Instituto de Entomología?... sin olvidarnos de Dolores Soria, nuestra compañera de siempre.

*Ilustración de cubierta:* los miembros de la Unidad Estructural de Paleontología y Estratigrafía del Instituto de Geología del CSIC que comenzaron a trabajar de forma estable sobre el Terciario continental de España. Primera fila, de izquierda a derecha, Blanca Gómez Alonso, María Teresa Alberdi (directora del grupo), Carmen Sesé y Dolores Soria. En segunda fila, de izquierda a derecha, Manuel Hoyos Gómez, Paloma Gutiérrez del Solar y Jorge Morales. Fotografía tomada hacia 1981 en la puerta de entrada del Instituto de Geología, que estaba ubicado en el ala sur del edificio del actual Museo Nacional de Ciencias Naturales, CSIC.

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DEL MUSEO NACIONAL DE CIENCIAS NATURALES**

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NATURALES**

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**MONOGRAFÍAS**

CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS  
MADRID, 2009

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## XVII

### AZOKH CAVES EXCAVATIONS 2002-2006

#### MIDDLE-UPPER PALAEOLITHIC TRANSITION IN NAGORNO-KARABAGH\*

*Y. Fernández-Jalvo\*\**

#### Introduction

Azokh is a limestone cave site in the Lesser Caucasus. The cave has an almost continuous stratigraphic record rich in fossils, which has produced evidence of human activity and tools spanning middle Pleistocene to historic times. A middle Pleistocene human mandible fragment was found by an Azeri-Soviet research team that had originally excavated the site between the 1960s and 1980s. Renewed excavations by the present research team have been ongoing since 2002. Both periods of excavation have produced several remarkable finds; here we describe the site and its importance for human evolution.

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\* Acknowledgements: This paper is in homage to Dolores Soria who was always curious and attracted by these excavations, the site, the surrounding landscape and people. This wants to reply her many interesting questions. Thanks for your great concern and interest, Loli.

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Azokh Cave is located in a corridor linking Eurasia with Africa - a pathway probably not only used by humans but also by other species of animals that appear and disappear in Eurasia at this time. Neanderthals survival strategies are seen in this site to be closely connected to bears (*Ursus spelaeus*), both being species restricted to Europe.

## The Site

Azokh Cave is located in the south-eastern part of the Lesser Caucasus, near Azokh village on the left bank of the Iskhanaget River in the district of Hadrut, Nagorno-Karabakh (39° 37.06" N, 46° 59.30" E, 862 metres -a.s.l.) (Figure 1a). The view over the river valley from the cave is extensive. To the west the valley is bounded by the 3,000 metre a.s.l Mets Kirs Mountain. Dense forests extend south, north and east of the cave, beginning near the cave as steep woodland terraces of various heights and descending stepwise to the Mugan Steppe where they merge with the plain.

The site borders submountainous and mountainous zones. Azokh Cave's importance lies in its location in a geographic corridor that provides access between Eurasia and Africa and *viceversa* (Figure 1a). In addition to human ancestors, other Eurasian and African fauna may have passed through this corridor. Since 1991, the Georgian site of Dmanisi (Figure 1a) in the Greater Caucasus, has yielded several hominid fossils. *H.georgicus* nov.sp. is thought to date to ~1.7 Ma (de Lumley *et al.* 2000; Gabunia *et al.* 2000). These remains represent the earliest known European hominins. Mezmaiskaya Cave (Russia) with 30ky has yielded remains of one of the last representatives of Neanderthals (Golovanova *et al.*, 1999; Skinner *et al.*, 2005) - these were survived by a population of Neanderthals at the opposite extent of Europe in Gibraltar (Finlayson *et al.*, 2006). These sites are at the edge of an extensive corridor which, at the present time, has changed due to tectonic movements and isostasy in the area. While Azokh cave is relevant because of its geographic location, the fossils found so far help our understanding of human evolution as well as human and animal behaviour. The cave contains a nearly continuous series relating to three Pleistocene species in Europe, i.e. *Homo heidelbergensis*, *Homo neanderthalensis*, *Homo sapiens*. Among these species, *Homo heidelbergensis* found at the site is the most eastern representative of this species, absent from other sites in the Caucasus. In 1999, 2001 and 2002 we surveyed Pleistocene outcrops in Armenia and Nagorno-Karabakh (Fernandez-Jalvo *et al.*, 2004) in order to determine the geographic corridor.

Azokh is a limestone cave site that has a long gallery and several halls/chambers extending north-south for about 200 metres (shaded black in Figure 1b). Today it is inhabited by a large community of bats. Sediments inside the gallery had not provided fossils before our investigations in the cave. The main entrance to the cave is located at the southern area of this cave system and extends perpendicularly to the long, interior gallery (Figure 1b) for up to 50 metres. This entrance was extensively excavated between 1960 and 1988 by a Soviet-Azeri team head-

ed by Mammadali Huseinov, an archaeologist from Azerbaijan. The cave has southeast orientation and its entrance has exposure to long hours of sunlight (Figure 1c). The site is named Azokh cave after the nearby town, but it is also known as Azikh or Azykh as named by M. Huseinov. Our geological survey has revealed several new entrances (Figure 1c), two of which, Azokh 2 and Azokh 5, are similar in sediment thickness and characteristics to the sediments in Azokh 1, although these new entrances are smaller. The particular interest of Azokh 2 and Azokh 5 is that they had not been excavated by previous teams. In this article we describe the history of the site, the resumption of excavations by our team including new results, as well as the potential the cave has for yielding further remains that will aid the understanding of human migration and behaviour.

### **Azokh Cave excavations 1963-1988**

Mammadali Huseinov discovered the cave in 1960 (Lioubine, 2002, Mustafayev, 1996). It is not clear whether the site was first discovered as a phosphate mine for the exploitation of bat guano from the interior of the system, or whether, from the outset, the primary consideration was its archaeological interest. Whatever the origin was, the excavations yielded abundant Middle Pleistocene fauna and human remains. According to Lioubine (2002), the first 15 years of excavations were exhaustive. Before these excavations began the entrance was narrow and sediments almost reached the top of the cave. Huseinov's notes state that a height of 3 metres separated the cave floor from the roof (Lioubine 2002). Today the entrance is about 14 metres high (including the trench at the entrance Figure 4). Huseinov described the stratigraphy in two publications (1965 and 1974) but Lioubine (2002) describes that beds were not assigned to a specific thickness and sedimentary description was based mainly on arbitrary criteria. It was only in 1975, as the result of a multi-disciplinary approach, that a better description of the lithology was carried out by palaeogeographers Gadziev *et al.* (1979)\* and Velichko *et al.* (1980)\*. Unfortunately, by that time most of the site had already been excavated, causing serious difficulties to these investigations - information on the stratigraphy and excavation procedures had either been lost or was too schematic (Lioubine, 2002). It was also difficult to recognise Huseinov's stratigraphic sequence deeper in the cave or that assigned to the fauna and lithics recovered (Lioubine, 2002). Huseinov's team excavated a huge amount of sediment. Gadziev *et al.* (1979)\* and Velichko *et al.* (1980)\* and Markova (1982)\* described a rich fossil fauna collection from this site (these and archaeological material are currently housed at The Natural-Historical Museum of Baku in Azerbaijan).

Huseinov differentiated 10 beds, but Velichko and Garziev distinguished 17 or 25 lithostratigraphic beds (Lioubine, 2002). From Bed VII to IX, the sediments are hardly cemented and they are exposed in a trench at the cave entrance (Figure 2a). The exposure was unfortunately achieved through the use of explosives

\* In Lioubine, 2002.

and pick axes, with the loss of much information (Lioubine, 2002). Pebbles found in Bed VII were considered an old culture, named by Huseinov as *Kuruchai culture*, «... as the Azikh Cave is located in the Kuruchai River basin. The only other known civilization equivalent to Kuruchai Culture dates back 1.5 million years to the Olduvai Gorge in Tanzania. Huseinov believed the Kuruchai Culture dated from between 1.5 million years to 730,000 years ago» (Mustafayev, 1996, pg. 26). The sequence ranges in age from several hundred thousand years at the bottom of the series to historic periods at the top of the series. The human mandible fragment found in Bed V was assigned to a new species named *Palaeoanthropus azykhensis* but according to Kasimova (2001) it is middle Pleistocene human type (L'Arago's type, *Homo heidelbergensis*). This author raised doubts about the location of this mandible which was originally placed in the third horizon of Bed V, suggesting an age of 250ka (Lioubine, 2002), but in 1985 the mandible was referred to as originating from the fifth horizon of Bed V, suggesting an age of 350-400ka (Kasimova, 2001). Lioubine (2002) describes the partial damage of the mandible due to the fact that this bed was excavated with picks that broke part of the mandible, and hence the exact location for the mandible could not be controlled (Lioubine, 2002). In spite of all this, the find has to be considered an important contribution to human evolution and palaeontology of the Caucasus thanks to M.Huseinov and his determination.

The excavations directed by Huseinov were interrupted in 1988 when the Nagorno-Karabakh conflict started, with the outbreak of war in 1989. An armistice proposed by Russia was agreed by both sides in 1994, and has held to this day, although a peace treaty has still not been signed. Huseinov, who died in 1994 at the age of 72, was never able to return to Azokh Cave.

### **Azokh Cave project 2002-2006**

The Azokh cave project was resumed by an international and multidisciplinary research group in 2002. At that point in time little of some of the original sediments remained - located at the walls of the cave entrance and deeper within the cave. However, no sediments remained near the cave walls of the main chamber causing considerable difficulty in the identification of sediments and beds described by previous teams. Fortunately, the top limits of Beds I, II, III and IV were drawn on the limestone cave walls (Figure 2b), allowing us to confirm the contacts with sediments at the back of the cave and recognise where the limits of the different beds distinguished by Huseinov were set. A large amount of sediment had been removed by the previous teams - we estimate this to represent an original volume of about 3400 m<sup>3</sup>, of which 970 m<sup>3</sup> approx has been left intact at the back of the cave entrance chamber (Figure 2b). The top and bottom of Bed V, where human fossil had been recovered in the 1960s, were not indicated on the cave walls, but according to our recognition of Huseinov's stratigraphy at the back of the cave shows Bed V sediments to be almost 3 metres thick (Figure 3).

While we have managed to identify Huseinov's original stratigraphic beds there are some discrepancies between our observations and his descriptions. Contrary to Huseinov's descriptions, bed rock<sup>1</sup> was not reached at the base of the trench at the entrance to the cave where a hard and heavily cemented bed of rounded cobbles of quartz, chert and flint were found, covered by a dark, asphalt-smelling, oily-sticky textured substance. Original descriptions by Huseinov and others state that this trench (see Figure 2a, Beds VII-X), produced 186 tools assigned as Oldowan (Mode 1) (Mustafayev, 1996). The existence of a new lithic culture (Kuruchai) and, more importantly, the validity of these stones as stone tools, have not been confirmed (Lioubine, 2002). Huseinov interpreted Beds VI and V as corresponding to early Acheulian (Mustafayev, 1996).

According to Huseinov, when Bed IV was deposited, humans had abandoned the cave (Mustafayev, 1996). Our excavations have yielded a rich bed of bear remains in Bed IV which was likely to have been a bear den, with bones bearing cutmarks related to human butchery processes. From Bed II we have uncovered a large atypical hearth associated with Mousterian-Levallois stone tools and an interesting taphonomic phenomenon of diagenetic mineralization probably related to bat guano and water filtering that has affected fossil bone preservation. A possible working hypothesis is that this occurrence may be related to an increase in the bat population as well as processes of erosion and cave inundation by water from the interior. Further research on the fauna, sedimentology and taphonomy of this bed, will allow us to test this hypothesis. Bed I has thick charcoal levels that apparently correspond to hearths, pottery and tools from the Holocene period. Bed I is deposited over Bed II following an erosive unconformity.

### *Azokh 1 Cave Entrance*

Azokh 1 is the cave entrance dug by Huseinov's team. Work here was abandoned for fourteen years during which time the entrance became impassable. Before we resumed excavations it was necessary to clear the vegetation and large limestone blocks that had collapsed from the cliff overhanging the entrance. These blocks were broken by our field assistants and used to make steps to allow access into the four metre trench that had been dug by Huseinov's team. A rope was also attached to the cave wall to provide safe passage into the cave.

Next we installed an aerial grid to enable us to determine the spatial location of squares, and hence record the location of finds in three dimensions. At the back of the cave sediments that might feasibly have been excavated were covered with tons of disturbed and mixed sediment from both the upper and lower beds arising from previous excavations (Figure 4). This reworked sediment formed a very steep slope and uneven floor that at times made preparation work extremely dangerous and problematic, frequently causing difficulties when anchoring screws to fix the aerial cables to the cave walls. Once the excavation grid was

<sup>1</sup> Further studies have shown the location of the bed rock (MURRAY *et al.*, in press).

finally in place, and in order to reach *in situ* sediments, we removed more than 3 metric tonnes of disturbed overburden sediments from an area of about 14 m<sup>2</sup> that covered the excavation area of Bed V (Figure 3).

For practical and referential reasons we described platforms of various heights produced through the excavations of the previous researchers. These platforms were named as the Lower, Middle, Upper and Uppermost Platforms, and they have been used and referred in the excavation sheets and fossil labels. The Lower Platform is the level at which the cave is accessed from the outside when we started our works, at the height of Bed VI of the original stratigraphical descriptions. The Middle Platform is the level of *in situ* sediment uncovered by previous excavations (corresponding to the middle part of Bed V of the original stratigraphical descriptions). The Upper Platform forms the limit between Beds IV and V of the original stratigraphical descriptions. The Uppermost Platform is located at the first ledge of the section situated at mid Bed II and continuing up through to Bed I (see Figure 3).

Stratigraphic beds previously described by Huseinov were identified, measured and described (Figure 3). The topography of the entire cave system was measured and mapped (Figure 1c). During this geological work, four more passages to the interior of the cave system were mapped. Two of these entrances have confirmed palaeontological content (Figure 4).

In 2003, we dug a test trench of 1 square metre at the Uppermost Platform in Bed II towards Bed III of Azokh 1 to determine the richness of the palaeontological content and control sedimentological traits of this bed. At that time the very top of the series (Bed I) had not yet been prepared for excavation, but it was nevertheless essential to know more about the deposits, the stratigraphy, the fossil content of this bed as well as to obtain information for dating purposes. The vertical section had deep cracks running throughout the entire section and blocks of sediment that were at risk of collapsing. Indeed, one week into the season of 2003, a rescue excavation was carried out to recover all fossils from the front section that was in danger of collapsing. The excavation was a very successful, with the recovery of abundant fossils (mainly bear, *Ursus spelaeus*) and stone tools (in obsidian and chert) associated with ashes and charcoal. The excavation revealed the area of contact between Beds II and III, showing that the beds sloped down from the interior of the cave outwards, indicating the karstic system as the sediment source. The trench was stopped at the contact with the top of Bed IV.

Excavations of Bed V took place in 2002, 2003 and 2005. In 2002, the excavation was planned to recover the palaeo-topography of the cave. A horizontal excavation was however undertaken in 2003 and 2005 to confirm the inclination of the sediments. This showed that sediments were sloping downwards from the cave interior, providing, as for Beds II and III further evidence that the source of the sediments was from within the cave (Figure 5). Excavation of Bed V was difficult and slow due to the hard brecciated sediments (Figure 5 bottom left), and fewer fossils have been comparatively recovered than from Beds IV to II. However, a number of important finds have been recovered from this bed, such as obsidian stone tools from such an older time period (Middle Pleistocene-

Acheulian). Obsidian is an exotic raw material, so that finding it here at this early period might indicate a type of exchange with other groups in the vicinity or the collection of this precious raw material during seasonal movements or *ex profeso* expeditions.

In 2006, excavation of the top of Bed I was carried out and revealed a «*fumiere*» - burnt layers that result from cleansing of the floor surface through deliberate burning of discarded food remains and animal excrement that accumulate when animals are kept in a cave. This find may represent recent history as the local population took refuge in the cave, together with livestock, during periods of Russian, Turkish, and Persian conflicts since the XVIII century. Radiocarbon dating will provide better information on the age of these deposits.

In 2006 a complete survey from the different beds in Azokh 1 Cave was carried out to obtain information on the following topics:

- a) Hygrometry (soil humidity) and pH.
- b) Monitoring relative air humidity and temperature.
- c) Detailed sampling every 20 cms for starch and pollen.

### *Azokh 2 Cave*

Azokh 2 is located at the northern side of Azokh 1 Cave. The topography, height and geomorphology of the cave roof and walls are similar to Azokh 1, although not as deep. The top beds seem to contain similar sediments to those that Huseinov excavated in Azokh 1 Cave, but the *in situ* sediments are covered by several tons of unstratified sediments. We removed and dry-sieved the overlying *ex situ* sediments rapidly, with most of this work being carried out in 2004. The sediments contained bone remains left by visitors in recent periods, together with some broken pottery sherds and metal artefacts that may date to Medieval and Bronze Age times, although there is no clear chronology. In 2002, a trench was dug at the cave entrance to determine the thickness of modern mixed sediments above the *in situ* sediment. By the end of that season, the trench had reached the *in situ* sediment, but there remained several tons of mixed sediment covering the rest of the site. We continued to remove sediment until there was enough space to stand up, at which point we installed an aerial grid (Figure 5). During the subsequent removal of mixed *ex situ* sediments (closer now to the *in situ* sediment) we recorded any find (modern food remains as well as any pre-historic or historic pieces) with reference to excavation square and coordinates that will be used in future excavations. Extension of the area deeper into the cave in 2003, revealed a massive accumulation of large blocks at the back of the cave and in a connecting steep shaft (Figure 6). These big blocks correspond to a cone of collapsed blocks in one of the chambers of the deep interior of the cave system that had been mapped during the topographic study of the cave in 2002 (Figure 1c). An inspection of the interior of the cave further revealed the magnitude of the rocks and the danger they posed for any excavation work, as the cone could

become destabilised by the removal of underlying sediments during the course of excavations. This discovery suggests that the rock accumulation originates from an intermediate chamber between Azokh 2 and the top of the limestone. Before beginning any excavation, safety and preventative measures need to be addressed. We invited S. Hayrabetyan, a mining engineer from Drambon Mine near Stepanakert, to visit Azokh to advise us safe solutions for long-term excavation. These works are still in progress and, therefore, excavations at Azokh 2 have not started yet (Figure 7). We, however, have dug two geological trenches towards the interior of the cave to obtain further information about the inclination of the stratigraphic beds, to identify the *in situ* sediment and understand its correlation with the interior of the cave. A third trench was dug outside the entrance, at the edge of the cliff next to the wall (Figure 6) to identify *in situ* sediments, cave wall geomorphology and karst formation. All these trenches have shown identical traits in sediment characteristics than Azokh 1.

### *Azokh 5*

In 2004, one of our field assistants (M. Balasanyan) drew our attention to fossils in the sediments outside Azokh 5 (see Figure 1c), an entrance to the cave system that we had previously mapped in 2002 but not surveyed fully. We then explored this entrance and after a narrow passage, an exposed 4 metre high section of untouched fossiliferous and archaeological deposits was exposed beneath (Figure 6), the interior gallery cave floor. An unknown depth of sediments lies beneath the 4-metre section, but seems to duplicate the exposed thickness. The discovery of these sediments is extremely important as it will change many of our previous and potential results. This connection with the inner part of the cave suggests frequent visits of ancient human groups, although the purpose and duration of occupation is still unknown. This is a second entrance containing fossiliferous sediments, with ceramics present in the upper layers, and covered by speleothems formed after sediment deposition. There is no evidence of any present-day incursion. The nature of these sediments will allow us to apply different analytic methods and techniques.

The entrance to this site (Figure 6) makes works inside this chamber difficult due to the narrow access nowadays. Two samples visible in the section (a sheep mandible and a long bone) were taken with some of the sediment from beneath them for DNA and dating. So far, 5 stratigraphic Beds, A to E, have been distinguished (Figure 8). Dating is in progress and at the moment, investigation has targeted geological questions and sampling. A 1 metre square test trench was excavated during the 2006 season. Samples were also taken every 20 cms for starch and pollen.

## Current progress

The investigations undertaken at present have concentrated primarily on local geological survey, and therefore, the emphasis has been on geomorphology, stratigraphy, sedimentology, karstic system dynamics and stone tool raw materials. With regard to the new sites, our main aim has been the survey of new entrances to determine their potential and value. It is not our aim in this paper to provide a complete list of results of our analyses so far undertaken; most of these investigations are in progress and will be published in the near future or are the subject of Doctoral Theses by both European and Karabagui students. Maps based on 3D methodology are also in progress for future exhibitions and internet publications.

Analysis of fauna and dating extends to the limestone where several corals and invertebrates have been found. These studies suggest a Jurassic age for the limestone. *Thalassinoides* tubes have been found in the sides of the trench in Beds VII-VIII (Figure 14). *Thalassinoides* is interpreted as a combined feeding and dwelling burrow, but has been observed as a boring in some cases. The probable trace maker was an arthropod, decapod crustaceans, related to marine environments present (Meldahl & Cutler, 1992; James & Bone, 1994) during the formation of the limestone in the Jurassic.

Bed II dating samples were formerly tried by radiocarbon analysis, but results show that the age exceeds radiocarbon range, that is, more than 60 ka. Stone tools from this Bed II appear to be Mousterian with a Levallois component.<sup>2</sup> Uranium series has given an age for Bed V of no more than 200ka, while racemization (D/LAsp) provides an age of around 300ka for the same area (Fernández-Jalvo *et al.* 2004). This is slightly younger age for the human mandible fragment recovered in 1968 established as 350-400ka, although the age is still middle Pleistocene. Stone tools accompanying these fossils from Bed V may be Acheulian, although pieces recovered so far are not diagnostic. Luminescence dating for this part of the cave (30 metres deep into the cave) has not been successful. New dating based on ESR and U-series is currently in progress at the Canberra laboratory and a subsequent analysis of Racemization on samples used for ESR may also provide a control for both methods.

Taphonomic studies carried out at Azokh 1 confirm the absence of reworking processes that may disturb dating results as has occurred in other sites (Grün *et al.* 2006). Bed VI, however, shows evident signs of transport. Diagenetic modifications observed on sediments from Bed II, stones and fossils, may, however, produce disturbances, and hence affect dating results, and this is currently under investigation. Charcoal and fossils for radiocarbon dating at the very top of the sequence (Bed I in Azokh 1 Cave, Bed A in Azokh 5 Cave, and Azokh 2 Cave) are nowadays also in progress.<sup>3</sup>

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<sup>2</sup> Further information on stone tool technology can be obtained from MOLONEY *et al.*, in press.

<sup>3</sup> Further information on dating can be obtained from FERNÁNDEZ-JALVO *et al.*, in press.

In general terms, we can confirm the presence of humans in Nagorno-Karabakh for at least two hundred thousand years. Almost all units show evidence of human occupation of the cave - at times it was intensive (Beds I, II and V in Azokh 1 Cave and Bed A in Azokh 5 Cave), and at times occupation followed the use of the cave by other animals, such as cave bears found in Bed IV. It seems that fossil animal species were extensively exploited as sources of food by humans at this site - this is evidenced by the abundance of bone remains bearing traces of breakage by humans and cut marks made by stone tools, as well as burnt fossil remains found in hearths, often in association with stone tools. Anatomical elements recovered from Bed IV were low meat and low marrow-bearing elements, such as numerous fibulae, hand and foot bones. Most bones were complete and many bore cutmarks made by stone tools. It seems that the cave bears were a particularly important food source for the humans. Evidence suggests that humans entered the cave and took advantage of hibernating bears, possibly butchering those that were already dead. This evidence also suggests that these anatomical elements were abandoned in the cave because they were of little use or nutrition, and so were not worth transporting. These butchery activities occurred towards the rear of Azokh 1 Cave entrance, indicating that humans did not chase bears out of the cave, but probably just took advantage of recently deceased or weakened animals, - a strategy that is considerably less risky than hunting these extremely large cave bears, which may have been up to 4 metres high, and weighed more than 700 kg. The most abundant species for macro- and micro-mammals are *Ursus spelaeus* and bats, respectively.

In addition to sampling for dating, several samples were also taken for palaeogenetic studies (DNA). Samples for DNA analysis were collected according to strict protocol to avoid contamination (see Figure 9; Pruvost *et al.* 2007). We sampled modern sediments from several different areas in order to provide a baseline for comparison with DNA obtained from fossil specimens in Azokh 1, Azokh 2, and Azokh 5 and from the dark gallery at the interior of the cave. Analyses of these samples are ongoing. So far site conditions have prevented the successful recovery of DNA and as there is no organic matter, the situation is similar to that at Apigliano (Smith, 2002) a special case of fossilization and bone preservation. Taphonomic traits show *in situ* fossils in all units studied so far. Bed V is characterized by a more cemented sediment, moderately rich in fossils. This is in contrast to Bed IV, which is extremely rich and has very dry and fine sediment (dusty loams). The top of Bed III and base of Bed II are also cemented, but not as much as Bed V. The top of Bed II in Azokh 1 is a difficult unit to interpret taphonomically (Figure 12). Present in the top of Bed II was a large hearth with associated fossils, stone tools and stones, but diagenetic acidic water percolations have produced strong chemical changes that have seriously damaged both fossils and stones. Chemical analyses by X-ray diffraction, fluorescence and dispersive energy, together with ultramicroscopic observations are providing interesting results of a special case of fossil preservation.

## Summary of work at Azokh 2002-2006

### *2002 season* (Figure 4)

1. To install the aerial grid in Azokh 1 as a permanent reference for systematic excavations.
2. To identify and understand the geological units described by previous teams that had excavated the site.
3. To confirm the potential of the cave to yield significant archaeological and palaeontological finds, and to add to the understanding of human migrations in this region.
4. To start palaeontological/archaeological excavations.
5. To describe the stratigraphy of the site.
6. To describe the cave topography.
7. To survey the area near Azokh Cave searching for comparative sites.

Local Field Assistants Azokh village: A. Ohanyan, A. Gervorkian, A. Balasanyan, H. Boghosian, G. Balasanyan.

### *2003 season* (Figure 5)

1. To continue extraction of the Middle Platform (Bed V) and extend excavations to the upper part of the series Uppermost Platform (Azokh 1 Cave).
2. To investigate cave formation processes (the slope of and correlation between beds).
3. To take samples for dating (ESR, TL, palaeomagnetism, racemization, isotopic, Carbon and Uranium series) from several units and areas (Azokh 1 Cave).
4. To increase fossil and lithic collections for the analysis and research study by specialists and PhD students (including bear fossils and DNA samples) (Azokh 1 Cave).
5. To clean, open and prepare the new cave entrance (Azokh 2) for excavation.

Local Field Assistants Azokh village: K. Arakelian, A. Azatkhanian, H. Balasanyan, M. Balasanyan, E. Balasanyan, G. Arkady.

### *2004 season* (Figure 6)

1. To wet-sieve and sort the sediment contained in sacks that could not be processed during the previous excavation season.
2. To undertake investigations on the cave formation processes including:
  - a) 3-dimensional digital mapping of the cave system

- b) survey and planning to resolve the safety and infrastructure problems in Azokh 2 (formerly Azokh North) - a cone of blocks in the inner part of the cave system that is at risk of collapse into the cave (see Fig. 1).
3. To take samples to complete fossil DNA preservation analyses.
4. To return fossils from the 2002 season that had undergone conservation and analysis to the Museum of Stepanakert.

Local Field Assistants Azokh village: K. Arakelian, S. Arakian, A. Arzumian, M. Balasanyan, A. Boghosian, Z. Boghosian, A. Gevorkian, A. Minassian, and A. Ohanyan.

#### *2005 season (Figure 7)*

1. Azokh 1 Cave:
  - a) To continue excavation of the Middle Platform (Bed V).
  - b) Preparation and excavation of the Uppermost Platform (Beds I-III).
  - c) To continue training of local field assistants in excavation techniques.
2. Azokh 2 Cave: to continue the safety works and planning for excavation of the cave in consultation with Dr. S. Hayrabetyan (Engineer, Drambon Mine, NK).
3. Azokh 5 Cave: to finish exploration of this cave entrance and to assess requirements for excavation in 2006.
4. Geological survey and sampling:
  - a) To complete 3-dimensional mapping of the entire cave system in order to further understand cave formation processes and to aid the understanding of the connection of the cave entrances with the interior of the cave system.
  - b) To continue sampling for dating purposes.

Local Field Assistants Azokh village: R. Abrahamian, A. Arzumian, Z. Assyrian, A. Gevorkian, A. Minassian, M. Ohanyan, G. Petrossian, M. Hayrabetian, M. Zacharian.

#### *2006 season (Figure 8)*

1. Excavation of Beds I and II, Azokh 1 Cave.
  - a) To excavate and prepare fossils recovered from these units.

- b) To sample for phytoliths, microgeomorphology, radiometric dating and taphonomy.
2. Preparation of Azokh 5.
    - a) To provide a detailed stratigraphy of this locality.
    - b) To survey and sample for dating purposes.
    - c) To provide a scaled geological section of the cave.
    - d) To excavate a test pit of the section (Beds A, B, C).
  3. Analyses of the whole sequences of Azokh 1 and Azokh 5 Caves:
    - a) Hygrometry (soil humidity) and pH.
    - b) Monitoring relative air humidity and temperature.
    - c) Detailed sampling every 20 cms. for starch and pollen of both sections (Azokh 1 and Azokh 5).

Local Field Assistants Azokh village: A. Arzumanian, Z. Boghosian, A. Gevorkian, A. Balasanyan, A. Bagdasaryan, M. Hayrabetian, M. Zacharian, K. Azatkhanyan, T. Assyrian, S. Avanesyan, V. Dalakyan, H. Martirosyan.

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## CAPÍTULO XVII



Figure 1a



Figure 1b

Figura 1c

### Figure 1.

- Top\_right: Site location. The white arrows indicate possible migration pathways from Africa. The main map shows the Caucasian mountain range and the location of Dmanisi, Azokh Cave, Koudaro, Barakai and Mezmaiskaya Caves.
- General view of the limestone hills where the site is located, pictured from the road to the town of Azokh. Top right: detail of the Main Cave Entrance, Azokh 1. Bottom left, view of the valley and the town of Azokh from the cave entrance.
- Topographic map of the caves of Azokh. The dark gallery (drawn here in black) is inhabited today by a vast population of bats. Top right: a picture of one of the test pits dug inside the dark gallery by other research groups searching for fossiliferous sediments. Top left: picture of the cave at the interior of the dark gallery. Azokh 1 was originally excavated from 1963 by Huseinov's team. Azokh 2 discovered by the current research group in 2002, is a second entrance to the cave, only 7 metres deep. Azokh 5 discovered in 2004 directly connects to the dark gallery with several metres of fossiliferous sediments.

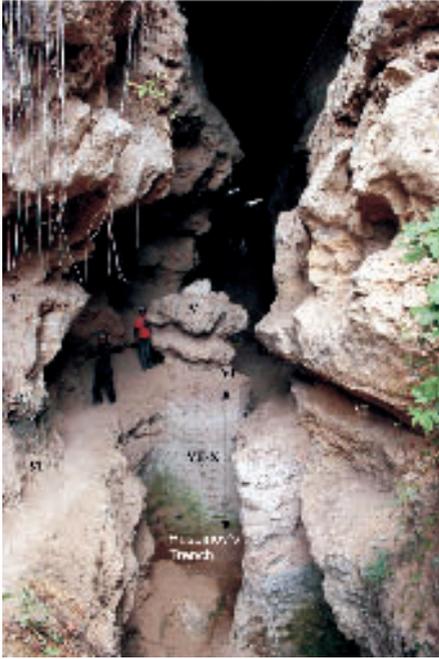


Figure 2a



Figura 2b

Figure 2.

- a. View of Azokh 1 where previous excavations led by Huseinov were digging. At the entrance, a 4m deep trench contains beds VII to X described by Huseinov. A few remains of beds VI and V were left adhering to the cave walls at this part of the cave.
- b. Excavations in Bed V. This view shows the extensive excavation performed by Huseinov's team. The green line shows the top of the sedimentary sequence. The walls of the cave are cleaned of sediment, but the contacts and the numbers of the beds were painted on the limestone walls.

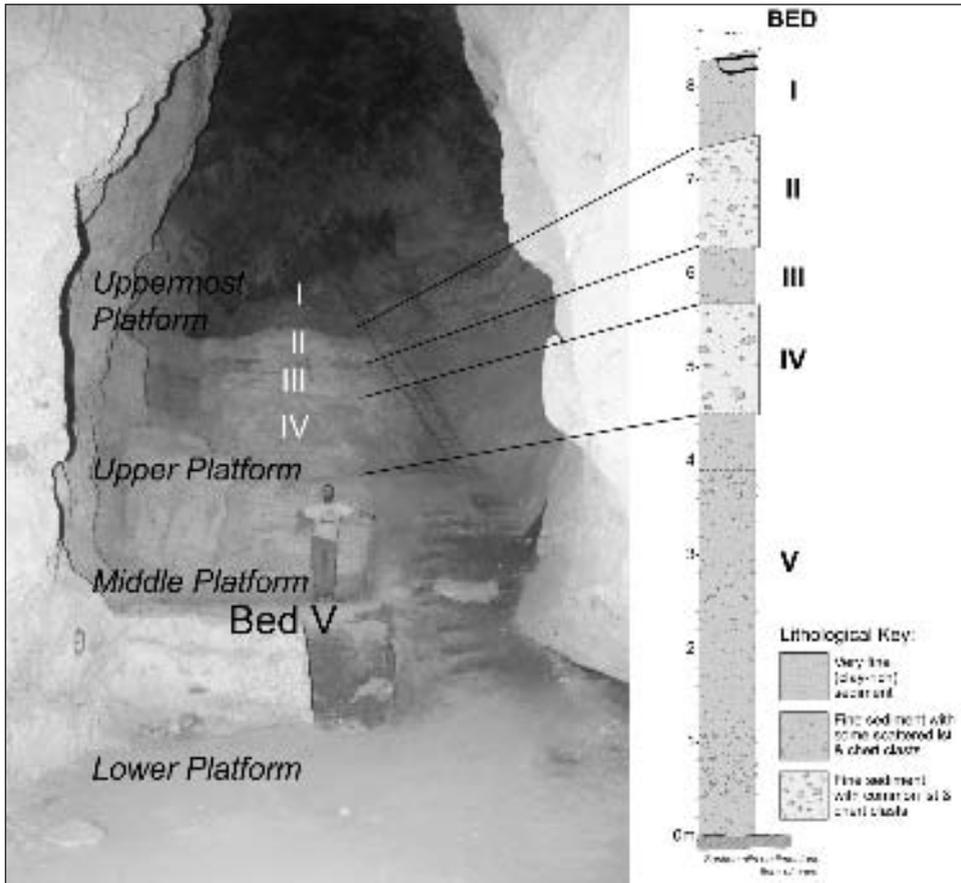


Figure 3.

Left: View of the excavation area left by Huseinov's team. About two metres thickness of overburden from previous excavations (about three cubic tones) was removed in 2002. For practical and referential reasons we described platforms (Lower, Middle, Upper and Uppermost Platforms).

Right: Stratigraphic section of Azokh Cave deposits. Beds have been correlated to descriptions and nomenclature stated by previous teams. Bed I has hearths, pottery and tools indicating Holocene Age. Beds II and III have yielded Mousterian stone tools. Bed IV was described by Huseinov (in Lioubine, 2002) as sterile, but we have found abundant fossil remains. Bed V has yielded human remains and Achelian stone tools. These beds are fossiliferous, together with Bed VI which has a evidence of high energy transport. According to Huseinov (in Lioubine, 2002) Bed VI corresponds to early Acheulian. Bed VII to the bottom of the series have been characterized by Huseinov (in Lioubine 2002) as pebble culture (Oldwan or Mode 1), but these beds are not fossiliferous and corresponds to moments of cave sealed (non-connected) to the exterior. We have not yet excavated down to this level, only sampled.

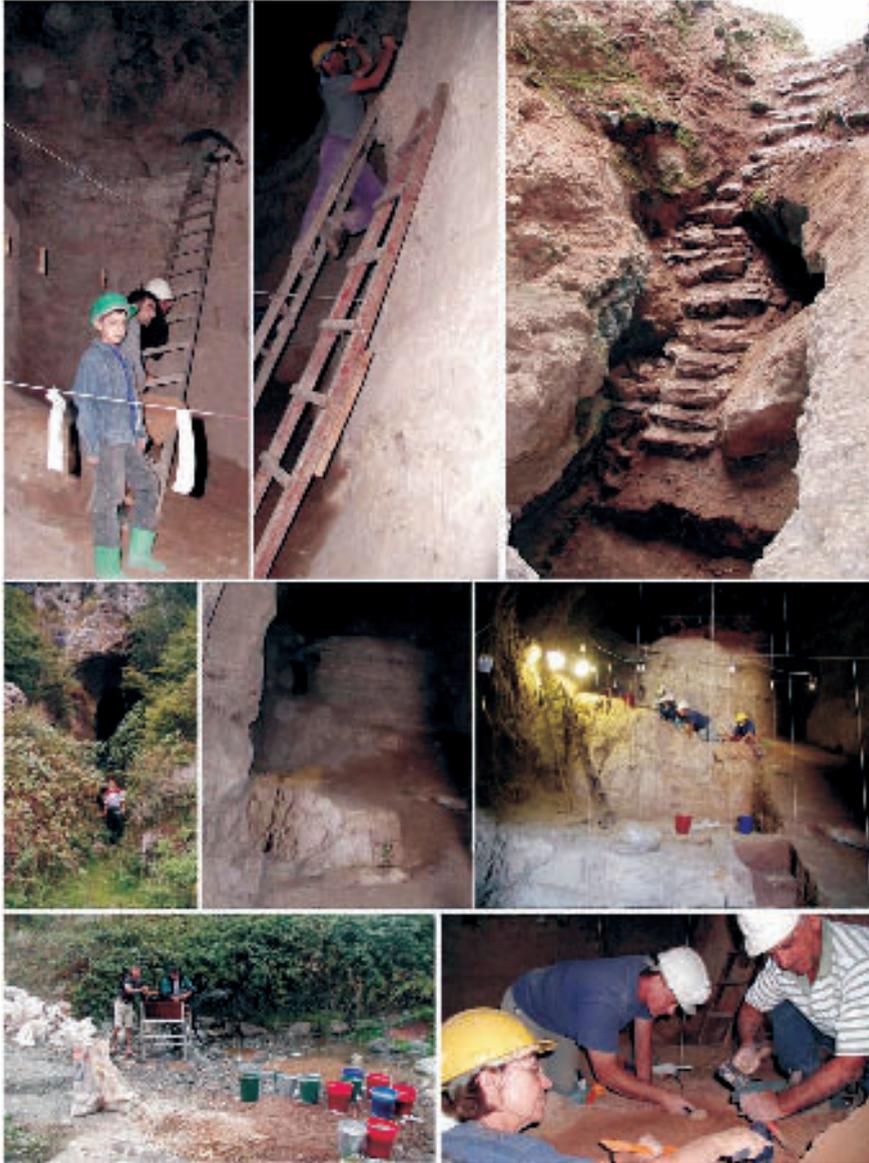


Figure 4. Summary of activities during the 2002 season. Top row, from left to right: Installing the aerial grid. Right: View of the steps made with broken limestones blocks which have fallen from the vertical cliff and which partially blocked the access to the cave. Middle row, left and centre: The site in 2002, before the excavations started, with the cave entrance covered by vegetation and the site covered by Huseinov's team with overburden sediment to protect the excavation. Right: View of the site after the aerial grid was installed and the overburden covering Bed V was removed; and preparing the excavation surface at Bed V-IV (Upper Platform). Bottom row, Left: facilities for wet sieving at a nearby river. Right: excavating a stone tool at bed V; sediment at this bed is especially cemented and hard.

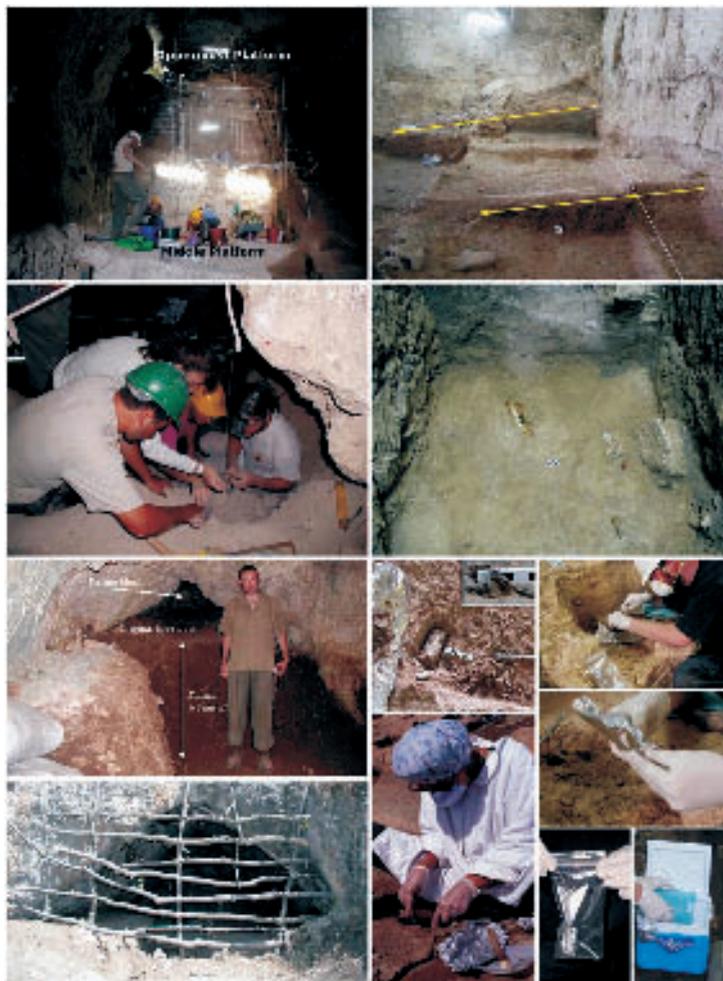


Figure 5. Summary of activities during the 203 season. Top row, left: Excavations continued in bed V (Middle Platform) and Bed II (Uppermost Platform). Top row, right: The Azokh sediments have an inclination from the interior of the cave towards the exterior as seen by the arrows. To confirm the sediment inclination and sediment source, we decided to start digging according to flat-horizontal plans. Second row, left: Rescue excavation during two days to recover fossils that were exposed along deep cracks in the sediment. Right: view of the test pit opened in D46 (one square metre) to control fossil content and stratigraphy. Notice the abundance of bear fossils and stone tools in obsidian associated to ashes. Bottom row, left, view of the entrance at Azokh 2 showing the original cave floor and the ex.situ sediment that has been removed; at the end of the cave, the falling block cone is indicated by a white arrow; below; fence protecting the site when the 2003 season finished. Sequence of pictures showing the procedure to recover samples for DNA. Masks, gloves and hats were used to prevent contamination by our breath and skin contact, and tools were previously sterilized. Samples were wrapped in foil and labelled, and they were kept in sealed sterilized plastic bags. Identical extraction procedure was followed sampling the sediment immediately underneath the fossil, and control samples of sediment from other parts of the excavation area were also kept sterilized and labelled. Finally all samples were stored in a refrigerator.

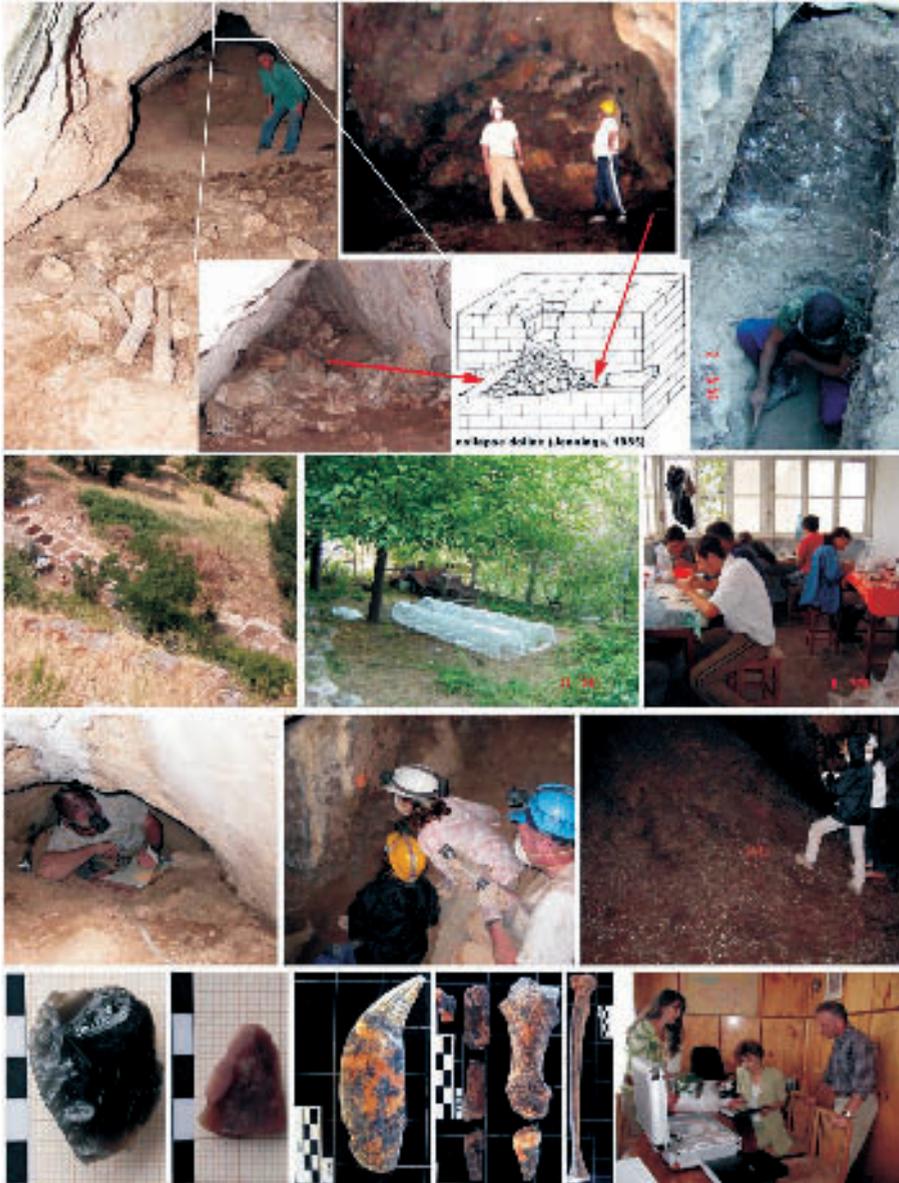


Figure 6. Summary of activities during the 2004 season. Most work was related to clearing the new sites (top left Azokh 2), and inspection of the falling block cone (both from the entrance of Azokh 2 and the interior of the cave) which provided the model shown in the block diagram. Test pits at the cave entrance of Azokh 2, were dug to show the configuration of the cave walls. Other work this year was concentrated on screening and sorting excavation residues from previous years' work (second row). The discovery of Azokh 5 was the highlight of the season. Further sampling for modern DNA in the interior of the cave. Lower row: stone tools and fossils from Azokh, restored and labelled, were returned to the Museum at Stepanakert (bottom right).

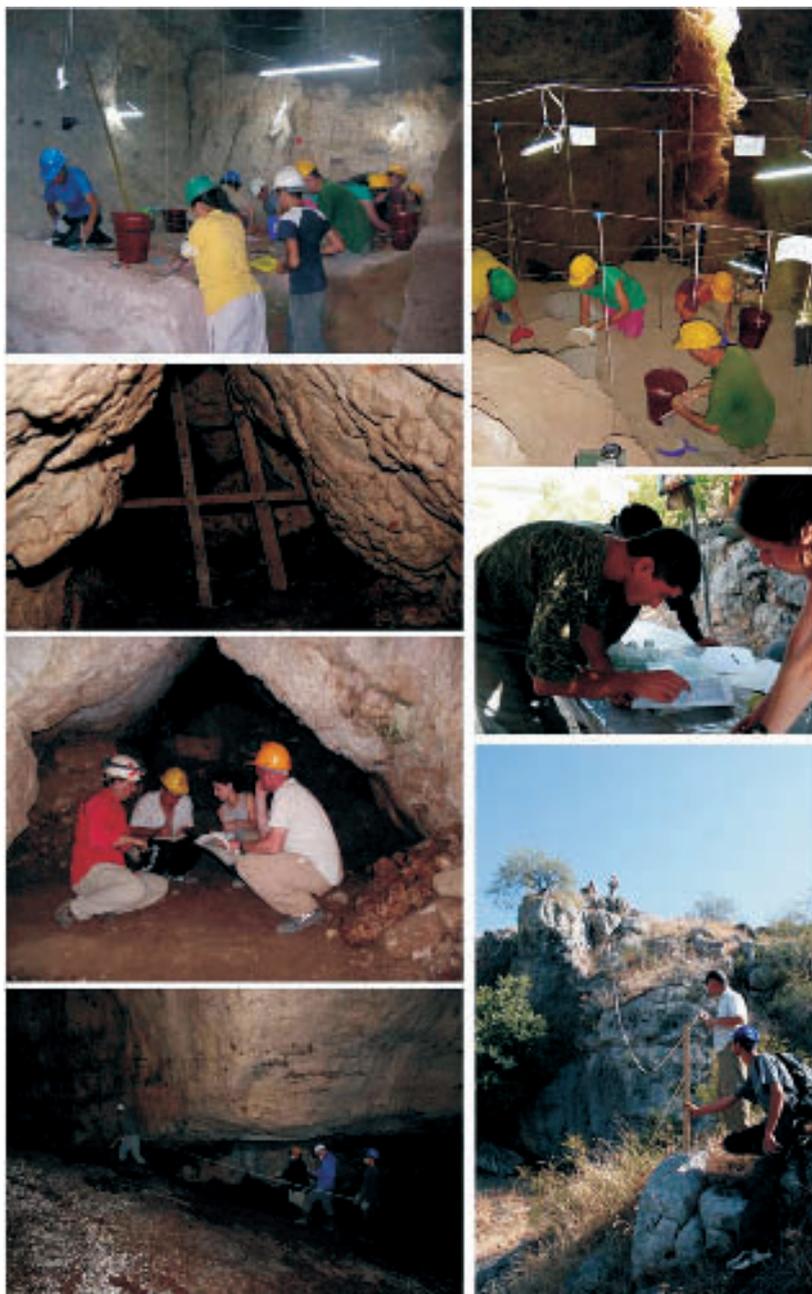


Figure 7. Summary of activities during the 2005 season. Excavations were performed in Bed V (Middle Platform) and Bed II (Uppermost Platform). Preparation to block the connection between Azokh 2 and the boulder cone was undertaken by specialists and team members. 3D topography of the interior and exterior of the cave system was accomplished.

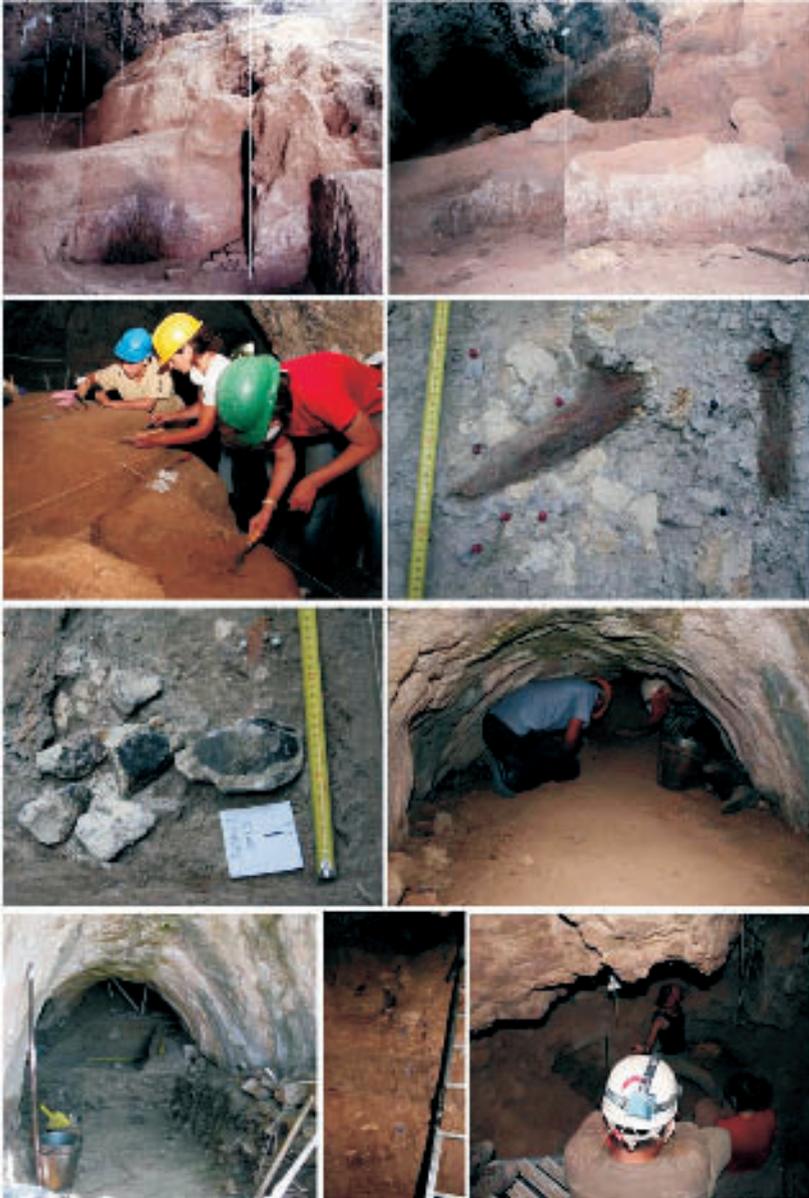


Figure 8. Summary of activities during the 2005season. Excavations at Azokh 1 were concentrated on Bed I and II. Bed I had an extensive hearth used several times and a «fumière» was distinguished (single hearth to burn animal dung and food remains). Second row, left: (Bed I) digging the fumière; right: (Bed II) fossils appear damaged due to diagenetic processes. Third row, left: (Bed II) burned stones at the bottom of the hearth. Right: Azokh 5 is opened and sediment was seen to be ex-situ due to collapse of sediments from Bed A at the top of the series. Fourth row left: cleaning the entrance to reach the in situ sediment. Centre and right: A trial trench of 1m2 was opened from Bed A to the top of Bed E to control the stratigraphy.