Excavation at NMO: the Mousterian Site at the Nahal Mahanayeem Outlet

The First Two Seasons

Final Report

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Background

In the fall of 1999, the Kinneret Drainage Authority undertook a large drainage operation aimed at deepening the channel of the Jordan River between the Pkak Bridge and the Ateret Fortress (Fig 1; and see (Sharon, et al. 2002) for details). A large volume of sediment was removed, damaging the Early-Middle Pleistocene deposits of the Benot Ya´akov Formation, as well as the Late Pleistocene Ashmora Formation comprising the upper portion of the geological sequence in this section of the river (Horowitz 1979).

During the drainage operation, the presence was noted of many stone tools and bones in mint condition within the piles of clay dug from the river trench. The main concentration of archaeological finds was observed in the sediment piles on the east bank of the Jordan River ca. 100 meters south of the present day artificial channel outlet of the Mahanayeem stream into the Jordan (Figs. 1-2; Coordinates: 33^{0}01’40’’N/35^{0}37’50’’E).
In the summer of 2002, a geo-archaeological survey in the vicinity of Gesher Benot Ya´aqov was conducted. Geological and archaeological data were collected from sections of the Jordan River bank cleaned for geological observations. In addition, geological cores were drilled to a depth of 10 meters at nine points along the east bank of the Jordan River (see relevant sections and cores in Fig. 2).

As a result of these finds, two seasons of excavation were carried out during the fall of 2007 and 2008 at the site now called NMO (Nahal Mahanayeem Outlet). The field and lab work was supported by the Irene Levi Sala CARE Archaeological Foundation and the Leakey Foundation. The results of these two excavation seasons are detailed below.

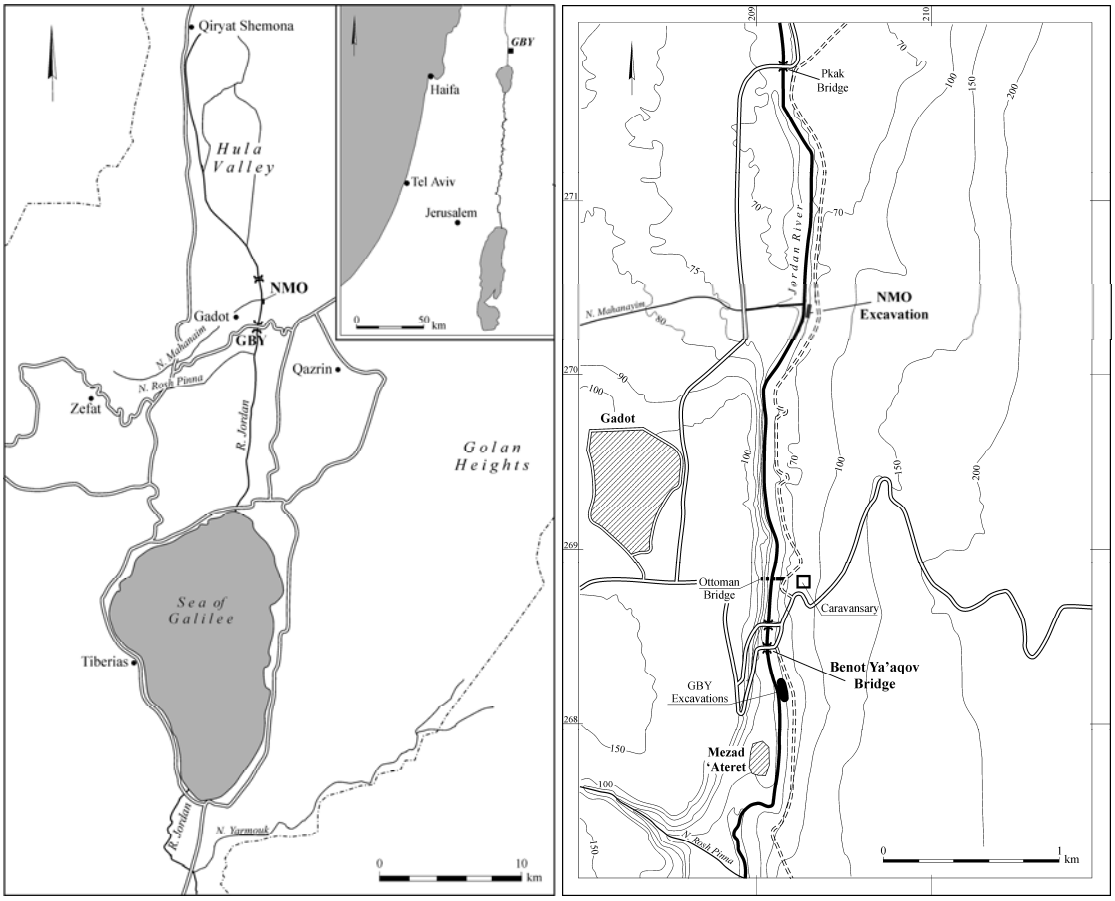

Figure 1: Location of the NMO Site

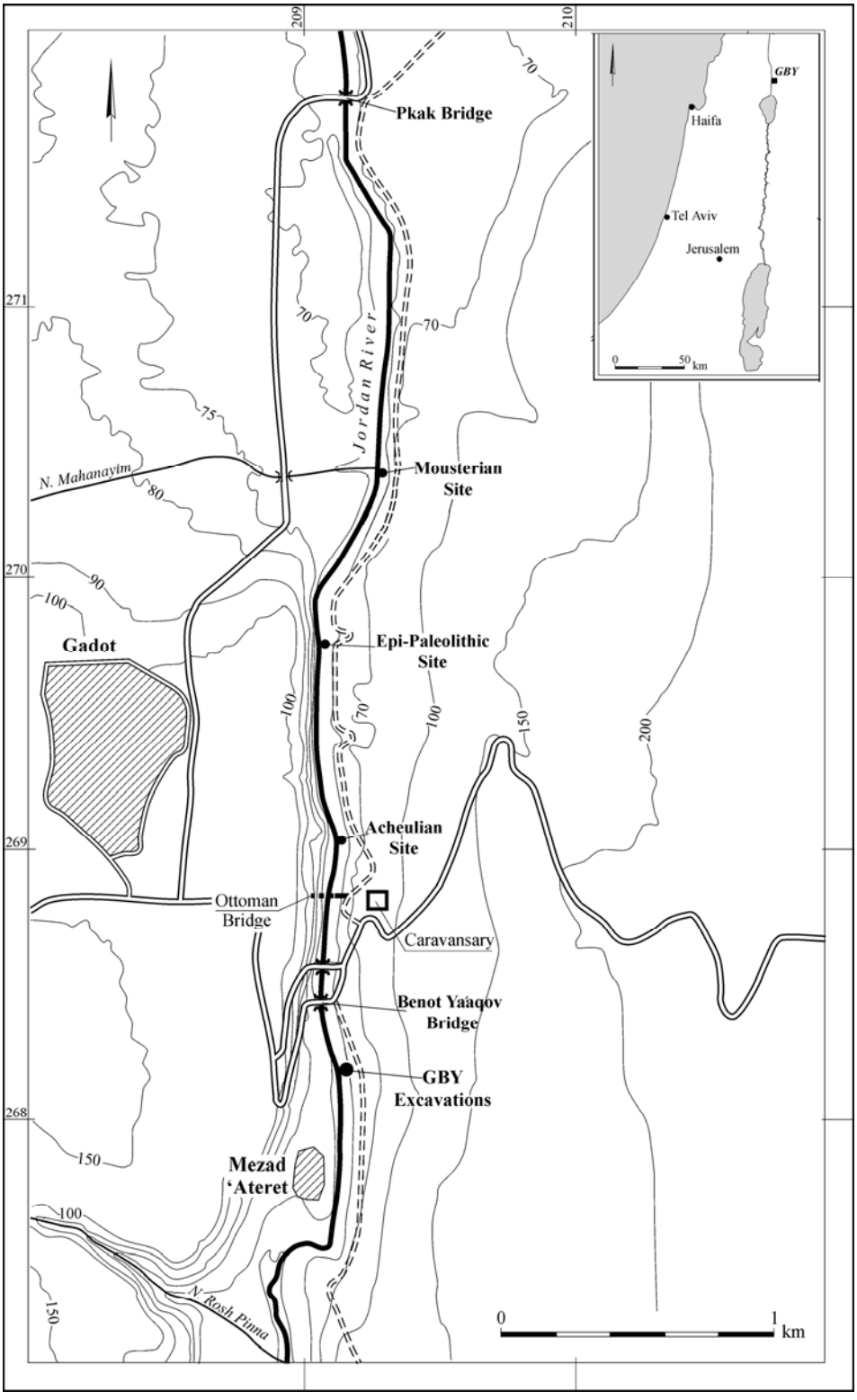

Figure 2: Location of specific localities mentioned in text

Pre-excavation Finds

The highlights of significant finds collected from the NMO site surface prior to excavation are reported first:

The Human Skull Fragment

The large piles of sediments dumped onto the banks of the Jordan River during the 1999 drainage work were left untouched until their removal during 2003. While removing a pile from the west bank of the Jordan immediately south of the Nahal Mahanayeem inlet (Fig. 2, 3), Israel Antiquity Authority inspector O. Barzilai collected large quantities of bones and stone tools. Among the bones, a fragment of human skull was identified (Fig 4). These sediments probably originated from the west river bank, from an unknown depth.

The fossil bone fragment is part of a braincase. A hard, reddish brown, breccia-like incrustation covered the fragment's internal and external bone tables. Cleaning confirmed our original impression that the bone is that of a hominid calvarium. The fragment consists mainly of the left parietal and bears the anterior section of the sagittal suture and the eroded lateral (left) part of the coronal suture. Adjacent to the sagittal suture lie the remains of the medial part of the right parietal bone. The break along the broken lateral edge of the right parietal is fresh. The edge of the rest of the fragment is coated with the breccia-like incrustation.

Aligning the remains of the sagittal suture with the midline reveals the exact anatomical location of the fragment: it extends from just behind bregma (which is not preserved) to a point slightly anterior to obelion (Fig. 5). The anteroposterior length of the fragment is about 75 mm, and its bilateral width is about 62 mm. Its thickness at the remaining anterior end of the sagittal suture is 5 mm; posteriorly, the bone thickens slightly, reaching 7 mm at the posterior end of the surviving sagittal suture.

Figure 3: NMO pre-excavation. 1. Mahanayeem stream channel; 2. Location of map where human skull fragment was found.

Figure 4: The human skull fragment from NMO

Figure 5: Fossilized Bone Fragment Superimposed on a Modern Calvarium to Show the Fragment's Anatomical Location

The fragment weighs 30 grams and is 34% heavier than a dry fragment emanating from the dissection room and comparable in size, thickness, and anatomical location. This discrepancy indicates a substantial degree of mineralization of the fossil fragment.

The sagittal suture is partially visible; only the anterior portion can be seen, and only on the exocranial aspect. Endocranially, the entire length of the suture is obliterated. This configuration indicates that at death, the individual was an adult of advanced age. We can see evidence of the age in the deeply excavated fossae for the arachnoid granulations on both sides of the midline (Fig. 6). Also on the endocranial aspect, well marked grooves for the anterior branch of the middle meningeal artery and its second bifurcation are visible. The bone surface of exocranial table is delicate and smooth, bearing no manifestation of the temporal lines. This topography, along with the slender and gracile appearance of the bone, suggests that the fragment belongs to a female.

Figure 6: Endocranial Aspect of the Fossilized Bone Fragment, Showing the Deep Fossae for the Arachnoid Granulations

A coronal cross section halfway down the fragment reveals that the summit of the calvarium was rather flat and that the bone surface curves abruptly 2 cm lateral to the sagittal suture and slopes downward toward the temporal bone. This curve creates a slight angulation of the contour. Given this topography, the fragment is not likely to be from a Neandertal calvarium, whose corresponding coronal cross section is characterized by a continuous (unsegmented), rounded coronal contour extending from one side of the calvarium to the other.

The Lithic Artifacts Associated with the Human Skull

A selection of tools collected from the same pile of sediments from which the fragment of human skull was found is shown in Figure 7. This collection contains at least two lithic components. The first group (Fig. 7: 2-4) is of Levallois Mousterian origin and includes several tool types made on Levallois flakes and blades. The second component is possibly Upper Paleolithic (UP) or even Early Epi-Paleolithic (Fig. 7: 1, 5-8). The UP tools include various types of end-scrapers made mainly of blades, burin on truncation and retouched blades. The small sample size collected from the pile does not allow a clear-cut definition of the assemblage. However, at least two different lithic industries, one of Middle Paleolithic and the other probably of Upper Paleolithic origin are

represented. This view is consistent with the observation by Goren-Inbar & Alperson-Afil (in prep.) of the assemblage collected from piles of sediments from the east bank of the Jordan within 50 meters from the human skull pile. Further research is needed before any other observations can be suggested.

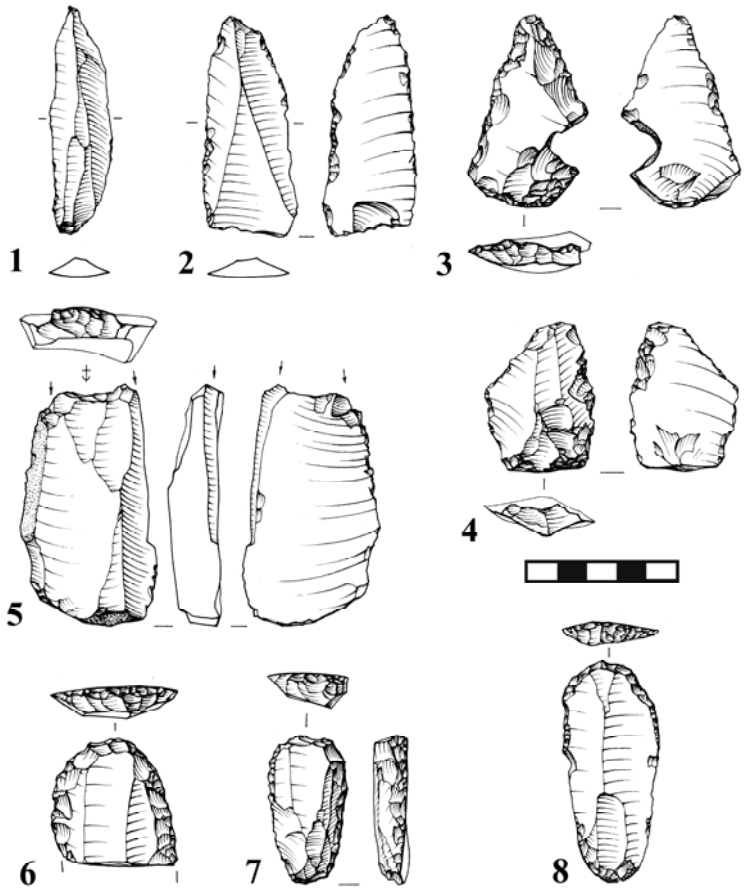

Figure 7: Lithic artifacts found in association with the human skull fragment

The Pre-excavation Fauna

Most of the bones collected at the site are in excellent state of preservation. Numerous fresh breaks, probably resulting from the heavy machinery digging, were also observed. The bone assemblage was collected from the piles of sediments and the geo-archaeological context of most of them cannot be reconstructed. Hence, only general observations concerning the whole assemblage can be presented. The species and their

frequency represented at the site are presented in Table 1. As can be seen by the rich diversity of species and their state of preservation, the potential of the site to uncover *in situ* remains is high.

The bone sample studied (N=321, Table 1) includes aurochs (*Bos primigenius.* Fig. 8), mountain gazelle (*Gazella gazella*), red deer (*Cervus elapahus*), Mesopotamian fallow deer (*Dama mesopotamica*), boar (*Sus scrofa*), hippopotamus (*Hippopotamus amphibius*), canid (*Canis* sp.) and lion (*Panthera leo*). Antler fragments were assigned to Cervidae and horn core fragments to Bovidae. The rest of the fauna could only be assigned to body size groups (Table 1): unidentified *Bos*, *Cervus*, *Dama* and *Gazelle* bones. Body representations include both cranial (antlers, horn cores, maxillary teeth) and postcranial elements (ribs, vertebrae, limbs, phalanges). Additionally, a few carapace fragments of turtle (*Testudo* sp.) and two bird bone fragments were uncovered. The data presented here provide additional information to that published earlier (Sharon, Feibel, et al. 2002), yet the general trend remains the same: cervids and bovids are the most common species.

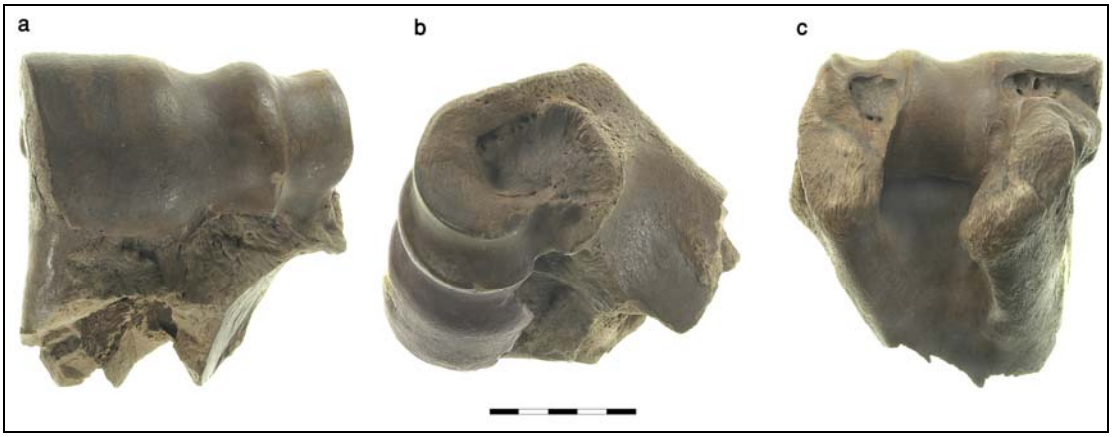

Figure 8: Bos Distal Femur fragment collected from surface at NMO

The species distribution in the current sample is similar to that of numerous Mousterian and Upper Paleolithic sites (Rabinovich 2003; Stiner 2005; Tchernov 1988). Yet, of particular interest are a few rare species. The presence of hippopotamus (represented by a single tooth fragment) in this Upper Pleistocene assemblage is a quite rare phenomenon,

which revives an old debate concerning the distribution of this species along the Levantine coast versus inland (Horwitz and Tchernov 1990). Recently, continuous presence of hippopotamus along the Jordan Valley during the later Pleistocene was observed (Rabinovich, personal observation).

Table 1: Fauna from the NMO site

Species	**N**
Gazella gazela	7
Bos primigenius	42
Cervus elaphus	10
Dama mesopotamica	19
Sus scrofa	3
Hippopotamus amphibious	1
Canis sp.	1
Panthera leo	2
Bovidae	6
Cervidae	9
BSGB (*Bos* size)	34
BSGC (*Cervus* size)	44
BSGD (*Dama* size)	62
BSGE (*Gazela* size)	6
Testudo sp.	4
Bird	2
Unidentified bones	69
Total	**321**

The Lion Skull and Femur

During the 2002 survey, a skull of a lion (*Pantera leo*, Fig. 9) and a lion femur (Fig. 10) were excavated from the banks of the Jordan River at the NMO site (Fig. 2: 5). The skull

was found *in situ* embedded in black, organically rich clay and the femur was excavated from immediately below it.

Figure 9: Five views of the lion skull. a. right view; b. left view; c. frontal view; d. posterior view; e. dorsal view

Figure 10: Lion Femur

The bones are in excellent state of preservation. The femur was found complete and was broken during excavation. The skull was found broken into many small pieces with some fragments missing, probably due to the activity of heavy mechanical equipment at this locality. Part of the left nasal bone is missing, and a distortion was observed towards the left part of the skull. The general outline of the skull and its size suggest a male lion. The completeness of the femur is quite rare in archaeological assemblages in the Levant. Lastly, based on field association and size, the skull and femur belong to the same lion.

Additional bone fragments, including a bovid molar, were found next to the lion bones. No stone tools were found in the immediate vicinity of the bones, although a few flint flakes were found during other visits to the site, embedded in the same black clay. Large felids are rare in archaeological sites of all periods. In the prehistoric Levant, lion bones are known primarily from Qafzeh Cave (Dayan 1989; Rabinovich 2002, 2003).

The First Excavation Season – 2007

The first season of excavation at the Mousterian site of NMO took place from August 26 to September 11, 2007. The aims of this preliminary excavation were to establish the stratigraphic context of the site's layers and to gain better understanding of the nature of the archaeological occurrences in this locality.

The 3-week excavation was executed with the help of students of the Institute of Archaeology of the Hebrew University, University of Southampton (UK) and from the Czech Republic. I would like to thank them and the members of Kibbutz Gadot who made the excavation possible. The excavation took place on the east bank of the Jordan River, opposite the outlet of Nahal Mahanayeem to the Jordan from the west. The excavation included the following (see Fig. 11-12):

1. Three small excavation areas, areas A to C along the banks of the river, in localities that were identified as showing archaeological potential.
2. Ten geological sections along the east bank of the Jordan River, aiming to achieve a correlated stratigraphy of the study area.

3. A deep geological trench (Trench I), some 30 meters long and 3.5 meters deep, dug by excavator tractor on the flood plain of the river. The trench was excavated during the last week of the excavation season in an attempt to better understand the information gathered from the excavation areas and sections and draw a comprehensive, sequential picture of the site's layers.

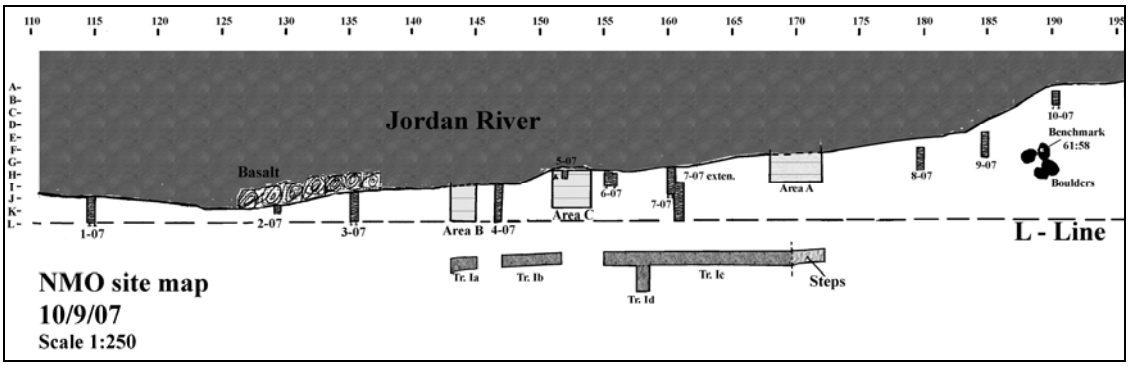

Figure 11: Location map of 2007 excavation season areas, river bank section and geological trench.

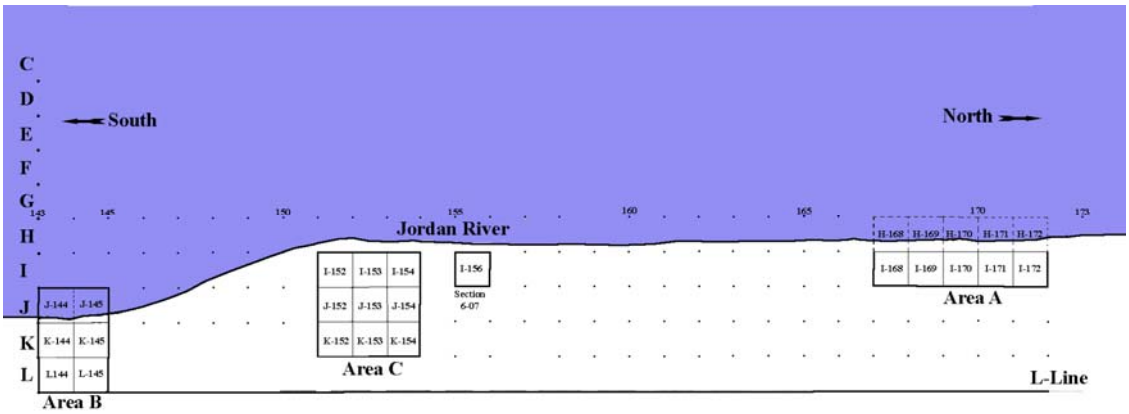

Figure 12: Location of 2007 excavation areas with the number of squares indicated.

Results of the 2007 Season

The geology and stratigraphy data retrieved from the 2007 season will be discussed below in the general description of the site's stratigraphy below. The excavation of three archaeological areas has revealed the following results:

Area A

This small area comprises the excavation of a total of 10 square meters along the Jordan River bank at the northern section of the site (Figs. 11-12). The five westernmost squares were partially underwater, depending upon daily changes in the water level of up to 50 cm as a result of artificial control of the water flow in the Jordan River. The area was selected for excavation due to the exposure of large basalt cobbles and boulders in the river bank and the numerous flint tools collected prior to excavation. The excavation of Area A exposed a series of clays levels, ranging in color from grey to black with occasional large boulders “floating” within them. These clays are very low in archaeological finds. The clay is generally rich with botanical material, and show many changes in color and texture (Fig. 13). At the lower part of the section a very flat and even “polished” surface was exposed resulting probably from “slick and slide” activity of the clay (Fig. 14).

Figure 13: Clay color at Area A

Figure 14: "Slick and slide" surface in the clay at Area A northern section.

Within the clay layers a concentration of large basalt cobbles and boulders ca. 1.5 meters in width was exposed. This concentration probably represents a buried channel, although the presence of large boulders in such a small channel suggests that the geomorphological nature of this channel is complicated. Figure 15 presents a general view of Area A at the end of excavation, while Figs. 16 and 17 show a close-up and a drawing of the area's eastern section. The large basalt cobbles and boulders are embedded within quartz silt-fine sand containing many black manganese oxide particles. These results are compatible with the water inundated swampy environment. Interestingly, the sediment contains zirconium and titanium, most likely originating from heavy minerals found within the quartz sand (R. Gross, Personal Communication 2007).

Figure 15: Area A at the end of the 2007 excavation season.

Figure 16: Area A east section at the end of 2007 excavation season

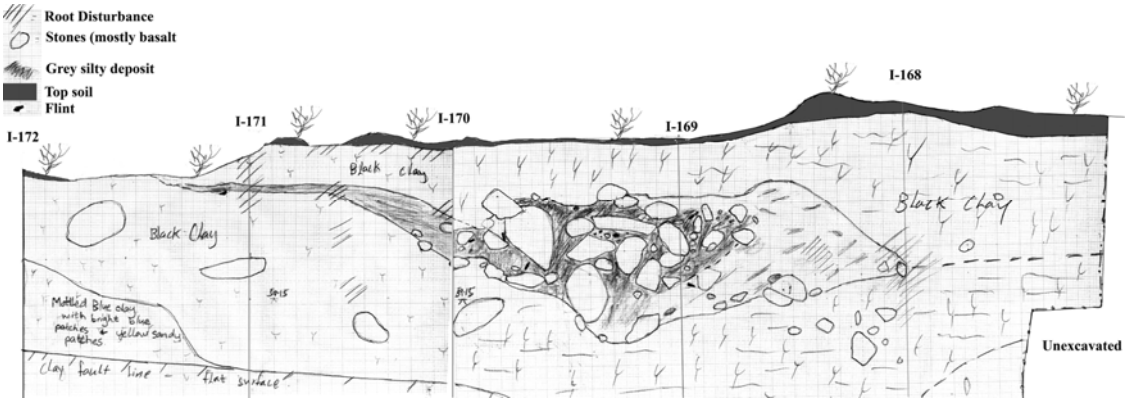

Figure 17: Section drawing of Area A east section

In between the basalt cobbles and boulders a wealth of flint artifacts was excavated. This is to date the richest assemblage excavated from the site and its analysis is ongoing. Preliminary observations suggest that while most of the artifacts are waste products that cannot be typologically attributed with certainty to any lithic tradition, a few very distinct Upper Paleolithic (UP) artifacts were found. This assemblage might be the source of the UP artifacts collected from the piles of sediments dug by heavy machinery during the drainage operation in 1999 (Sharon et al 2002; Goren-Inbar, Personal Communication). Most of the artifacts are made on light grey flint which lacks the dark patina typical of many of the Middle Paleolithic artifacts excavated from the site. They are also very fresh, showing no evidence for weathering caused by water transportation. Bones are practically absent from this area. Further excavation and the enlargement of the sample are needed in order to clarify observations.

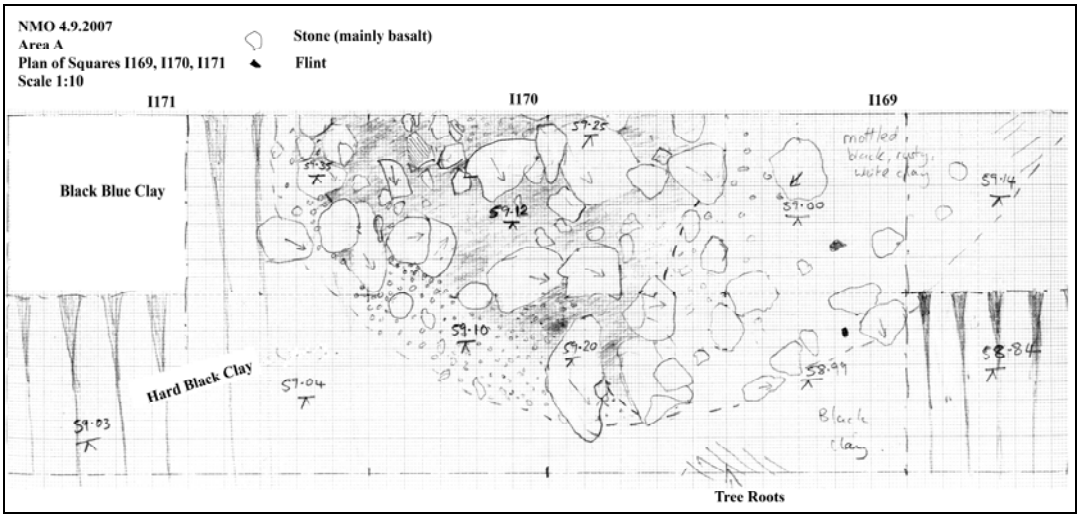

Figure 18: Excavation map of Area A excavation.

Area B

This location (Figs. 11-12) was chosen for excavation due to the presence of many MP flint artifacts as well as animal bones within basalt cobbles and boulders on the Jordan River bank at water level. Many flint tools and bones were collected at this locality during visits to the site prior to excavation and it was assumed that this area would have the best potential for exploring the presence of Middle Palaeolithic occupation at the site. Six square meters were opened to test the nature of this archaeological occurrence (Figs. 19-20). After a short excavation it was clear that the area is mostly comprised of archaeologically sterile layers, representing the margins for the exposure of the MP layers of the site. The contribution of Area B to our understanding of the NMO site geology and general stratigraphy is important and will be discussed in the geology section below. Yet, in terms of the archaeology, the area has very little to offer and was closed within a few days of excavation.

Figure 19: Area B at the end of the 2007 excavation season

Figure 20: Area B during excavation

Area C

This area was opened as a result of observations made during the first half of the 2007 excavation season. It became clear from the excavating of the river bank sections and of Area B, that in order to find the MP layer of the site, it was necessary to locate an area between sections 4 and 6, which had already revealed Mousterian finds. Nine meters were excavated during the second half of the 2007 season (see Figs. 10-11 for location). The contribution of Area C to the understanding of the NMO site's stratigraphy is

discussed below. Archaeologically, the layer bearing MP artifacts and bones was exposed mainly in a small section of squares I152, I153 and I154 at the western margins of the area (Fig. 11, 21). Within a layer of dark clay, lying on top of a layer of basalt cobbles (see below) numerous animal bones were excavated primarily including the bones of Bos primagenius (Fig 22, 23). The most significant find in this layer is the skull of Bos and two horns excavated in square I152 (Fig. 24). The skull was found lying upside-down with a few flint artifacts scattered around it (Fig. 25-26). It should be noted that a layer of relatively recent river channel sediments comprised of mainly sand and pebbles was covering the upper part of the skull and possibly removed the other part of it. Nevertheless, the skull was well embedded within the layer of dark clay holding only MP artifacts and bones. The flint artifacts excavated from this layer included Levallois flake and points in low frequency. Low frequency of flint artifacts seems to be a typical component of the NMO site as discussed below. The flint artifacts are un-weathered but show dark, almost black patina typical to the waterlogged sediments of the Gesher Benot Ya´aqov vicinity.

Figure 21: NMO Area C 2007 at the end of excavation. Arrow indicates find point of Bos skull in square I152

Figure 22: Area C Square I153 sub-square d. Bos mandible and flint artifacts.


Figure 23: Area C Square J152. Bos bone on basalt cobble layer.

Figure 24: Excavation of bos skull at Square I152

Figure 25: Skull of bos, with horns and lithic artifacts during excavation at Area B, square I152

Figure 26: Additional angle looking at the square I152 bos skull from the west.

Additional Finds

The focus of this section is on the finds from the *in situ* Mousterian layers unearthed during the excavation. Many additional artifacts came from the excavation of the upper layers of the site (the ancient river channels) and include late period stone tools (UP or Epi-Palaeolithic bladelets and cores and Neolithic arrowhead), lead fishing net weights (Fig. 27), ceramics and even 3 coins, possibly from the Muslim period.

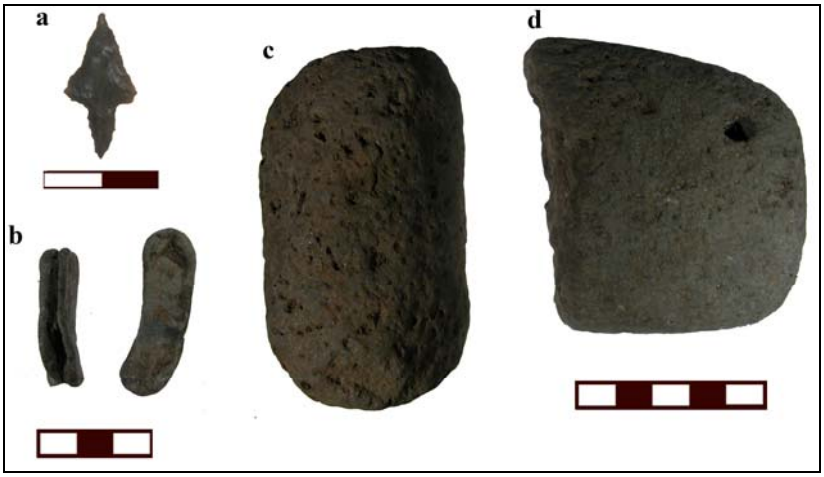

Figure 27: Late period finds from the 2007 excavation season. a. late Neolithic arrowhead; b. lead fishing net weight; c-d. basalt grinding stones.

The Mousterian layers were exposed in a very small area, totaling less than 5 square meters. The main finds are Levallois blades and flakes including a few typical Mousterian points (Figs. 28-29). The lithic artifact density seems to be relatively low but the tools found are very well made and indicative of the Mousterian period. In contrast to the lithic assemblage, the faunal assemblage of these layers is extremely rich and in excellent state of preservation. Apart from the skull of bos described above, animals found include cervids, wild boar and turtles. Preliminary study has shown that the botanical remains are well preserved within the clay layers, together with charcoal that is found in large quantities.

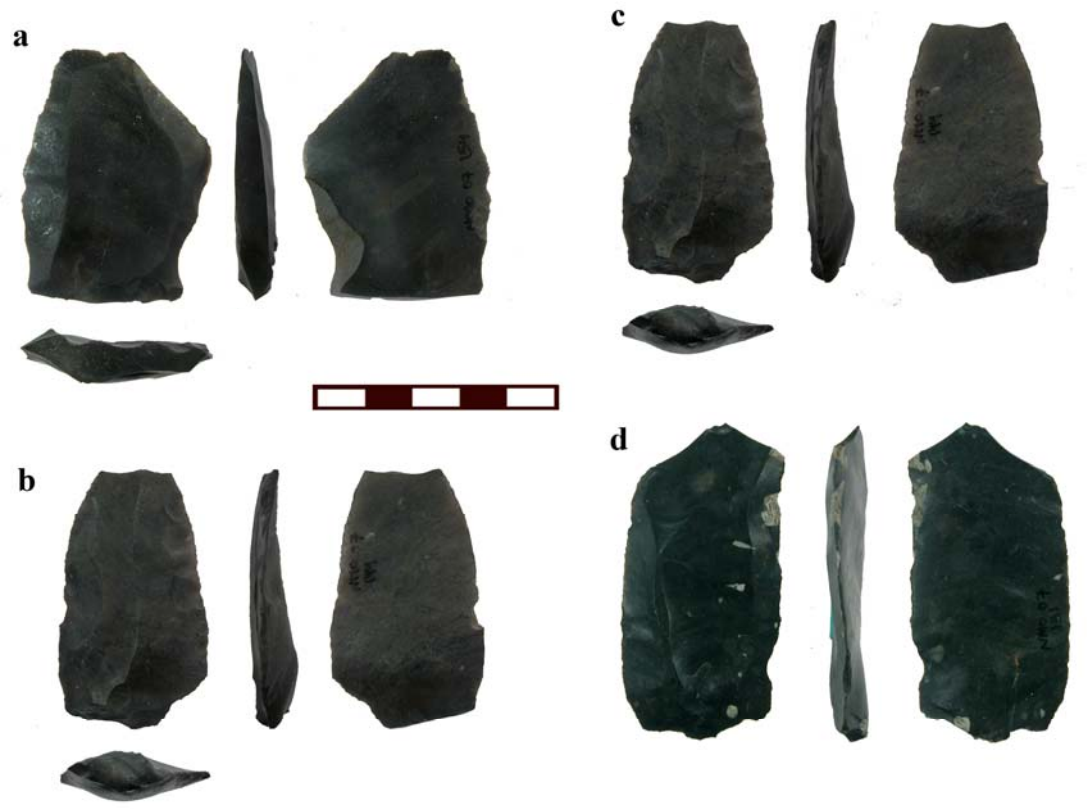

Figure 28: Levallois points and flakes from 2007 season.

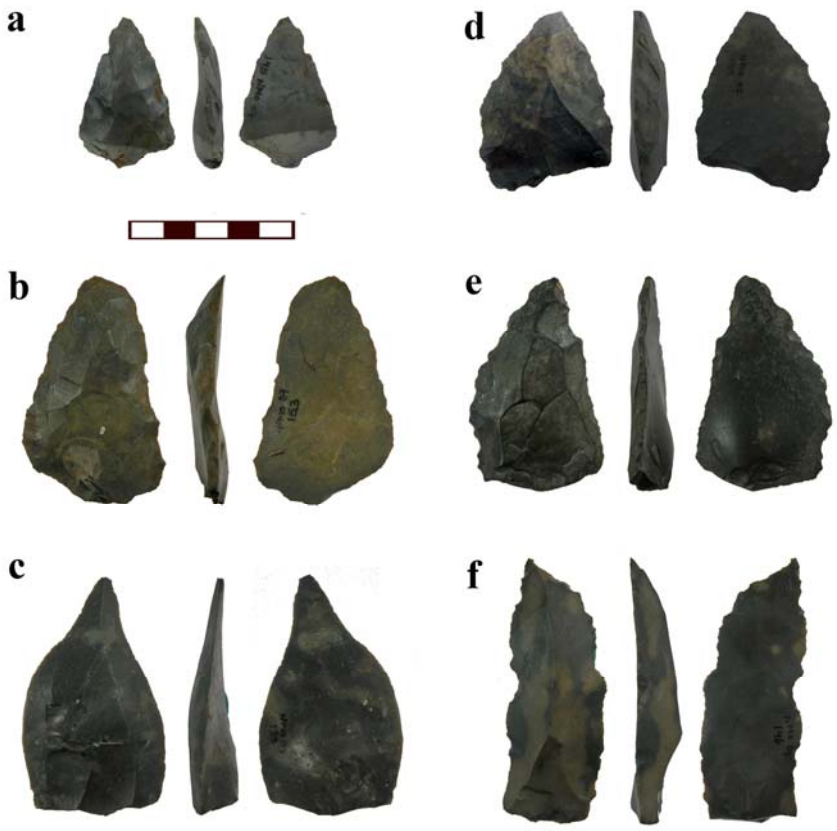

Figure 29: Levallois points from the 2007 season. a-b – excavated from area A; c – excavated in Section 6-07; e – surface collected.

NMO Stratigraphy and Geology

The geological layers north of Gesher Benot Ya´aqov and towards the Hula Valley are all assigned by Horowitz (1979) to the Ashmora Formation (Fig. 30). This formation comprises primarily layers of clay and peat that were suggested to have been formed by the swampy Lake Hula during the Late Pleistocene and Holocene. As a result of the Jordan River trench deepening during drainage work over the last decades, the Jordan River currently flows in a channel that is a few meters below its course at the beginning of the twentieth century. The data obtained from the newly exposed sediments illustrate a much more complicated stratigraphy than previously suggested.

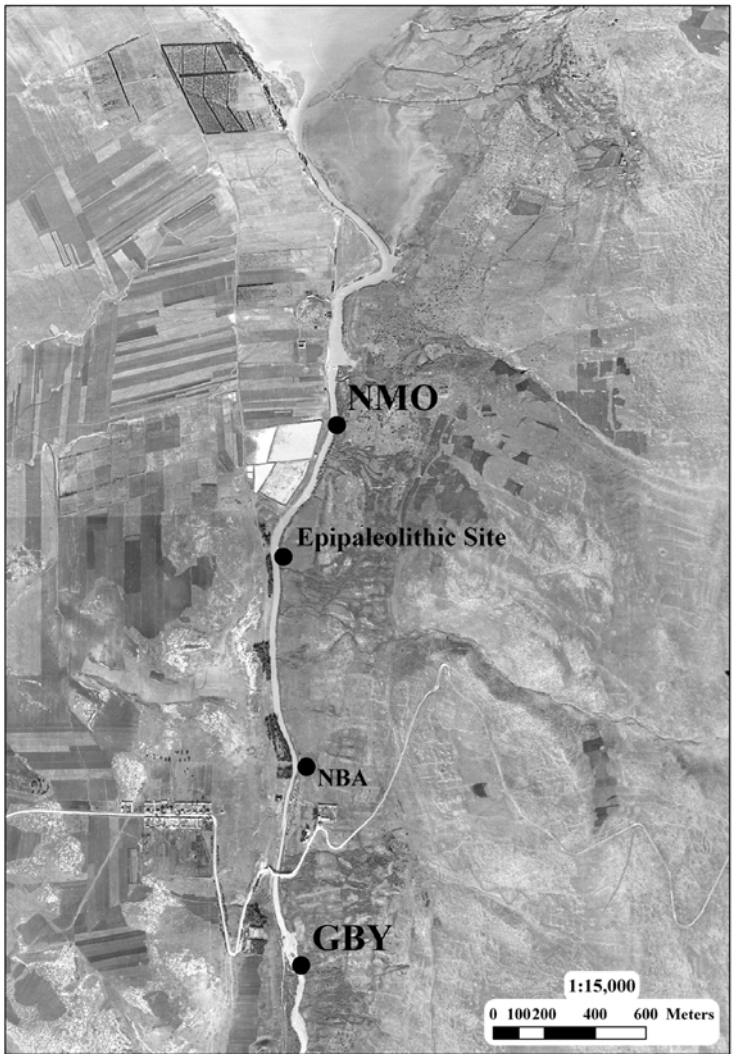

Figure 30: The Hula Lake and Jordan River in 1945 showing the region before Hula Lake massive drainage operations.

The data collected from the clearing and study of 10 sections of the river bank combined with the data from the geological tractor trench I and the excavation of three archaeological areas (Fig. 11) has enabled us to gain preliminary understanding of the study area's geology and general stratigraphy. Fig. 31 presents the combined drawing of all 10 sections dug during the 2007 season. Figure 32 is a drawing of the east section of geological Trench I. For location of the sections please refer to Fig. 11.

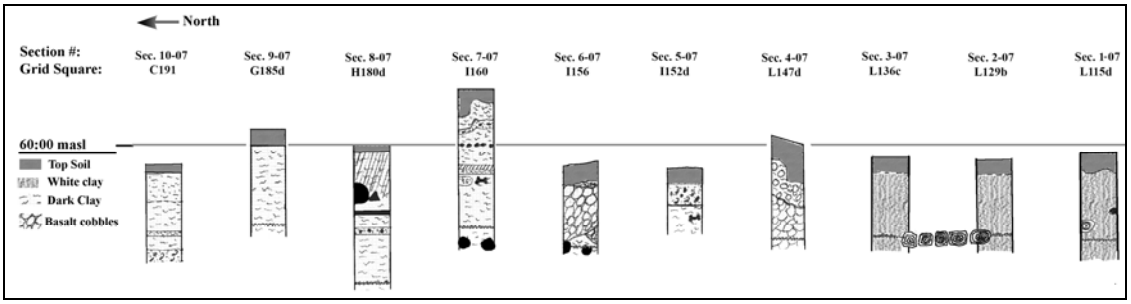

Figure 31: The NMO 2007 sections

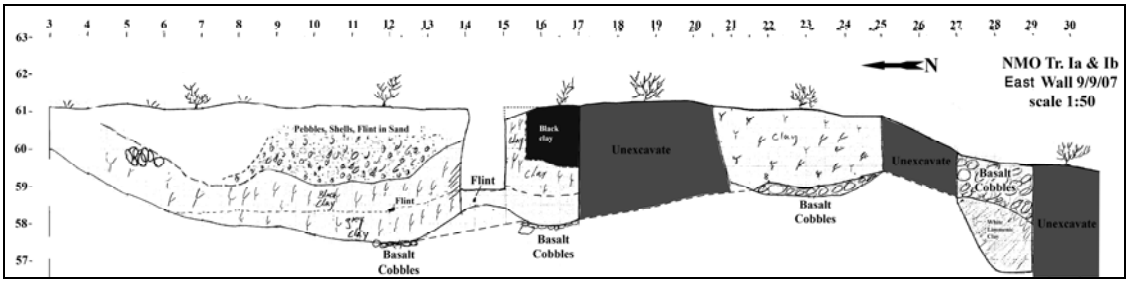

Figure 32: Trench I east wall section

When combining the data from all sources including the 2008 excavation of Area D (see below) a general stratigraphy of NMO can be suggested as follows:

At the southernmost section of the study area the Jordan Bank is formed by a layer of light gray limnic sediment with lances of darker brown clay (Fig. 33). The upper part of this layer is cut by heavy machinery activity, and a geological trench dug to a depth of 3.5 meters below present day surface has not reached the bottom of the layer (Fig. 32 – section of Trench Ia). Embedded within this layer are occasional very large, heavily exfoliated, boulders of basalt, whose presence in this low energy accumulating sediment awaits explanation. Field observations did not result in a conclusive explanation as to the

origin of these basalt boulders (Fig. 34). It was suggested that they might represent the upper part of a basalt flow underlying the limminic sediments. On the other hand, they seem to be surrounded by the limnic sediments and may represent a remnant of flood covered by the lime sediments. Primary study of a geological core, 10 meters deep, that was drilled ca. 50 meter south of the NMO sections indicate the presence of a basalt flow at this locality (C. Feibel, Personal communication). This might support the suggestion that the boulders originate from a basalt flow. Further work is needed before and conclusions can be presented. This layer was probably formed in a paleo-lake with a water depth of a few meters.

Figure 33: Section 3-07 showing the top soil overlying light colored limnic sediments.

Figure 34: Heavily exfoliated basalt boulders on the bank of the Jordan River between Section 07-2 and 07-3

At either case, all of our observations have shown that this layer of limnic sediments is archaeologically sterile and that the study should focus on the northern section of the study area.

The light colored limnic sediments are in sharp vertical contact with a layer of large basalt cobbles and boulders to the north. This contact, visible in both Area B (Fig. 35-36) and in Geological Trench Ia (Fig. 32) seems to be very sharp and sudden. At the present state of our knowledge, it seems that the best explanation for this geological contact lies in the presence of a tectonic fault line in which the older limnic sediments were uplifted, while the basalt layer represents a younger feature.

Figure 35: Area B 2007. Contact between white limnic sediments to the south and basalt cobbles Layer 5 to the north

Figure 36: Area B from the north. Line indicating the vertical contact between the limnic and basalt layers.

Moving further north, the basalt cobble layer slants northward and dramatically to the east and west. The nature and geomorphological origin of this basalt layer is one of the main questions the NMO site poses to future research. The layer is comprised of basalt ranging in size from boulders to pebbles. Basalt is the sole rock type within this layer. The upper part of the layer includes generally well-rounded cobbles and boulders. When this upper thin level is removed, additional cobbles and boulders are exposed but they are

weathered and exfoliated. According to the exposure of this layer in section 4 (Fig. 11), the degree of weathering increases in depth until ca. 1 meter below surface, where the basalt has almost entirely deteriorated into clay.

On top of the basalt layer is a layer of dark clay embedded with many small pebbles of limestone. This is the layer containing the MP tools and animal bones. Many of the bones were laying immediately on the basalt cobbles in its contact with the overlaying clay. However, the results of the 2008 excavation demonstrate that this layer is thickening towards the north as the basalt layer is slanting downward. At this part of the site, the next layer is comprised of a series of organically rich, grey clay with areas of oxidized orange spots. Many slick and slide surfaces are visible and further study is needed to define the nature of these clays. An occasional flint artifact or bone was found, in most cases as an isolated find. Into this layer of clay cut much younger channels that deposited sand with numerous pebbles of limestone, flint and basalt. These are probably channels of the ancient Jordan or smaller streams that flowed into it. Their age can be estimated to few hundred years by the presence of ceramics and lead fishing net weights found in them. Nevertheless, some of these channels penetrate quite deep into the clay layers and may be of much earlier age, up to thousands of years old. Many stone tools were found within these channels including Neolithic axes, arrowheads and grinding stones (Fig. 27) suggesting the presence of a Neolithic site in the vicinity. Such Neolithic sites were indeed reported from the lower slopes of the Golan Heights ca. 1 km north of NMO. The stratigraphic sequence of the site is sealed by a layer of top soil, ca 25 cm thick, laid by the Jordan River since the end of drainage work in the year 2000.

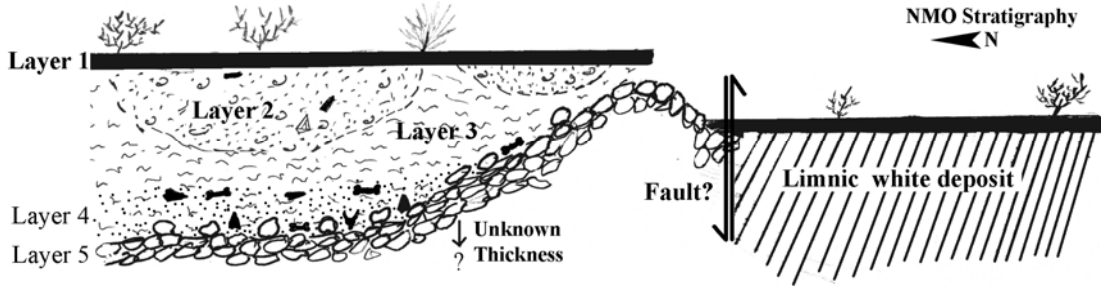

Figure 37: General stratigraphy of the NMO site.

The site's stratigraphy is presented in Fig. 37. In summary, the southern section of the study is comprised of a white limnic deposit that is archaeologically sterile. This layer is cut from the north by a layer of basalt cobble and boulders possibly due to a tectonic fault. The northern section of the study shows the following stratigraphy from top to bottom:

- Layer 1 – recent top soil laid by the modern Jordan River.
- Layer 2 – channel deposit of an old Jordan River channel made of sand and cobbles with numerous mollusks. The presence of ceramic and metal artifacts dates them to recent time.
- Layer 3 – a series of clays, mostly grey in color with occasional flint tools or bones.
- Layer 4 – the archaeological layer containing MP flint tools and many animal bones. The finds are concentrated directly in the contact between Layer 4 and the basalt Layer 5 below it but the layer is thickening towards the north.
- Layer 5 – basalt cobbles and boulders of unknown depth forming the bottom of the stratigraphic sequence at the site.

The Second Excavation Season – 2008

The excavation season of 2008 took place between September 7 and September 25. The work was done mainly by students of the Hebrew University of Jerusalem and volunteers.

Area D

Based on the results of the 2007 excavation season, the plan for the 2008 season was to open a larger excavation area situated between the localities in which layer 4, bearing the MP archaeological remains, was exposed. These localities included Area C, Sections 07-6 and 07-7 and the geological Trench Ic. A new area was therefore opened, named Area D (Fig. 38). From the study of the site stratigraphy, it became evident that in order to reach the archaeological layer, a substantial amount of earth must be removed, in particular towards the eastern portion of the site. A small JCB digger was used to remove the top soil and upper levels and expose the layers for excavation. A total of ca 64m^2 was excavated by the tractor, but only part of it (ca 28m^2) was excavated to archaeological layer depth. In the rest of the area a much shallower depth was exposed by the tractor, mainly to create a rim of lower section around the excavation area for safety reasons. Figure X shows a map of the Area D excavation indicating that only a surface of 16m^2 was excavated during the 2008 season.

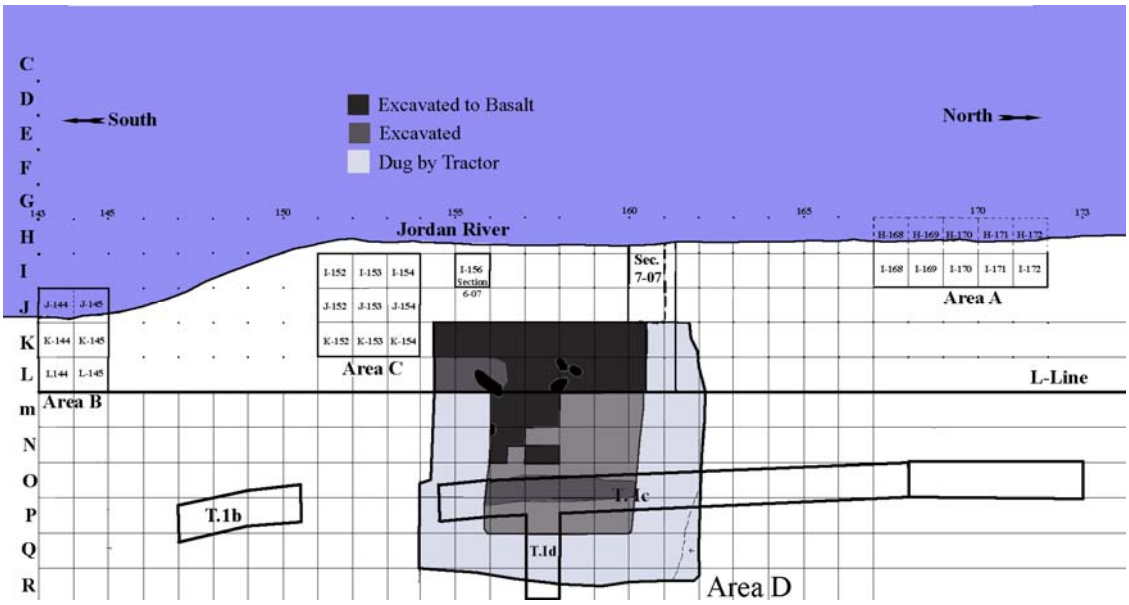

Figure 38: Excavation map showing the location of Area D in relation to the 2007 excavation areas.

Figure 39: Area D at the end of excavation, 25.9.08.

Preliminary Results of the 2008 Season

Stratigraphy

The results of the 2008 season at Area D confirmed the stratigraphic observations of the 2007 season. The same stratigraphic sequence as described above was observed in Area D, with the main archaeological Layer 4 located on top of the basalt cobble layer number 5. Nevertheless, the excavation contributed to refining the following stratigraphic issues:

The nature of the basalt cobble layer – Layer 5 was further studied. The layer surface was exposed in a relatively large area. The main feature of this layer is its topography. The layer is formed as a "pile" or a "river bar" formed from basalt boulders and rounded cobbles. It can be described as a small hill of basalt slanting in a moderate slope towards the north from 59.60 in square K155 to 58.80 in square K159, resulting in a gradient of

80 cm over ca 5 meters. In contrast, to the east, and probably to the west, the layer is slanting dramatically from 59.25 in square K157 to 58.40 in square N157. However, the basalt layer 5 is also exposed in the geological Trench Ic at a level of 57.40 in square O158. This gives an estimated gradient of 1.85 meters over 5 meters. One way to explain this peculiar topography is to suggest that we are looking at a bar (created by a flood?). Yet, Layer 5 is comprised of only basalt. The only source for the basalt in the region is the basaltic slopes of the Golan. In addition, if as suggested by the rounded nature of the cobbles, Layer 5 was deposited by water activity, then the landscape to the west does not allow for such high energy accumulation. An additional option is that the unique topography is a result of tectonic activity. At the current state of research this can only be brought as a hypothesis for further research.

An attempt to understand the nature of Layer 5 was executed by means of excavating 1 square meter of the layer to a depth of ca 50-70 cm below its surface in square K156 (Fig 40). The cobbles were removed one by one, their size measured and their roundness and level of weathering recorded. The study has shown that all along the section exposed, basalt is the only rock type present in the layer. Below the first layer of cobbles that are relatively un-exfoliated, the degree of weathering increases with depth and the cobbles and boulders at a depth of ca 50 cm have almost completely deteriorated into clay (Figs. 41-42). This is a somewhat unexpected result; if the weathering of the basalt is atmospheric, the situation should have been reversed and the exfoliation state should have increased towards the surface. More work is needed, apparently, in order to answer these questions.

Figure 40: Testing the nature of basalt cobbles in Layer 5 at square K156

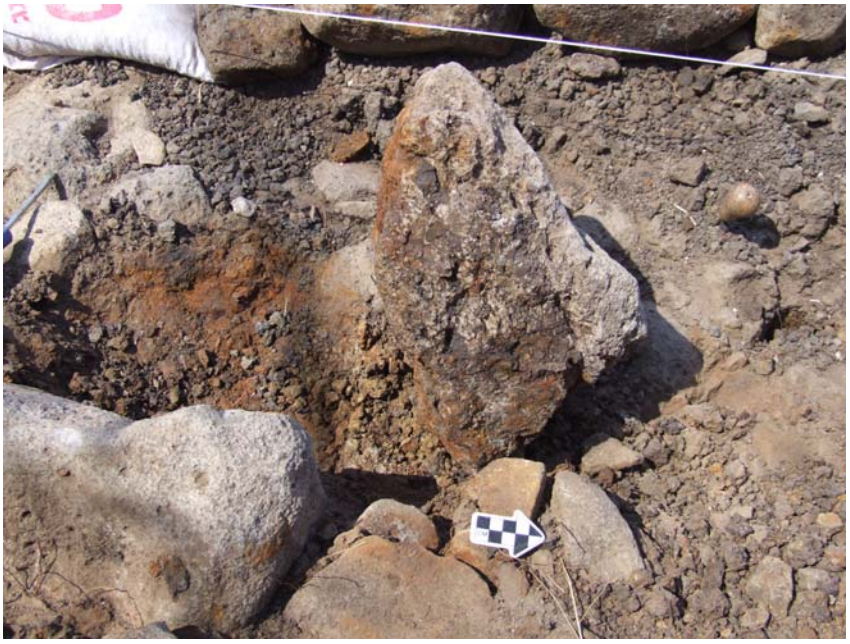

Figure 41: Basalt boulder showing increasing degree of exfoliation downward) from right to left in the figure)

Figure 42: Basalt deteriorated into clay at ca 50 cm below the surface of Layer 5 in square K156

Whatever may be the explanation of the topography of Layer 5, it seems that at the time of occupation, this is the typography the NMO hominids found. It was probably a small hill of basalt in the middle of the swampy mud that surrounded it. This may explain the attractive nature of this location to the hominids, who found within the swamp stable ground suitable either for ambush or as a place to bring the hunt for butchering and processing. This is one of the hypotheses that will be tested during the next excavation seasons at the site.

The archaeological Layer 4 rests on top of the basalt in almost all of the squares excavated in the site. Preliminary observations suggest that Layer 4 is densest at the "top" of the basalt pile and is much less dense toward the east. At the early stages of excavation, it was thought that the layer rests immediately on the basalt layer. The excavation at Area D, and in particular in squares K158 and K159 (Fig. 38) has shown that Layer 4, which is made of dark sandy clay with many light colored particles, has a thickness of up to ca 40 cm in these squares. Only after a larger surface is excavated and the fine stratigraphy is studied in detail, can the significance of this observation be fully presented.

Fauna

The study of the faunal remains from the 2008 season is, of course, ongoing. Yet it is clear that the finds of this season have enlarged both the variety of animal species represented at the site and the sample size for the animals previously found. The bones are quite fragile and require careful conservation treatment for future research. Taxon representation includes: Mollusks, Aves, Testudines, *Gazella gazella*, *Dama mesopotamica* (Fig 43), *Bos primigenius* (Fig. 44), *Equus* sp and *Sus scrofa*. In addition, many bone fragments were identified to body size (BSGB, BSGC, BSGD). Cut marks were observed on three bones. Carnivore gnawing and scratches were also present. This assemblage includes the base of a male aurochs skull, a complete sacrum of an aurochs (Fig. 45) and other teeth and post cranials.

Figure 43: Antler tip in square L159

Figure 44: Bos horn and femur in Layer 4, squares K158 and K159.

Figure 45: Complete sacrum of an aurochs in square K158

Figure 46: Concentration of bones in square L159

Flora

The presence of large pieces of wood as well as numerous seeds and fruits in the layer bearing MP archaeological remains was confirmed during the 2008 season. A few branches of wood were excavated. The largest, measured to ca 30 cm in length, was exposed in square K158 (Fig. 47). The study of the NMO wood pieces by Prof. E. Werker is ongoing. The two largest branches were both identified as Oak, possibly Quercus boissieri. This is a species that lives today at elevations above 500 meters above sea level and was not found in the wood assemblage of the excavation of GBY (Goren-Inbar et al 2002).

Figure 47: An oak branch, ca 30 cm long in square K158

The site's sediments have yielded numerous seeds and fruits that are under study by Dr. Y. Melamed at Bar Ilan University. The species identified to date include Ceratophyllum demersum; Chenopodium/Suaeda; Cladium mariscus; Cyperus sp. a; Cyperus sp. b; Lycopus europaeus; Ranunculus subgen. Batrachium; Rupia sp.; Scirpus cf. holoschoenus; Scirpus lacustris; and Silybum marianum.

Of special interest is the very large number of Gaertn (Silybum marianum) unearthed in square K159 (Fig. 48-49). The seeds were found at a depth of over 2 meters below the present day surface on top of a basalt boulder which is part of Layer 5. These seeds are, most probably, not the result of human activity. The main candidate for such accumulation is the harvester-ants (*Messor semirufus*). The question as to whether these are recent or ancient ants still awaits an answer.

Figure 48: Silybum marianum seeds in square K159

Figure 49: Silybum marianum seeds in square K159

Figure 50: Silybum marianum seeds

The Lithic Assemblage

The lithic assemblage excavated from Layer 4 at Area D is small yet very significant. The total number of flint artifacts larger than 2 cm excavated during the entire 2008 season is 125.

The lithic artifacts were found in the Layer 4 dark clay, mostly in vertical position as if they were stuck in the mud (Fig. 51). While this might suggest that they are not fully in primary context, they clearly show no evidence of any transportation in water and are extremely fresh. In addition, some of the flints show clear association with the bones (Fig. 52).

It is interesting to note that only very few of the flint artifacts show evidence of burning. The assemblage of small micro-artifacts, on the other hand, has higher numbers of burned pieces and they may be used for TL dating.

Figure 51: Flint flakes and blades in vertical position in Layer 4 square L159

Figure 52: Flint flake and bone fragment in close association in square L157 Layer 4.

Preliminary observations regarding the 2008 flint assemblage have yielded the following preliminary observations:

1. The assemblage is obviously small and the density of lithic artifacts is very low in comparison to most other Mousterian sites excavated (Gilead 1980; Goren-Inbar 1990; Jelinek 1981).
2. Within this small assemblage, the percentage of tools is very high and waste products are almost absent.
3. The main morpho-types represented are points and retouched blades (Fig.53)
4. Many of the artifacts show utilization marks on their edges.
5. The assemblage is clearly laminar in nature and most of the points are elongated (Fig. 53).
6. Although Levallois flakes are present, the majority of the artifacts were probably produced by means of the laminar core method (Dojtczak 2008; Meignen 1998; Meignen 2007, 2008).

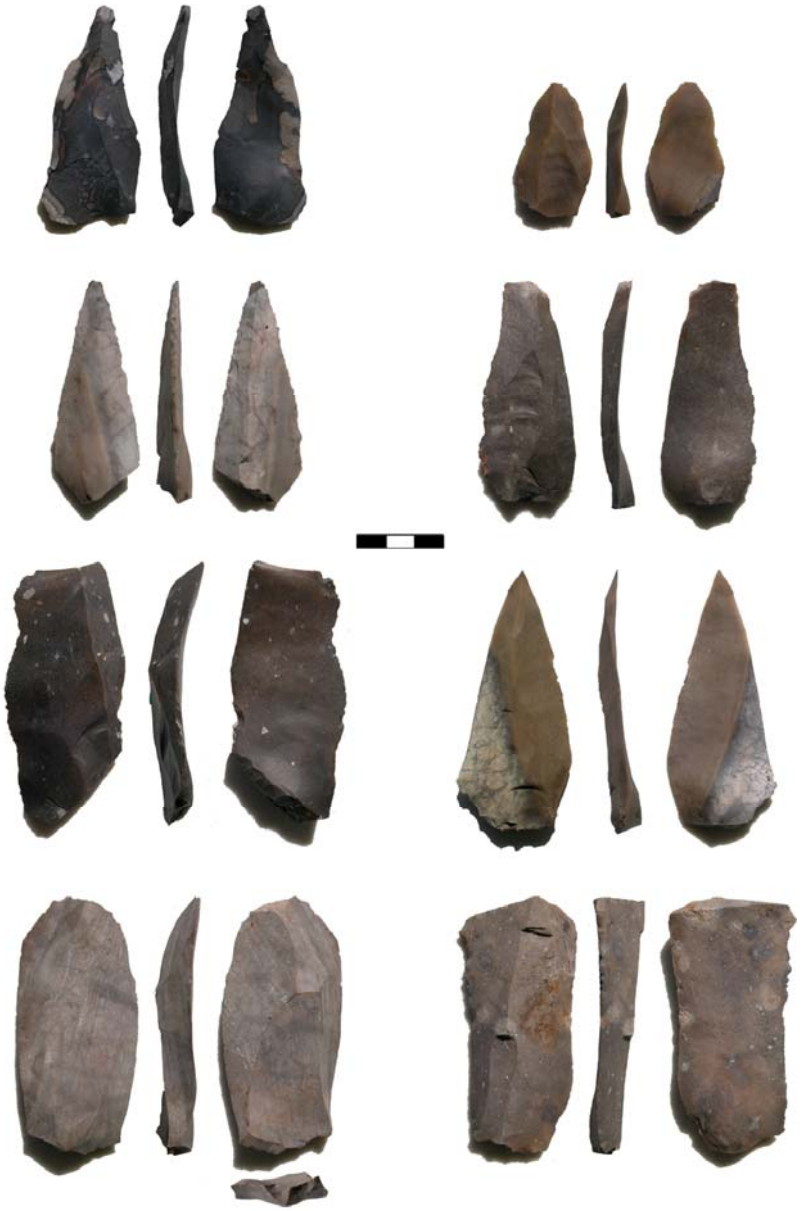

Figure 53: Flint artifacts from Area D, 2008 excavation season at NMO

The lithic assemblage excavated during the 2008 season suggests that the lithic industry of the NMO site (at least the one represented in Layer 4) may be assigned to the early elongated Mousterian tradition of the Levant (Copeland 1975; Garrod and Bate 1937; Meignen 2008; Shea 2003). If this is indeed the case, the NMO site is the only open-air site in Israel that can be assigned to this early phase of the Middle Paleolithic. This suggestion is also chronologically significant as it places the site within the earlier stages

of the MP estimated at present to be ca 200 Ka (Bar-Yosef 1998; Mercier, et al. 2007; Shea 2003).

Additional significance of the NMO lithic assemblage is the low number and density combined with the low percentage of waste products. Archaeological observations presented above suggest that the site represents a short term occupation, in which hominids came to this locality for some kind of hunting, butchery and meat processing activity. The presence of very limited number of tool types, including primary points and blades that could have been used for meat slicing, may suggest a task specific nature for the NMO occupation. It can be suggested that we are looking at a very specific tool kit that represents only what the NMO inhabitants selected to carry with them to the hunt, explaining why all the waste products as well as other tool types such as burins or scrapers are either absent or under-represented.

It should be noted, of course, that these suggestions are based on the excavation of only a limited area and are preliminary. They might be true only specifically for Area D Layer 4 while other localities at the site may show a different nature of occupation, as suggested by the assemblage of tools collected from the piles of sediments at NMO (Goren-Inbar & Alperson-Afil, personal communication).

Closing of the excavation

At the end of the excavation the excavated surface of Area D was covered with a geo-technical fabric (Fig 54) and the excavation pit was filled with sediments to protect the layers (Fig 55).

Figure 54: Area D covered with geotechnical fabric.

Figure 55: Area D covered with sediments at the end of excavation.

Future Research Goals

Dating - One of the main challenges of the excavation at NMO is to establish a date for the site layers. From the data presented above, it seems that the best strategy will be to use the TL method. We hope to initiate a dating project at the site, including dosimetry, beginning at the next excavation season.

Ostracods – the study of ostracods may contribute to the reconstruction of the paleo-environment of the site as well as for other proxies such as nature of accumulation, water levels, salinity and more. Collaboration with Dr. S. Mischke is underway and soil samples from sections 07-2 and 07-4 (Fig. 11) were collected. The results of this preliminary study will enable us to conduct a large scale study of the site's ostracods and paleo-environment (see attached report for preliminary results).

The Significance of the NMO site

The NMO site provides a unique opportunity to explore four areas of humanity's cultural and biological origins, development and variation. The first area is the behavioral pattern and subsistence strategies of Middle Palaeolithic hominids in the Northern Dead Sea Rift. The site is open air and suggested to be of short-term and task-specific nature. This nature of occupation will allow us to study the behavior pattern of the MP hunters, their task-related lithic tool-kit and their subsistence as evidenced by the animal bones they left behind. Research findings should contribute to the debate over the hunting capabilities of early Mousterian hominids as well as the differences between Neanderthals and anatomically modern humans. The data retrieved from long sequence Levantine Mousterian cave sites normally does not permit such resolution. The Mousterian culture is, at present, almost unknown from the Northern Dead Sea Rift (with the exception of the Nahal Amud cave sites) and, in particular, the presence of early Mousterian has rarely been documented. The second area of exploration is the environmental background for the human activity at the site and the human interrelation with it. The preservation of botanical material is unique among MP sites in the Levant, enabling this study. The preservation of seeds, fruits and wood may also enable us to learn about the vegetarian

diet of MP humans. The documented presence of wood pieces gives reason to believe that further pieces may be unearthed showing marks of human activity. The human skull fragment is the only human remain ever found in a Mousterian open-air site in the Levant and with it lies the potential to contribute to the third area of humanity's development, the debate over the chronology, co-existence and behavior of Neanderthals vs. anatomically modern humans in the region. And finally, clear indications for the presence of Upper Palaeolithic tools in one of the site's excavated assemblages suggest that the chronological and cultural margins of the site's layers covers a wide range of archaeological periods. If additional findings can confirm the occupation of UP hominids, the site may contribute to our understanding of the emergence of modern humans in the Levant and their migration routes out of Africa.

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