EXCAVATIONS IN MANOT CAVE: 2010 PILOT SEASON

Permit number G-62/2010

by

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Abstract

Manot Cave is a unique relict karst cave located in the western Galilee, Israel. The cave was inhabited from the Middle Paleolithic through the Epipalaeolithic periods (250,000-15,000 BP) before it was naturally blocked. The finding of abundant archaeological chipped stone tools, animal bones, bone tools and human remains in the cave lead to a pilot excavation season, conducted during July-August 2010. The results of this excavation are presented herein.

The cave has a prelatic morphology and probably included a small entrance and two natural terraces (inside the cave) where most of the human activities likely occurred. Speleothems are located throughout the cave including a massive cluster that predates the human occupation. The characteristics and composition of the lithic finds suggest the occupation in the cave was intensive during the Upper Palaeolithic period attributed to the Ahmarian and Aurignacian cultures. When unoccupied by humans, the cave was apparently used intermittently by carnivores as attested by concentrations of long bones along the cave walls as well as near the original entrances.

Introduction

Manot Cave is located on the southern slopes of Givat Hardalit by the confluence of the Nahal Esh'har tributaries in the western Galilee (map ref. NE 218450-771150, SW 218350-771050; Fig. 1). The cave was discovered in 2008 during construction activities which damaged the roof of the cave. Immediately after, a team from the Cave Research Unit of the Hebrew University visited the cave and reported the findings of a human skull and other archaeological remains to the Israel Antiquities Authority (IAA). Following these discoveries a short archaeological survey was conducted by O. Marder and H. Khalaily on behalf of the IAA in September 2008 reviling a spectacular cave with active speleothems containing rich archaeological remains dated to the Middle (250,000-47,000 BP) and Upper Palaeolithic (45,000-22,000 BP) periods (Fig. 2).

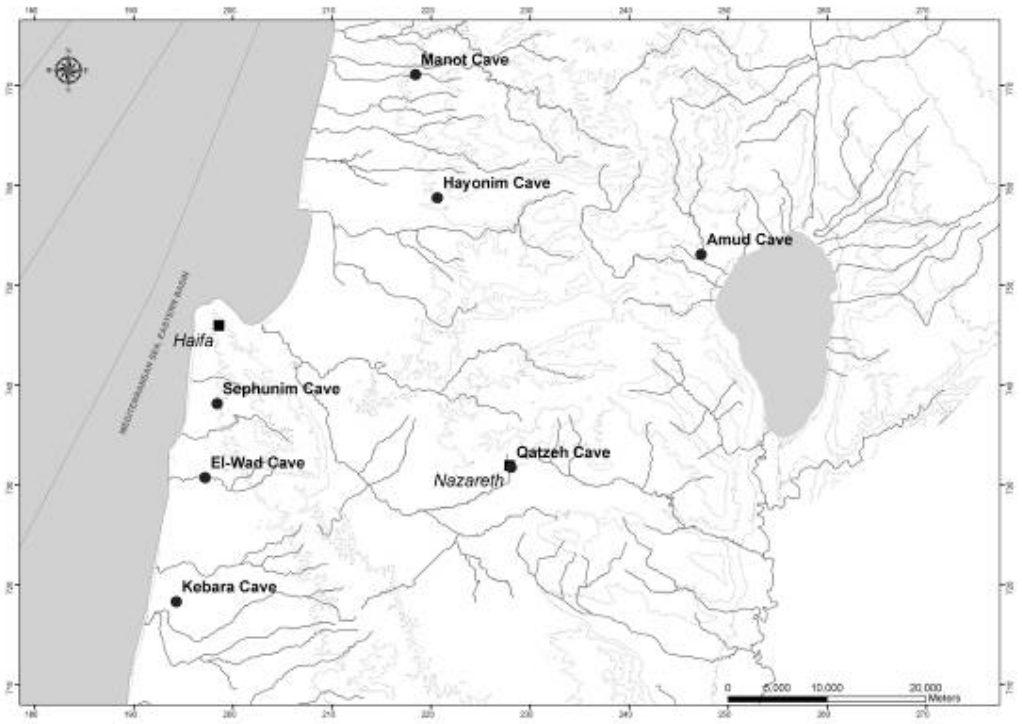

Figure 1. Location of Manot Cave and other cave sites mentioned in the text.

Following these discoveries the Israel Antiquities Authority and the Tel Aviv University decided to initiate a pilot excavation season during July 2010 to check the feasibility of a long term interdisciplinary research. The aims were to examine two

issues. (1) The archeological potentials at the cave, in particular the Upper Palaeolithic remains as these are expected to contribute in comprehending the geographical origins and dispersal routs of anatomically modern Homo sapiens (and see discussion below). (2) Tracing an entrance to the cave in order to improve the logistical access to it, as currently the only way in is made through the ceiling by rappelling. [1]

Figure 2. View of active speleothems inside Manot Cave.

The 2008 Survey

Due to unsuitable logistical conditions (deficiency in oxygen inside the cave; absence of proper lights) the survey was brief (one working day) focusing on the general characteristics within the cave. The most obvious observation was that the cave was blocked by rock falls and probably had two entrances attested by two taluses; a small and moderate one in the east and a massive steep one in the west.

Twelve archaeological find spots containing diagnostic lithic artifacts, charcoal pieces and faunal and human remains were plotted. Among the lithic

[1] Thus requiring special preparations that are time consuming and expensive propositions.

components notable were Middle and Upper Palaeolithic tools and cores (Figs. 3-4). The former consisting of a Levallois point (Fig. 3:1; find spot 3), typical of the Mousterian culture (e.g. Hovers 2009). The Upper Paleolithic component (find spots 1-6) seemed to represent the Aurignacian culture (Belfer-Cohen and Bar-Yosef 1981) as attested by carinated endscrapers, retouched bladelets (including atypical el-wad point) and burins (Fig. 4:1-6). This notion was further supported by a polished bone pendant (Fig. 4: 7; find spot 5).

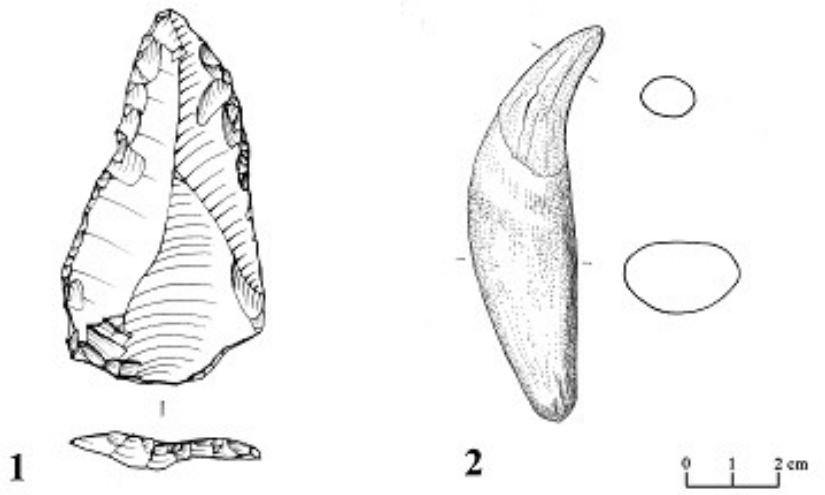

Figure 3. Middle Palaeolithic (Mousterian) finds from the survey. 1 Mousterian point; 2 bear canine.

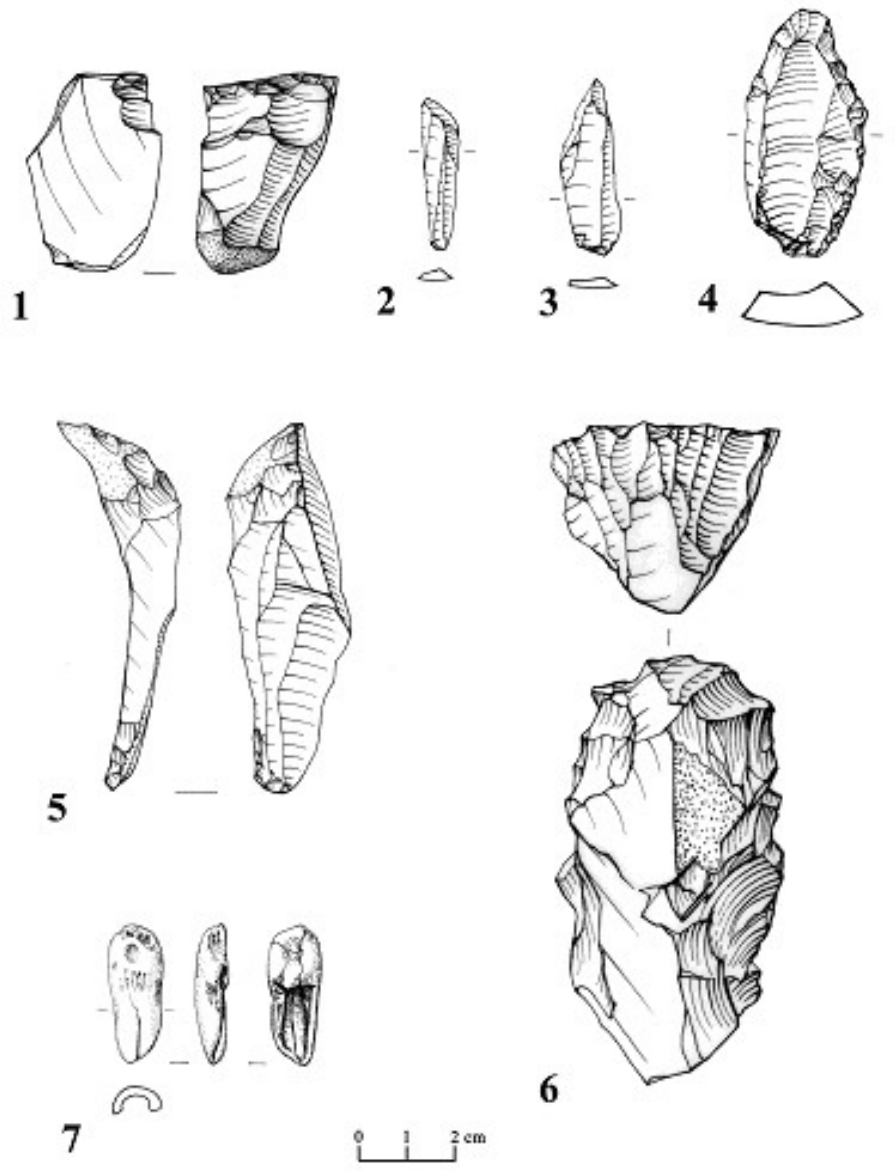

Figure 4. Upper Palaeolithic (Aurignacian) finds from the survey. 1 burin; 2-3 bladelets; 4 nosed endscraper; 5 overpassed blade; 6 carinated scraper; 7 bone tool.

The preservation of the animal bones in the cave seemed excellent, and was assumed to reflect two activity patterns (and see discussion in the faunal report). The first is anthropogenic, represented by bone fragments and burnt items often associated with lithic artifacts (find spots 1-6). The second activity is biogenic, attested by complete long bone shafts and mandibles found along the cave walls.

The taxa constituent included large mammals such as fallow deer, red deer, gazelle, horses, wild cattle, hyenas and bears (Fig. 3:2), as well as microfauna.

The human remains at Manot consist of an incomplete skull (calvaria) of anatomically modern human (Fig. 5). Even though the exact location of the skull is yet unclear (collected by amateurs prior to the survey presumably at find spot 12), it was assumed to derive from the Upper Palaeolithic context.

Figure 5. Skull fragment of anatomically modern human from the survey.

In sum, the results of the 2008 survey suggested Manot Cave is probably one of the most promising prehistoric sites ever discovered in the region for conducting a comprehensive multidisciplinary research for the following reasons.

1) The fact that the cave was sealed for a period of at least 15,000 years increases the chances for better preservation of prehistoric remains.
2) The cave is rich in archaeological remains dated to the Middle (250,000-47,000 BP) and Upper Palaeolithic (45,000-22,000 BP) periods. Since most of the documented finds in the survey date to the Upper Palaeolithic period and the recovered skull fragment was identified as anatomically modern human

the site is of high value in for the study of the origins of modern human population and their dispersal into Europe,.

3) Being an active carstic cave with an excellent record of speleothems a study of the isotopic composition of the cave deposits is warranted; for climatic and environmental reconstructions and U/Th dating of the archaeological occupations.
4) The abundance and great variety of faunal remains as well as their excellent state of preservation will enable a trustworthy reconstruction of the human diet. Furthermore a study based on microfauna within the cave will add vital information to paleoenvironmental reconstruction.

The 2010 excavation season

The 2010 excavtion season was conducted as a pilot focusing on several issues thus requiring an assembly of a multi-disciplinary research team. Accordinglly the field work included: an archaeological excavation in three field areas (opened adjacent to potential findspots identified in the 2008 survey), a comprehensive field survey (in and outside of the cave), documentation and collection of seven findspots of bone accumulations (recognized in the 2008 survey) by the archaeozoological team, a geological exploration and documentation of the cave (including sampling speleothemes for further lab research) and a sedimentlogical study of several localities (including the excavation areas) for assessing post-depositional processes.

The excavation areas

The excavation was conducted in three areas within the cave, their specific locations were chosen based on the 2008 survey results (Fig. 6). Due to the different physical characters of the investigated areas different field methods (i.e. resolution of the excavation) were employed.

The location of Area A in the south-eastern part of the cave was made for two reasons. The first is its proximity to the small moderate eastern talus that indicated on a possible entrance to the cave (Fig. 7). The assumption was that if this was the major entrance to the cave then Area A is located within the entrance hall, which is common in many cave sites in the Mediterranean woodland zone. The second reason was the discovery of a Levallois point on top of the eastern talus. Its presence was thought to indicate a Middle Palaeolithic attendance within this part of the cave.

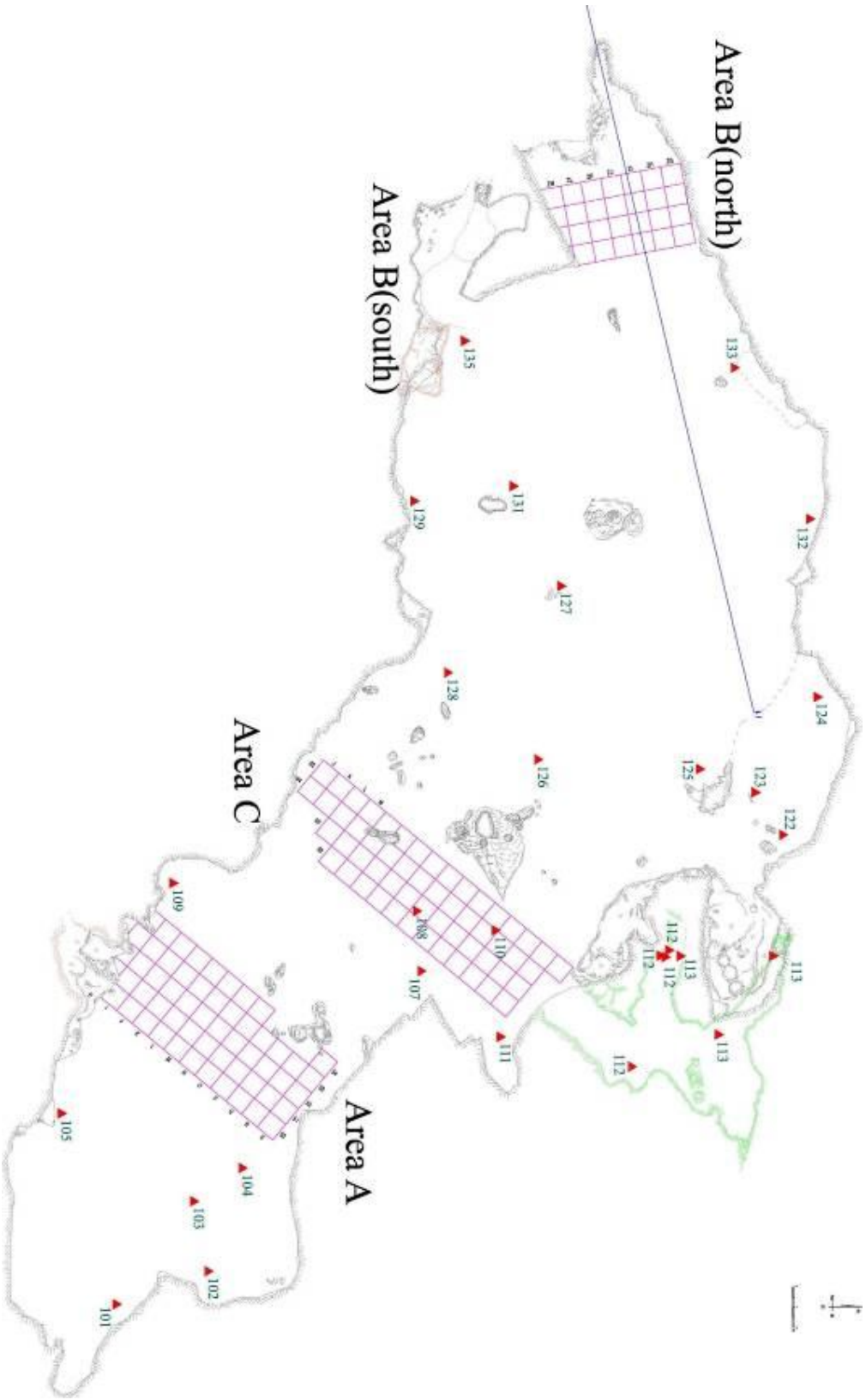

Figure 6. A plan of Manot Cave and the excavation areas. Red triangles represent find spots identified in the 2010 survey.

Figure 7. The eastern talus. A view to south-east.

Area B was situated on the other side of cave, at the upper most end of the massive steep talus (Fig. 8). This was most probably the major entrance to the cave based on the massive rock falls and penetration of tree roots and fresh loose sediment. Although this area was surely disturbed by these processes it was excavated for a logistical reason which was to trace and ultimately open an operational entrance to the cave.

The third excavation Area C was situated next to a dense concentration of Upper Palaeolithic finds at the center of the cave (Fig. 8). This locality was recognized in the survey as one of the richest in archaeology including many flint items, bone, bone tools and charcoal.

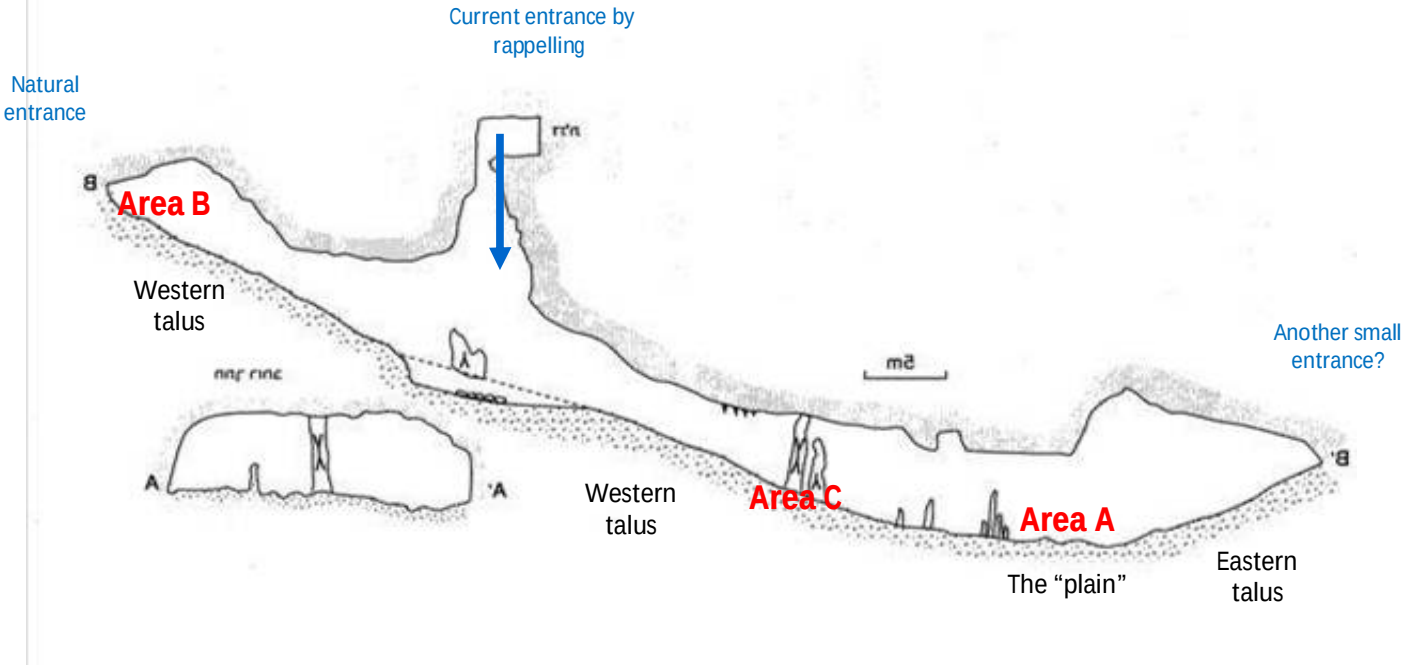

Figure 8. A schematic section of Manot cave, looking north.

Area A

Area A is located on a relatively flat surface between the two taluses. The surface is made of rock falls and active stalagmites embedded in thick accumulation of mud (Fig. 9). A total of 12 square m was excavated in varying resolutions. In general the excavation was conducted using a 1X1 meter grid except for two control squares (Q51-52) that were subdivided into 0.5 m squares. The sediment was removed in five cm spits and was subjected to selective wet sieving (1/5).

Figure 9. Area A. a view to north-east. Note the high density of rock falls.

The stratigraphy in this area is composed of one layer; a dark brown clay sediment which likely derived from both taluses. Many rocks and stalagmites (some are non-active) with no horizontal order are present. The only defined unit is a thin flowstone layer (formed by geological processes) identified in square N52.

The finds in area A include mainly flint items but also a few bones fragments. It was noted that the density of the finds increased as going deeper. The lithic component equally consists of Middle and Upper Paleolithic finds. The former is represented by Levallois flakes and tools while the latter by blade cores and blanks (Fig. 10).

Currently no archeological horizon was identified within this area. It seems that the Upper Palaeolithic component drifted from the large talus to the west where an abundance of Upper Palaeolithic finds were recorded in area C (see below). As for the Middle Palaeolithic, since no concentration was identified on the taluses it possibly derives from below the rock falls within area A.

Figure 10. Area A. flint artifacts: Left- a Levalois point; Right - bidirectional blade core with preparations.

Area B

Area B is characterized by a massive rock fall accumulation which is located at the uppermost part of the large talus (Fig. 11). Due to its disturbed nature it was excavated in low resolution. Most of the work was done using heavy tools (pick, shovels and mechanic hammer). The excavation consisted probing a narrow tunnel (ca. 5 m long) that reached ca. 2 m' below the surface and a trial square (1X1 meter) excavated inside the grid in five cm spits. The excavated sediments, from the tunnel and trial pit were subjected to a selective dry sieving (1/10).

Figure 11. Area B. a view to the west.

At present no stratigraphical sequence was recognized in this area. The sediment is composed of dry brown loose sediment, likely brought into the cave by tree roots. Notably there are no stalagmites in this area. The finds include flint items, animal and human bones. The lithic component consists bladelets and microliths, namely Kebaran (Fig. 12), thus attesting an Epipalaeolithic occupation in this part of the cave.

Area C

Area C is located on a steep slope toward the bottom end of the western talus where an exposure of an Upper Palaeolithic horizon was identified in the 2008 survey (Fig. 13). The surface is partly covered a flowstone that derives from a massive stalagmite to the north (sqs N-O 64-65). A total of 3 square m were excavated in high resolutions. The grid was divided into sub-squares and the spits were no more than 5 cm. Diagnostic flint artifacts and complete (or nearly complete) bone were piece plotted in three coordinates. All of the sediment was wet sieved through a one mm mesh.

Figure 12 Area A. flint artifacts: Microliths.

Figure 13. Area C. a view to the north.

The stratigraphy in this area is very complex and consists of at least two layers and several units (Fig. 14).

The upper layer, composed of loss dark brown clay sediment, is sealed by a flowstone surface that adjoins a massive stalagmite. This layer contains few artifacts with no horizontal order. Below it, is what appears as an archaeological horizon composed of lithics, bones and charcoal pieces. Below this layer there is another sediment layer, ca. 20 cm overlying brecciated grey layer containing lithics, bones and charcoal pieces. This layer is likely composed of several horizons that formed a mixture of artifacts and flowstone.

Figure 14. The section of Area C at Manot.

The finds in area C include an enormous amount of flint artifacts and bones. Currently most of the martial was retrieved from the upper unit but several items were also collected from an exposure of the lower unit. Nonetheless, regardless for the stratigraphy both units consist of Upper Palaeolithic material assigned to the Ahmarian and Aurignacian traditions (Fig. 15).

Figure 15 Area C. flint artifacts: Upper Palaeolithic flint tools and a basalt pebble.

The 2010 survey

During the 2010 season, an archaeological survey was carried out in and out the cave. Inside, 35 find-spots were plotted (points 101-135 in Fig. 6). Two types of archaeological features were identified. The first were concentrations of complete or nearly complete animal bones along the cave walls (Fig. 16). Notably, these bone assemblages included only cranial and postcranial bones, probably the result of carnivore activities (see faunal report below). The second included high density concentrations of mixed flint and bone fragments. These were exposed due to erosion caused by dripping water from the ceiling of the cave and may indicate the presence of archeological layers below. Along the cave walls, chert beds belonging to the late Cenomanian Sakhnin formation were recorded. The flint nodules are tabular

and elliptical in shape, making them suitable for the preparation of blade cores (Fig. 17).

Figure 16. Isolated long bone along the cave wall

Figure 17. Flint nodules embedded in the eastern wall.

The survey outside the cave revealed concentrations of chipped flint artifacts on the western slope. This location is close to the supposed main blocked entrance to the cave (Fig. 18). Notably, no finds were recorded on the southeastern part where the other entrance was presumed. The finds on the western slope include patinated non-diagnostic flint artifacts. No bones were found.

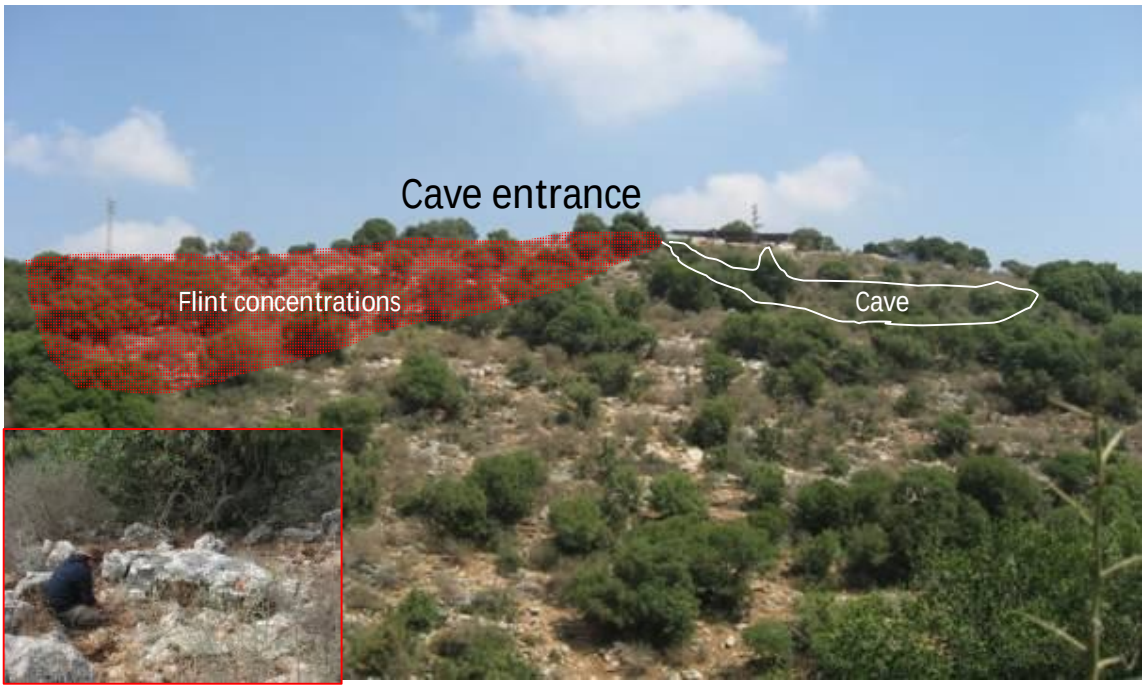

Figure 18. Location of the cave entrance and concentrations of flint outside the cave.

Geology and cave study

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Manot Cave, (coordinates 168378-271072, Israel Grid) is a relict karst cave. It formed in dolomite of the Sakhnin Formation of late Cenomanian age. Cave morphologhy includes smooth walls and solution cupolas, which indicate formation by dissolution below the watertable, by slow-moving water. Its present altitude, ~220 m asl, is over 100 m above the local present watertable, indicating that it formed prior to the Pleistocene uplift of the region. The uplift was associated with groundwater dewatering of the cave. Since then, dripping within the vadose zone has formed large speleothems in the cave, including flowstone, stalactites, stalagmites and large columns. Speleothem deposition seems to have occurred also during human occupation of the site. Some of them have been dissolved by aggressive water. Flowstone crusts associated with cultural strata may allow dating by U-Th method. Late Pleistocene breaching by surface denudation has formed an entrance, through which subaerial deposits, such as terra rossa have entered the cave, as well as faunal and anthropogenic elements. The entrance was later clogged and sealed by subaerial debris.

The cave is an inclined elongated chamber, 80 m long. Small side voids are partly connected to the main chamber. The chamber width varies from 10 to 25 m. The height of the chamber varies locally from 3 to 10 m, and the overall height difference (from the highest ceiling to the bottom of the cave) is ~30 m. The highest part is at the north western edge, where an ancient entrance is suspected, due to a slope of colluvial terra rossa material descending from there south-westward. The entrance is blocked by rock debris and terra-rossa.

The lowest point of the cave is at a side void close the south-western wall of the lowest point in the chamber. Here a vertical climb of 5 m leads to a hole in a wall of speleothems. The hole leads into a lower room reached by rappelling 7 m below the hole. In it speleothems are corroded by aggressive condensation. In a cup on a composite stalagmite there are many broken stal layers with a microlithic blade,

some chert and bones. These were obviously collected by humans. A horn of *Dama mesopotamica* covered by speleothem crust lies on the bottom.

The sediment-filled floor and the rock ceiling both slope in parallel at ~20 degrees for some 65 m, from the uppermost edge down to the bottom of the chamber. From there towards the south-eastern edge the ceiling is irregular and the sediment-filled floor rises towards another suspected ancient entrance. The subaerial surface above the cave is sloping southward, allowing the possibility of such entrance.

The gravitational talus slopes contain also anthropogenic and faunistic remains, such as tools and bones. These are exposed particularly where strong (winter) dripping water or its downstream flow excavated the slope.

The uppermost ceiling of the main chamber is very fractured in a polygonal way, with many living roots penetrating from above. Roots are seen also in lower part of cave, probably associated with a group of relatively large oaks observed above the cave.

A 15 m high shaft rises near the northern wall some 25 m down-slope from the upper edge. The uppermost end of this shaft was breached on 13.5.2008 by construction works, creating a new entrance into the cave. Karstic cupolas in the shaft indicate phreatic origin and possibly some condensation corrosion.

Geogenic cave sediments include mainly terra rossa type clays, calcite speleothems, and some rock fragments. The thickness of the deposits beneath the floor is not known. Much of the detrital deposits seem to have moved gravitationally downward along the cave floor slopes.

In the north-eastern wall of the chamber, multi-level side voids contain some interesting natural features (associated with with Kebaran artifacts). These include three large 'kamenitzas' (type of 'saflul') in line connected to each other, within bedrock, ~0.5 m diameter each. They seem to have formed by aggressive water which spilled from one to the other. Some bat guano could participate in their formation, but it is not present today. Possibly there was another organic matter. Chert nodules are common in the bedrock walls. A relatively large 'ephemeral stream' flowed along the north-eastern wall of the main cave chamber, entering the 'Kebaran chamber', flowing downwards to its lowest level. It carried clay and deposited it in a quite-flat 'alluvial fan on the lower level of the side void.

Sedimentlogy and biomineralization

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This report is based on the samples we took from the cave during an approximately 6hr period at the end of July 2010 – towards the end of the first season of excavation. The aims were to obtain initial information on site formation processes, diagenesis and the potential for radiocarbon dating. 45 sediment/rock samples were taken, 18 bone samples and 14 charcoal samples. All these samples were analysed using FTIR – close to 100 spectra were obtained. We will describe the main features of each of the localities we sampled, and then draw some conclusions.

Sediments

The bedrock is all dolomite, and analyses of 3 samples reveals that the HCl insoluble fraction comprises 0.35%, 0.8% and 0.9% of the total rock by weight. The major mineral components of this insoluble fraction are clay and quartz. The clay is not obviously different from the clay sampled inside the cave. This insoluble fraction of the rock that dissolved to form the cave could be a component of the sediments inside the cave, provided it was not somehow transported out of the cave. Even if some sediment was transported out, the heavier quartz fraction could be enriched in the cave as the lighter clay fraction would be preferentially removed.

Area 1 – Top of the Major West-East Talus

This area is presumed to be close to one possible entrance. The rock surfaces are perfectly preserved showing no evidence of having reacted with phosphate. The sediments are composed mainly of clay, with quartz as a minor component. The clays were not heated.

Area 2: Small Erosion Gulley on the Main Talus Slope

The area sampled was about half way down from the top of the talus slope. The flat flowstone found on the surface of the sediments are all composed of calcite, but have different degrees of atomic order. This presumably reflects the rate and conditions under which they formed. The buried flowstone (#5) has reacted with phosphate and has a major component of carbonated hydroxyapatite (cHAP). The surfaces of the rocks also have been mildly phosphatized (termed reaction rims).

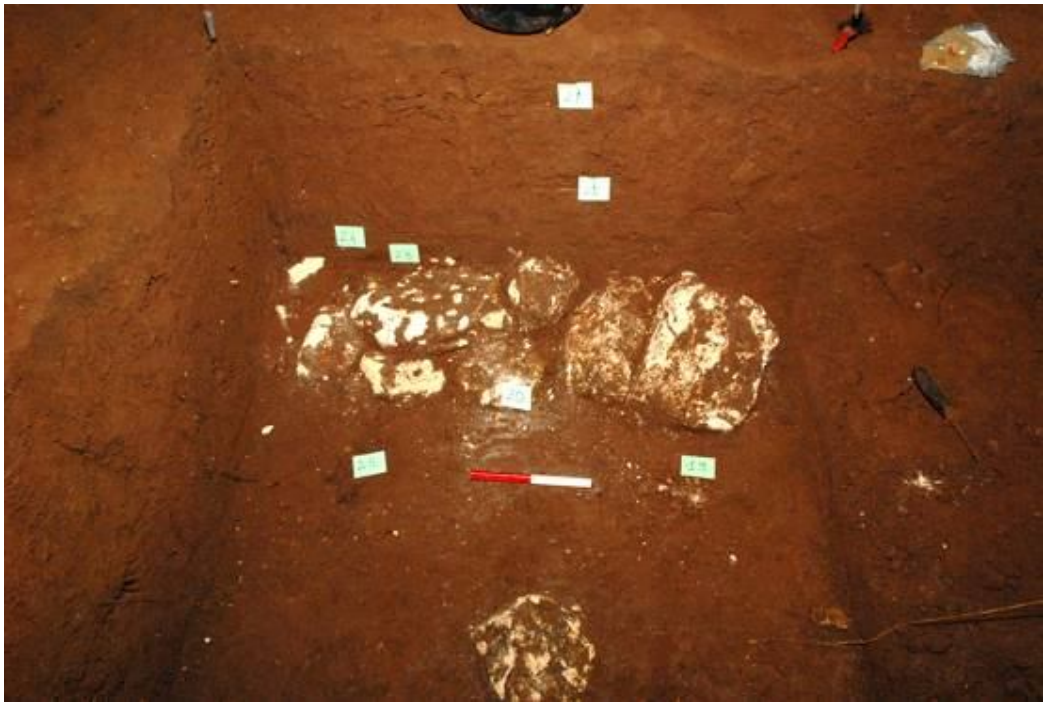
Brecciated sediments have a calcitic cement, and the black coatings analysed are cHAP (and not Mn and Fe oxides). No evidence of heated clay.

Area 3: Small Talus from Assumed Second Entrance to the South

The sediment is mainly clay and a minor component of quartz, comparable in all respects to the sediment outside the cave. The rocks on the talus have no reaction rimes – pure dolomite.

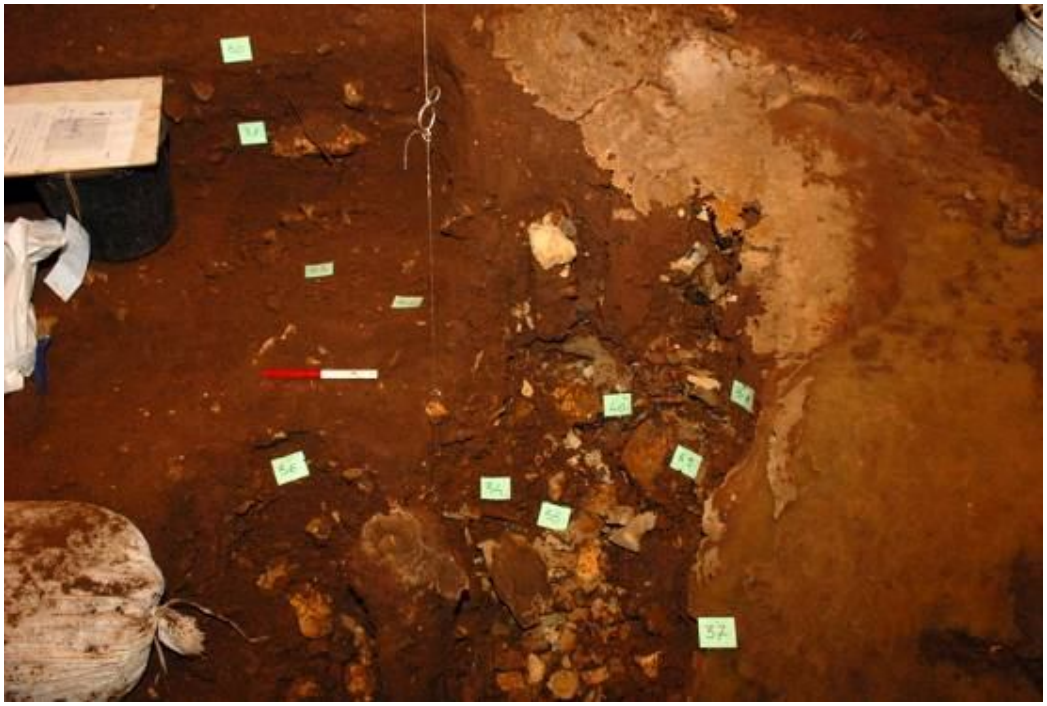
Area 3: Excavation Grid Area A

Square M51 was analysed in detail.



The sediments above the rocks are mainly clay and are not burned and do not contain phosphate (>around 0.5-1.0% the detectable limits for FTIR). The rock surfaces are heavily altered to cHAP. This is the case for all rock surfaces analysed in this area. Some of the small nodules are composed entirely of cHAP. The dolomite has also reacted in such a way as to produce amorphous calcium carbonate (ACC), which is usually a highly unstable mineral phase, but can be stabilized by Mg. The Mg was presumably derived from the dissolved dolomite. In one sample aragonite was present. This too could be due to high Mg ACC crystallizing into aragonite – a known reaction pathway. It is doubtful whether anybody has ever reported on these chemical processes in caves – it is not clear at this point how important it is.

Area 4: The talus Slope (Area C)



In terms of mineral etc this area is similar to the upper talus slope exposure we analysed – traces of phosphatization, flowstone formation with disordered calcite and unburnt clay-rich sediment.

Conclusions

1. We find very little evidence of intense anthropogenic activity on the talus slopes.
2. Area A is very different from the talus slopes. There is a major source of phosphate that has reacted intensely with the buried rock surfaces. The sources of phosphate could be dissolved bones (were there any bones found in this area, and if so do they show signs of dissolution?), or bat and bird guano. Another possibility is that this area being at a low elevation in the cave, is the site of intense hydrological activity, that also somehow concentrates phosphate. This is certainly not a promising area to excavate from the mineral preservation point of view.
3. The talus slope minerals do not appear to have been derived from eroded human occupation sediments at the entrances. The clays are well preserved

and no major presence of calcitic ash (although this could easily recrystallize). This is in contrast to the rich assemblage of bones and flint tools. The possibility of sorting of fine grained sediments by surface erosion down the talus slope, leaving the bones and tools more concentrated close to the surface, should be considered.

Bones

The 17 bones analysed have splitting factors (crystallinity) in the range of 3.1 to 3.8. except for one with a SF value of 5.1, which could be burnt. Thus the mineral phase of the bones is moderately to well preserved. Collagen was tested for 6 bones, and there is an indication that some might contain small amounts of collagen. This would require more detailed analysis, and careful testing of the purity of the collagen before it could be used for dating.

Charcoal

14 samples of charcoal were analysed. The only reliable indicator of preservation we have so far is the weight loss after treatment with alkali and acid. The weight losses ranged from 50 to 89%, which is high. This implies that the charcoal is not well preserved. The problem with this high sample mass loss is that clay is concentrated in the final fraction. This implies that the age could be shifted by unknown amount if this caly is not removed before dating.

Therefore we need to carefully clean charcoal and use the % of Carbon in the final fraction as parameter for selecting the samples for dating.

Careful analysis of the better preserved samples before dating is very important in this type of sediments and environmental setting.

Dating

Before we proceed with dating we should decide which contexts are more important and build a kind or priority list.

We should check both charcoal and bones since they could have different origin both in time and in deposition. Charcoal has a large chance to be anthropogenically produced while bones could be the results of predators.

The faunal remains

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The most conspicuous feature of the archaeology of Manot Cave may be the numerous accumulations of well-preserved animal bones on the surface, adjacent to the cave's walls. The concentrations (hence 'findspots') greatly differ in size and topography, as some are clearly the accumulation of fluvial transport (composed of bones and lithic artifacts), presumably from archaeological layers within the cave, while others are devoid of lithics and are found on topographically higher places. Seven findspots composing mainly of faunal remains were documented and collected or sampled during the 2010 season, in order to study their taphonomy and compare them to the faunal samples originating at the stratified archaeological deposits. The following are description and preliminary field observations of each of the sampled findspots.

Findspot 101

A surface concentration of bones (no lithics) near the top of the southern talus of the cave (ca. 5 m. from the supposed lower opening), adjacent to the eastern wall. The area of the concentration of bones is ca. 2 m^2. The findspot was drawn and photographed and the bones (n = 11) were collected to numbered bags. They included complete and incomplete limb bones of *Gazella*, *Dama* and *Capra*, as well as some astragali and a phalanx. Some probable carnivore gnawing marks were observed. Most of the bones appear to be in situ, as they took some light cleaning to expose. This accumulation is in a topographically high place and the inclinations of the long bones are horizontal.

Findspot 101

Findspot 102

Several complete limb bones and some stones/speleothems in a small area on the surface of the southern talus, adjacent to the eastern wall. No lithics. This accumulation was photographed and one bone (a complete *Gazella* radius) was given to E. Boaretto for collagen testing. The bone is not in situ and lies next to a few similarly complete limb bones, on the surface.

Findspot 105

A single complete bone (a nearly complete radius [?] of a carnivore [?]) and two broken speleothes on the surface of the southern talus, adjacent to the western wall. This findspot was photographed and collected.

Findspot 105

Findspot 112

A rich and relatively deep findspot in the entrance to the central corridor (the 'skull area'). Many stones and bones, some of which are complete, and no lithic items except for one flint core, in an area of 2x0.8 m. This concentration was drawn, photographed and collected ('level I') and then cleaned again to reveal more bones, which were subsequently documented and collected as well ('level II'). It is possible that more bones are to be found under level II. Some of the bones were strongly attached to speleothems. The finds from level I (n = 15) include a complete metacarpus and a distal radius of *Bos* (a rare species in the cave so far); a complete *Dama* mandible and *Gazella* phalanges and scapula. The bones from level II (n = 14) appear to be more fragmented, as they include long bone shaft fragments as well as a vertebra and ribs of *Gazella* and isolated teeth of *Dama*. Some buckets of sediment from cleaning and exposing the bone levels were sent to wet sieving in order to recover all small finds.

Findspot 112 – before cleaning

Findspot 112 – level I

Findspot 112 – level II

Findspot 122

A rich concentration of bones and some lithic items, approximately in the middle level of the large talus, adjacent to the western wall in a small chamber extending from the main hall. A small channel is clearly visible and virtually all finds are in its path or at its lowest point, where the channel dips toward the lower chambers (the 'skull area'). In that point several long and almost complete bones got stuck and did not fall down with the stream. They include limb bones of *Gazella* and *Dama*, stuck in various inclinations. The higher area of the channel contains mainly small finds, small stones and some black material. Small stones and speleothems are scattered around. Previous surveying in the area yielded Kebaran points, indicating that the material here was redeposited by the stream from the 'Kebaran terrace' at the higher part of the cave. This findspot was cleaned, photographed and all material was collected from an area of 1 m^2 (effectively less because there were almost no finds outside of the course of the channel). The sediment from cleaning and exposing the finds was sent to wet sieving in order to recover all finds.

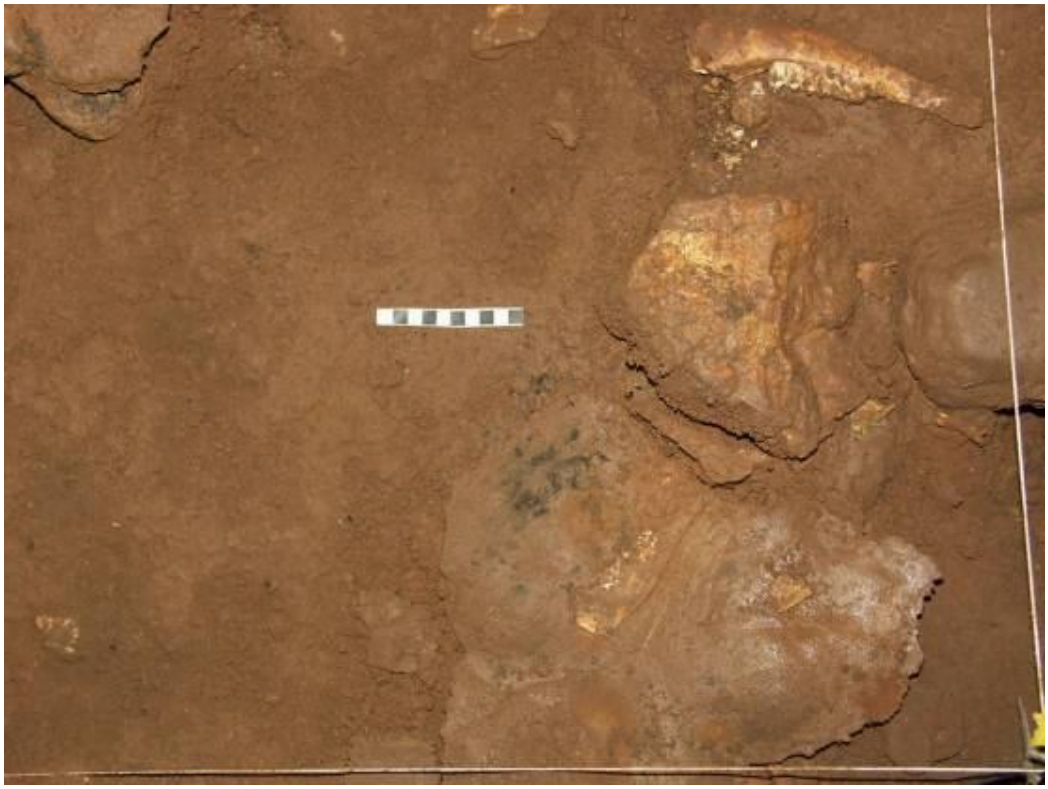
Findspot 122 – before cleaning

Findspot 122 – after cleaning

Findspot 125

A small concentration of finds in an area of less than 1 m^2, adjacent to the western wall of the large hall, approximately at mid-height of the large talus. The bones here may be in situ, as they some of them are attached to speleothems. This findspot was cleaned, drawn and photographed, and all finds were collected. The sediment from cleaning was sent to wet sieving. The main findings were two complete mandibles (a juvenile *Cervus* and an adult *gazella*) lying horizontally, a complete vertebra and a *Gazella* 1st phalanx, as well as some small stones and broken spleothems. Lithics were not encountered here.

Findspot 125



Findspot 135

A large (ca. 6 m^2) concentration of finds and stones at the uppermost area of the cave, adjacent to the eastern wall of the main hall. Several complete and incomplete ungulate bones as well as lithic material were observed here on the surface, and light cleaning of the eastern part of the concentration exposed some more finds. The entire concentration dips SW, as it is a part of the large talus. The eastern half of the concentration (closer to the wall) was drawn, photographed and collected. The notable finds are a deer skullcap with antlers in their initial growth, *Dama* maxillary teeth and *Gazella* and *Dama* metapodials and other limb bones.

In proximity to this findspot a nearly complete *Cervus* metatarsus gnawed by a large carnivore was found on a rock shelf, and left in place for now.

Findspot 135 – zooming on the deer skull with antlers

Summary

We sampled seven findspots, all adjacent to the cave walls and consisting of complete bones or large bone fragments. Findspots 101, 102 and 105 are located on the smaller (southern) talus, findspots 112 and 122 are the lower and upper samples of the channel along the eastern wall (leading to the 'skull area'), findspot 125 is located at mid-height of the large talus, next to the eastern wall and findspot 135 is located in the uppermost area of the cave, next to the western wall.

Preliminary field observations stress the difference between the bones collected at these findspots and the faunal remains originating at the stratified Paleolithic levels of the cave (mainly Area C). The bones from the findspots are less frequently associated with lithic items and are usually found at or near the surface, sometimes along streams. They also exhibit more completeness and clear carnivore gnawing marks. The ungulate species are the same as in Area C (*Gazella, Dama, Cervus, Capreolus, Capra* and *Bos*) but it seems that more large carnivore remains are found in the findspots, whereas more small game (tortoise, hare, fox, etc.) are

found in Area C. It appears that both hominins and large carnivores (hyenas?) played a significant role in creating the faunal assemblages of Manot. According to the evidence available now, it is possible that anthropogenic and carnivore deposits in the cave are spatially segregated. A detailed taphonomic analysis and comparison of the findspots and the Paleolithic faunas at Manot are needed to discern the agents of accumulation and post-accumulation processes of the bone concentrations. This will enable us to draw inferences on Upper Paleolithic subsistence and ecology.

Summary and future research

Manot Cave is probably one of the most promising prehistoric sites discovered in the region. The fact that the cave was sealed for a period of ca. 15,000 years must have contributed to the excellent preservation of the finds, therefore increasing the chances for revealing *in-situ* contexts. As mentioned above, most of the finds documented in the survey were dated to the Upper Palaeolithic period, which is the time-span associated with the dispersal of modern humans into Europe. Today, it is widely accepted that these populations originated in Africa from where they spread throughout the old world via the Levant.

On the basis of the recovered skull fragment, it is reasonable to assume that more human remains are present in the cave. Upper Palaeolithic human remains from Israel are extremely rare, without a single intact skull available (Bergman and Stringer 1989). To the present, the pattern of dispersal of modern humans into Europe during the Upper palaeolithic is one of the greatest open questions in human evolution. Manot cave has the potential to supply clear answer to this query. Furthermore, older (Middle Palaeolithic) human materials can also be retrieved at the cave, potentially enlightening the issue of the origin of modern humans.

The Upper Palaeolithic period in the Levant consist of two major archaeological cultures: the "Ahmarian" and the "Aurignacian". The former is a local tradition that evolved from the Middle Palaeolithic while the latter was probably introduced from Europe (Gilead 1991; Bar-Yosef and Belfer-Cohen 2010). Preliminary observations suggest that the Upper Palaeolithic component at Manot is characteristic to the both cultures. It is important to note that only few sites (Ksar Akil, El Wad and Kebara), some excavated more than 70 years ago revealed evidence for both traditions. Nevertheless, very few human remains were found in Upper Palaeolithic (Bar-Yosef 1973; Bergman and Stringer 1989).

Consequently the major contribution expected in the initial stages of research at Manot will be in the study of the Upper Paleolithic human remains, emphasizing the origins of modern human population. The research is also expected to contribute to paleoenvironmental research by the fauna and the speleothems studies.

The presence of active stalactites at Manot Cave makes it a candidate for being a tourist attraction. The wide variety of spectacular stalactites with archaeological finds and the relative large dimensions of the cave show the potential for opening it to the public, once the entrance issue is solved. Currently, there is only one stalactite cave, Soreq Cave that is open to the public in Israel. The advantages of Manot are its location at the northern part of Israel and the contents of archaeological occupations which are absent at Soreq Cave.

Being an active carstic cave with a record of at least 15,000, a study of the isotopic composition of the cave deposits is warranted. This study should provide climatic and environmental reconstructions and assist in dating the archaeological occupations using U-series.

In sum, the cooperation between the Israel Antiquities Authority and the Dan David Laboratory has the potential to shed light on one of the most important phase in the history of mankind, the faunal world that surround him, and the climate and environment he had to cope with within the Eastern Mediterranean region in the examined time-periods.

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