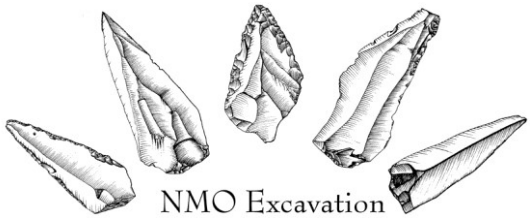


Nahal Mahanayeem Outlet Excavation

Report on the 2014 Excavation Season

Submitted to the Israel Antiquity Authority

June 20, 2015

The NMO project is supported by:

The CARE Foundation

Introduction

The eight excavation season at Nahal Mahanayeem Outlet (NMO) Mousterian site lasted four weeks and took place between August 4 and August 28, 2014. Team included students and volunteers from the France, Italy, Austria, Sweden and UK. In addition students from the Tel Hai College participated, as two groups, in 2 weeks field school during the 2014 season. This is the third year of very successful field school at the Tel Hai College (2 credit points) which helps bring many students to know and like archaeological work.

The goals of the 2014 season were, in a similar way to the previous season, to continue excavating in the primary excavation area – Area D (Fig. 1), in particular towards the north, where the excavated squares are rich in finds, and to the south of the area, where additional levels of occupation were suspected. Additional goal of the 2014 season was to fully expose the basalt pile forming the bed-rock of the site (Layer 5, see below). This basalt cobbles and boulders layer is forming a hill, standing some 2.5 meters above the surrounding surface. The full exposure of this hill allowed us to gain new understanding of the morphology, typography and nature of the layer and its significance to the forming of the site and the nature of occupation.

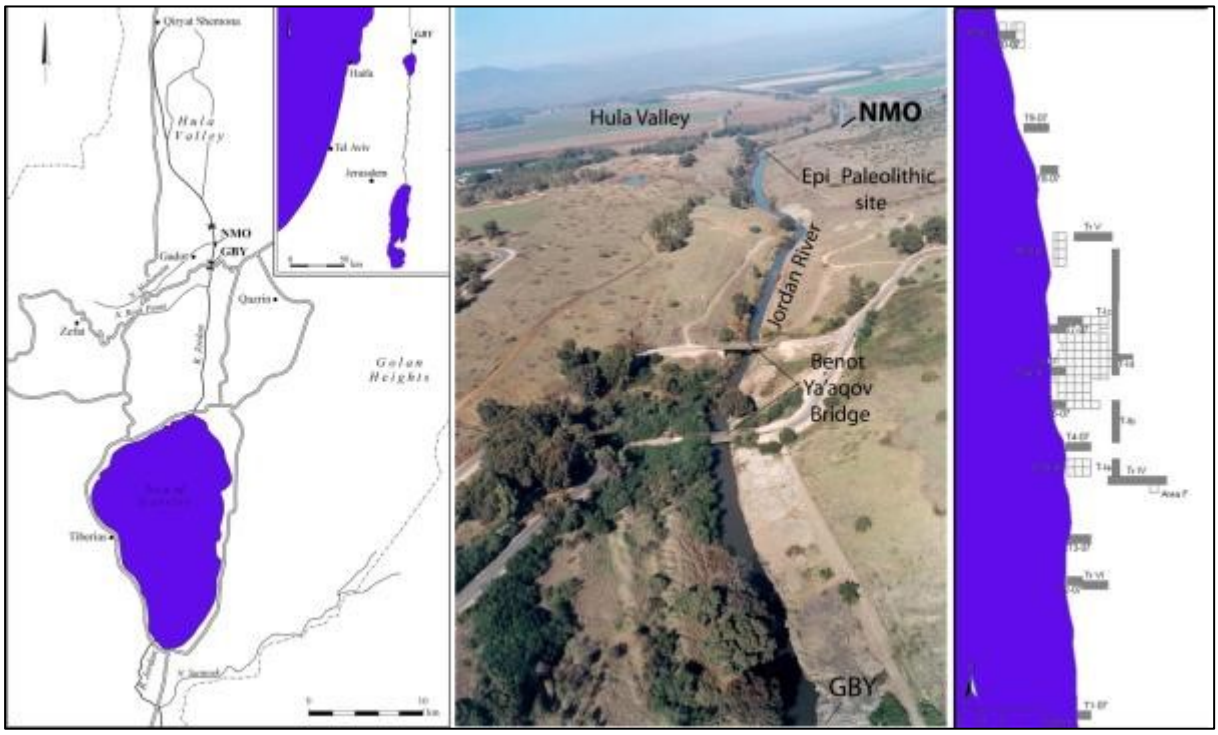


Figure 1: Location of NMO site and general map of excavation and trenches.

Figure 2: NMO from the east

Excavation methodology

Excavation grid and datum were based on the data from previous seasons (see previous IAA reports). The use of a Leyca total station device enabled us to return to the grid and datum of earlier excavation seasons with very high precision.

The total station device was also used for the recording of all finds, soil samples and other samples, trenches and other reference points and data at the site. Each find or sample has its spatial data recorded and organized within the site's database. Different numbering is used for the recording of flint artifacts, bones, wood and soil samples. The additional category of "other" is used for different, non-flint lithic raw materials (such as basalt) and for finds that fall outside the above categories. Soil sampling continued the policy practiced during the previous seasons. In each of the excavated squares, a section of 10 cm was left at the middle of the square during excavation. This section "pillar" (known at the site "carrot"; Fig. 2) was regularly collected in 5 cm slices as soil samples. This method ensures the collection of soil samples along the entire sedimentological sequence of each of the excavated squares. The soil samples were recorded using total station and numbered sequentially with the year, the square and the serial number recorded on the bag and in the computer (for example NMO 13/01). In addition, soil samples were collected every three days specifically for zooarchaeology (labeled RB/14/#) botany (labeled YM/14/#) and fungi (labeled ID/14/#). Specific samples

were also collected from location of special interest identify during excavation. All samples are kept at the excavation storage at Kibbutz Gadot. The complete list of 2014 season soil samples is given in Appendix 4.

Sediment sampling and sieving – the policy of the site is to sieve all the sediments excavated. Sieving in Jordan River water is a heavy time consuming effort. The fine clay of the sediments demand long sieving process that may sum in 20-30 minutes per bucket. Some 40-50% of labor time is invested in sieving (not counting the sediment sorting time at the lab). Therefore, in squares where the sediments are almost archaeologically sterile, like when excavating the layer 3 soils above the archaeological layer 4, we adopted a different strategy in which only one bucket per spit is sampled. The sampling method is recorded in the square daily excavation pages and is constantly evaluated. When excavation reaches the archaeological layer, the sediment is always fully sieved.

Figure 3: soil sample sections (carrots) in squares M162 and N162.

Figure 4: Sieving sediments 2014 season.

Finds orientation: we have continued the previous seasons method of recording and indicating the in situ inclination of exposed large bones and flints. For each of the finds larger than 5 cm we record its position similar to all finds at the site. In addition, we record two points on the far ends of the find. The points are recorded as the artifact ID umber with added a and b. The line between these two points will allow us to quantify the inclination of each of the finds and to discuss the taphonomy resulting.

Bone preservation and restoration on site: bones exposed at the site, and in particular from the lower, waterlogged squares, are found in complete form. However, when exposed by excavation they form cracks and may, if not carefully handled, collapse into many small fragments when extracted (Fig. 5). The unique completeness of the bones is one of the site's advantages for the zooarchaeology study. Complete bones are rarely found in prehistoric sites at the Levant. Such bones, when measured, can provide valuable information regarding size of animal and other crucial information. The breakage of the bones prevents these advantages and forces the investment of much time and energy in lab preservation and refitting work. In an attempt to tackle this problem, and in consultancies by Ms. Gali Bainer, the site's bone preservationist, we developed and applied a method aiming for the preservation of the bones in one unit that can then be preserved at the lab. The unique conditions at the site and in particular the wet sediments present special preservation challenge. The bones are actually excavated in under-water conditions as water run into the excavated squares during excavation as well as during the night and practically "wash" the glue off the bones. It was necessary to find glue that will hold in water on the one hand, and will be easily removable on the other hand. Such glue was found by G. Bainer and we experimented its use during the 2013 season. The selected method involves the application of glue to the bones immediately during their exposure (even before they were fully excavated) and rapping the exposed surface with gauze pads and glue. The gauze kept all parts of bone together and enabled us to

extract the bones in complete form (even if cracked) into lined boxes (Fig. 6). This method was proven successful and saved great deal of conservation work. The method was applied during the 2014 season and allowed us to extract very large bones in complete and undisturbed form.

Figure 5: fractured bone before conservation treatment

Figure 6: Bones extracted from Square N162.

Figure 7: bone preservation in the field.

Jordan River Water Level and excavation conditions: After the extremely dry winter of 2014, with less than 50% of the annual precipitation, water level in the Jordan River was the lowest since we started excavating in2007. Water level measured on August 13 at 08:00 in the morning was 58:14. As a result, the excavated sediments were relatively dry and we had no events of flooding in the excavated area. Additional result of the low water level was the exposure of some bones on the bank of the Jordan, and in particular two bovid jaws exposed immediately north of Area D (Fig. 8 and see below)

Figure 8: bovid jaw bones on river bank north of Area D

The 2014 Season - Report

Opening Area D for excavation – In accordance to the aims of the excavation season which was to expose the entire excavated surface of the basalt of Layer 5 we used a JCB excavator tractor to remove all soil from the entire excavated Area D. All the squares that were excavated during the previous years were exposed and we enlarged the Area by cleaning a line of squares at the south part of Area D. In addition, the squares in the north, at lines 163 and 164 that were not previously excavated were dug by the tractor to a level of 58:60 cm – some 20 cm above the expected appearance of the archaeological layer in north Area D. This was done in aim to excavate the archaeological layer in theses squares without wasting time for the removal of sterile soil above it.

Figure 9: location of excavation squares 2014.

For general location of the excavated squares in Area D see Fig. 9. The primary excavation area of the site, Area D, was excavated with the goal of continuing the previous season excavation by enlarging the excavation area in particular sections of interest. The focus of the 2014 season was on squares at the northern, southern and western parts of Area D (Fig. 9). As this was the final excavation season at NMO, we opened and cleaned the entire excavated surface of Layer 5 basalt hill. The aim was to get a complete picture of the basalt hill, its topography, extent and height over the surrounding surface. The basalt hill was photographed from all angles and directions in an attempt to produce a 3D model (under progress). In

addition, a drawn photography of the site was used for aerial photographs of the cleaned and exposed basalt (Fig. 10 and see discussion below).

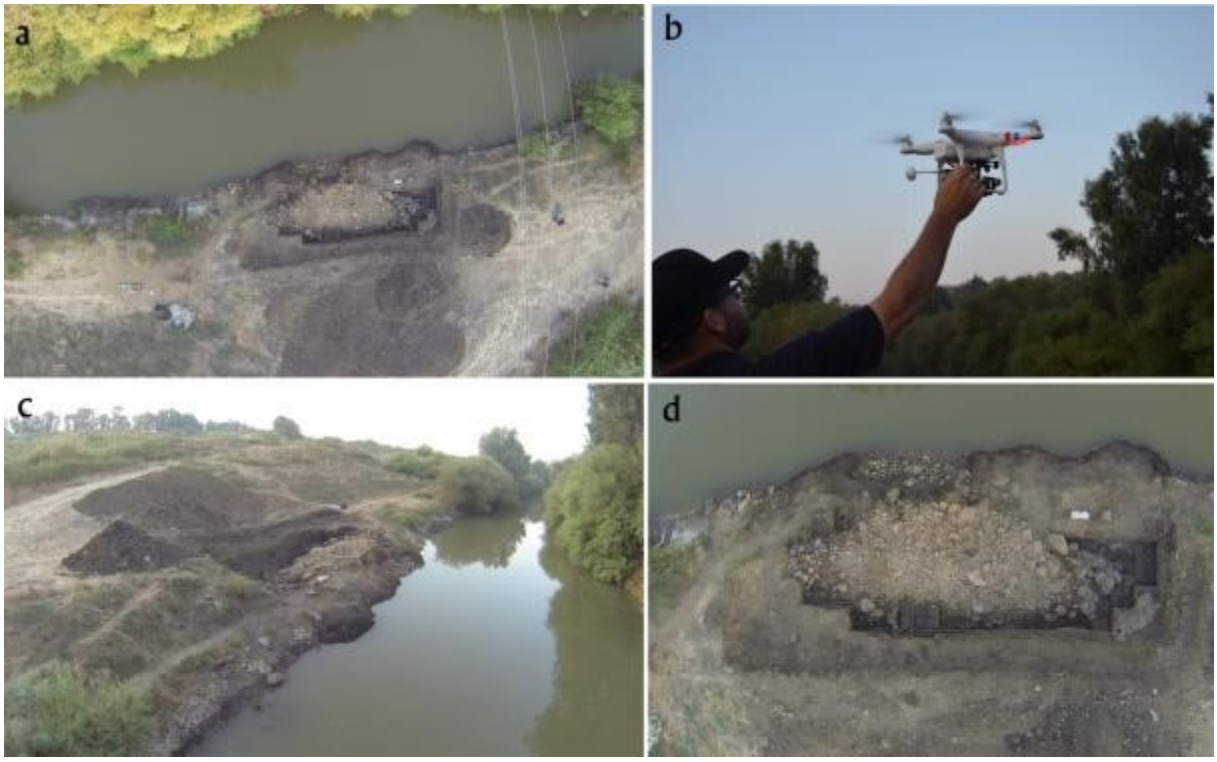


Figure 10: Aerial photography by drone

Figure 11: NMO – general view from the south

Figure 12: NMO at the end of the 2014 season - general view from the north

Figure 13: NMO Area D at the end of 2014 season. Three views from above.

Figure 14: NMO Area D at the end of 2014 season. Three Views from the south-west.

Bones at the Jordan River Bank North of Area D

Due to extreme low water level in the Jordan River during the summer of 2014, parts of the bank were exposed that could not be seen in previous years. As a result, two large fragments of bovid jaw bones including the teeth were observed and excavated within the dark mud of the river bank (Fig. 15). Few additional bone fragments and one or two isolated flint flakes were excavated from the river bank next to the jaw bones. A large piece of wood/charcoal was also exposed and taken by total station. The sediment here is the dark mud with many Gingi (iron concentrations, see previous reports). The location of the bones, as recorded by the total station is presented in Table 1. The bones are found only few meters to the north west from the excavated squares of Area D and in approximately the same elevation (58.30 -58.20). It seems that they can be attributed to the archaeological horizon excavated at the north part of Area D at the same elevation, very rich with bovid bones, possibly of a single individual. Future zooarchaeologiacl research may add information on this issue. The bones were treated according to the site's preservation protocol (see above) and excavated. It should be noted that a skull and femur of a lion were excavated from the river bank in similar context during the 2002 survey of the site (Sharon et al., 2008).

Table 1: the bones from the Jordan River Bank.

Bone #	Coor. East	Coor. North	Level	Square #	Date
6120	3005.984	1066.443	58.347	G166	06.08.14
6121	3005.707	1066.195	58.211	G166	06.08.14

Figure 15: Bovid jaw bones on the bank of the Jordan River north of Area D

Area D North section

This is a rich part of the excavation at the "foot of the basalt hill". The squares excavated during the 2014 season are shown in Figure 16.

Figure 16: Area D north – location of excavation squares.

Sedimentology and stratigraphy

At this part of Area D, the basalt that was slanting toward the north until the 160 line (see Fig. 1) seems to "straighten up" and keep of a flatter level toward the north. The nature of the basalt surface seems to change from a relatively flat "pavement" with large boulders sticking up to a more hectic surface with deep "holes" between the basalt stones. Inside these holes the sediment seems to be almost sterile from Archaeological remains (Figs. 17-23). It seems that the archaeological horizon stops at a level of 58:00 more or less where the lower sediment inside the "holes" is almost empty. Almost because a single large and broken bone was founds in square K162 and occasional flint flake was recorded (Figs. 19-20). Within the holes in the basalt, and in particular in square L162 (but also in other squares) whitish or grey sediment is found, somewhat similar to the "white stuff" north of Area D. The structure of the light color sediment is of ointment, again very similar to the carbonate sediments to the south.

Above the level of 58:00, the sediment is rich in archaeological finds and is comprised of dark mud very rich with grey and light color small particles. The layer of "tuktuks", observed already in previous seasons is tupically found immediately above the basalt of layer 5 and in the upper 50 cm or so above it. The light color dots start at a level of ca. 58:50 and their frequency increases as excavation surface goes down. Near the basalt of layer 5 the sediment becomes almost sandy, full of these "tuktuks" and rich in archaeological finds. This is not a homogenous continues layer but more of a patchy lens nature. In some of the squares a contact can be observed between the "tuktuks" and the dark mud. Present day basalt piles or dry river beds running down from the Golan will not be clean and sterile (Figs. 26-24). When observed such surfaces are covered by dry vegetation and small pebbles of limestone and basalt. It may be, therefore, that the sandy sediment, rich with dissolved limestone, may represent a flooded surface where rising water level form kind of a "halo" of limestone above the basalt (Fig. 23). It is suggested that this sedimentology may resemble a shore line environment and some mixing of the sediments along the 161 squares. It is hence suggested that this area was the water front at the time of occupation, and water level was around 58:50 or below (Figs 17-18; 22).

Figure 17: Area D North Squares looking south. Note the different nature of basalt in the north.

Figure 18: Area D north. a. close-up of basalt of Layer 5. a. a view from the north west; b. a view from the east.

Figure 19: Bone at the bottom of "hole" in Square K163c Level 58:00. Note the weathering of the bone – somewhat "rolled" in appearance.

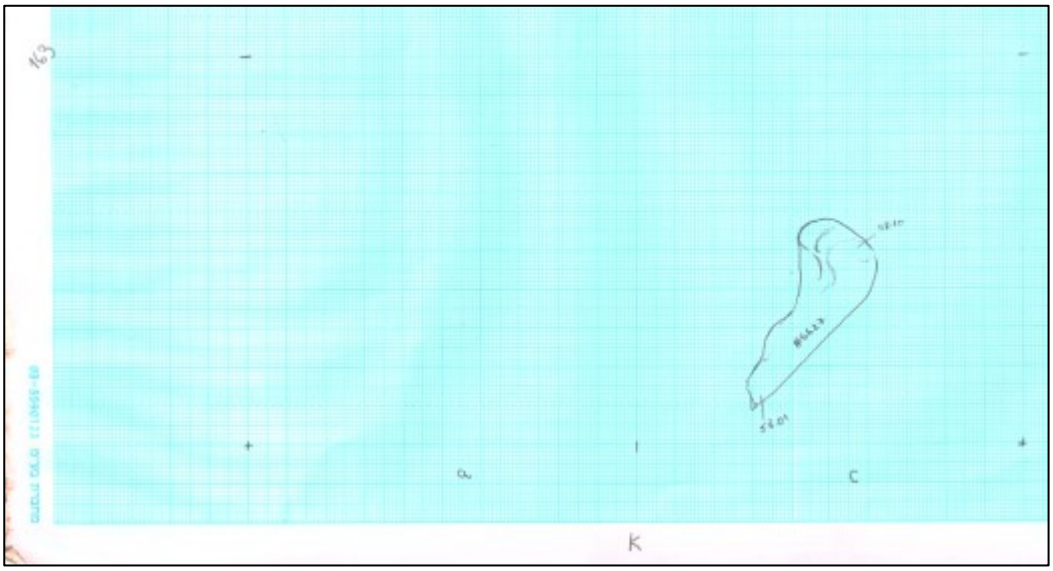


Figure 20 Figure 21: Bone at the bottom of "hole" in Square K163c Level 58:00. Draw.

Figure 22: Area D north squares end of 2014 season. Note the "holes" between basalt boulders.

Figure 23: "White stuff" under boulder in square L162.

Figure 24: Sediment at square L164 at level of 58:45. Note the clean grey sediment and the emergence of the first light color dots "tuktuks".

Figure 25: Sediment at square K162d at level of 58:22. Note the intensity of white particles

Figure 26: Sediments at square L161d level 58:35. Note contact between layers marked by arrows. A lens of many "tuktuks" in contact with more fine mud to the west (left). Note white sediment lens at lower left.

In square K162, at the western part of the square a layer of small cobble to pebble size stones was unearthed starting at level of 58:30. These small basalt stones are forming a small "bar" like feature and may represent a local concentration within the shallow water of the lake in this locality or a continuation of the basalt pile toward the North West (Fig. 27).

Figure 27: Small cobbles in Area D square K163 (marked by arrow)

The finds of the 2014 season at the north squares of Area D, and in particular in the eastern squares of M and N line (Fig. 9) contributed much to our understanding of the nature of site, sediments and human occupation:

Wood and botanical remains – the primary observation to be noted is that this part of the site is very rich in botanical remains. Hundreds of botanical finds are scattered in these squares ranging in size from few millimeters to twigs and branches up to 30 cm in length (Figs. 30-40). Many of the botanical remains are clearly found in the form of charcoal while others are unburned. In many cases it is hard to distinguish between burned and unburned pieces. No clear concentration can be seen among the botanical remains, partly because they are so many that the whole area of c. 10 square meters seems to be one large concentration. So no fire place could be identify and it was suggested that that such pattern may represent either fire-place that was washed by water and redeposit in nearby shallow water. Another alternative is that the dry vegetation on the bank of the lake was burning and the small fragments fall into the water and mud. In some places a group of branches was unearthed forming a small pile or concentration. The meaning of these small concentrations is unclear at the current state of research. A preliminary study of the botanical remains from the north of Area D indicates that many of the remains belong to a monocotyledone plants. It seems that the roots and branches of Lesser Bulrush (*Typha domingensis*) are a possible candidate for identification. The Bulrush plants are growing in shallow water at the margin of calm water bodies and swamps. This identification supports the interpretation of this part of the site as the shallow water and fine mud on the bank of the Paleo-Lake.

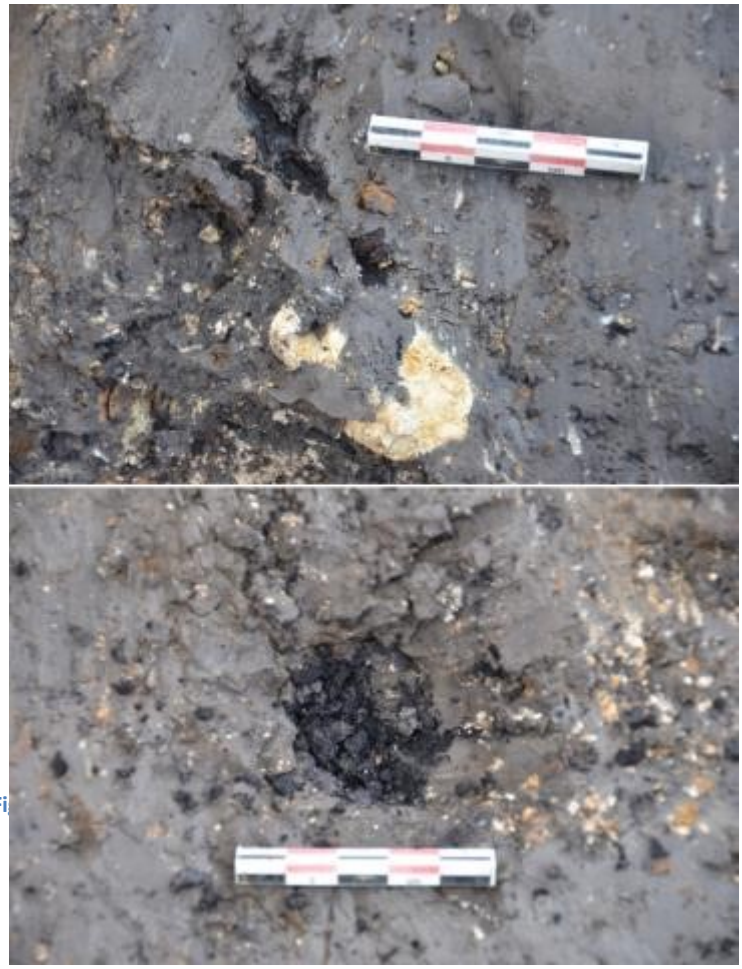


Figure 28: Charcoal in fine mud at Square M162 level 58:40

Figure 30: Wood fragments at Square L162 level 58:40

Figure 31: Wood "pile" at Square L162b level 58:40

Figure 32: Wood "pile" at Square L162b level 58:40. Close-up.

Figure 33: Wood "pile" at Square L162b level 58:40

Figure 35: Wood "pile" at Square L162b level 58:40. Close-up

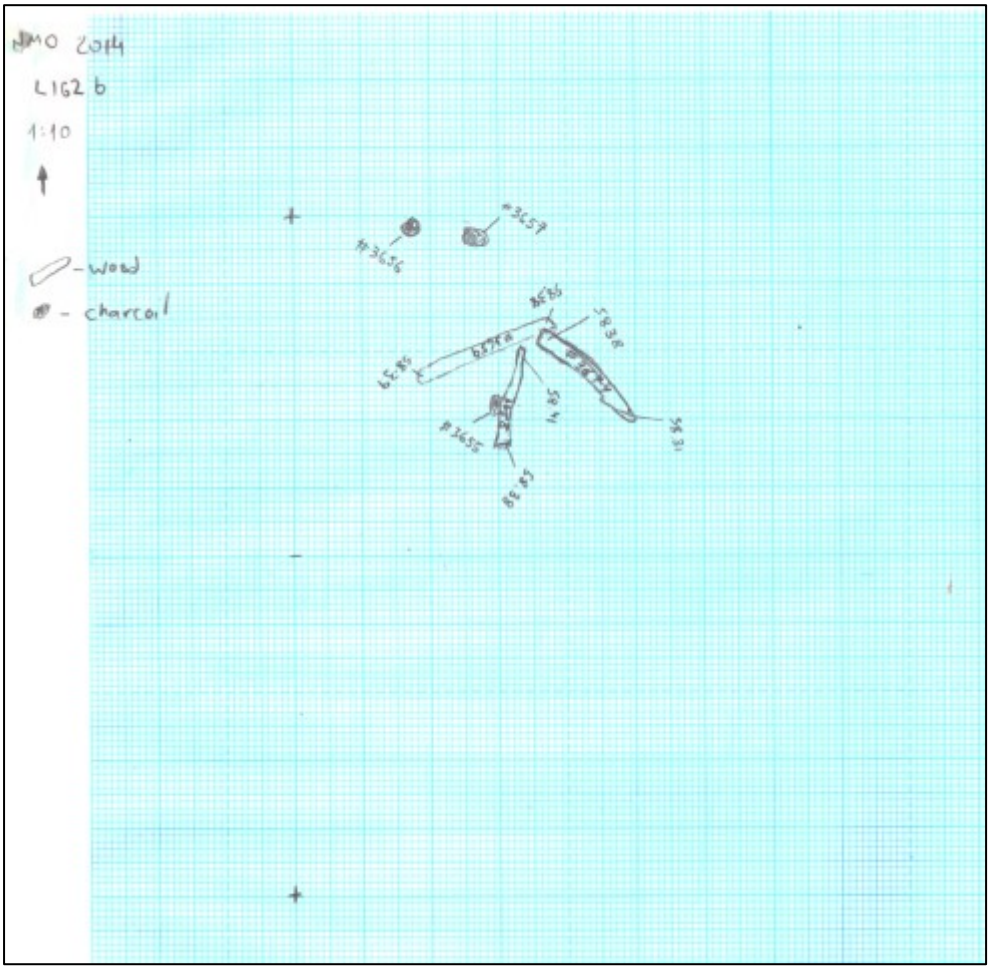


Figure 34: Wood "pile" at Square L162b level 58:40. Draw.

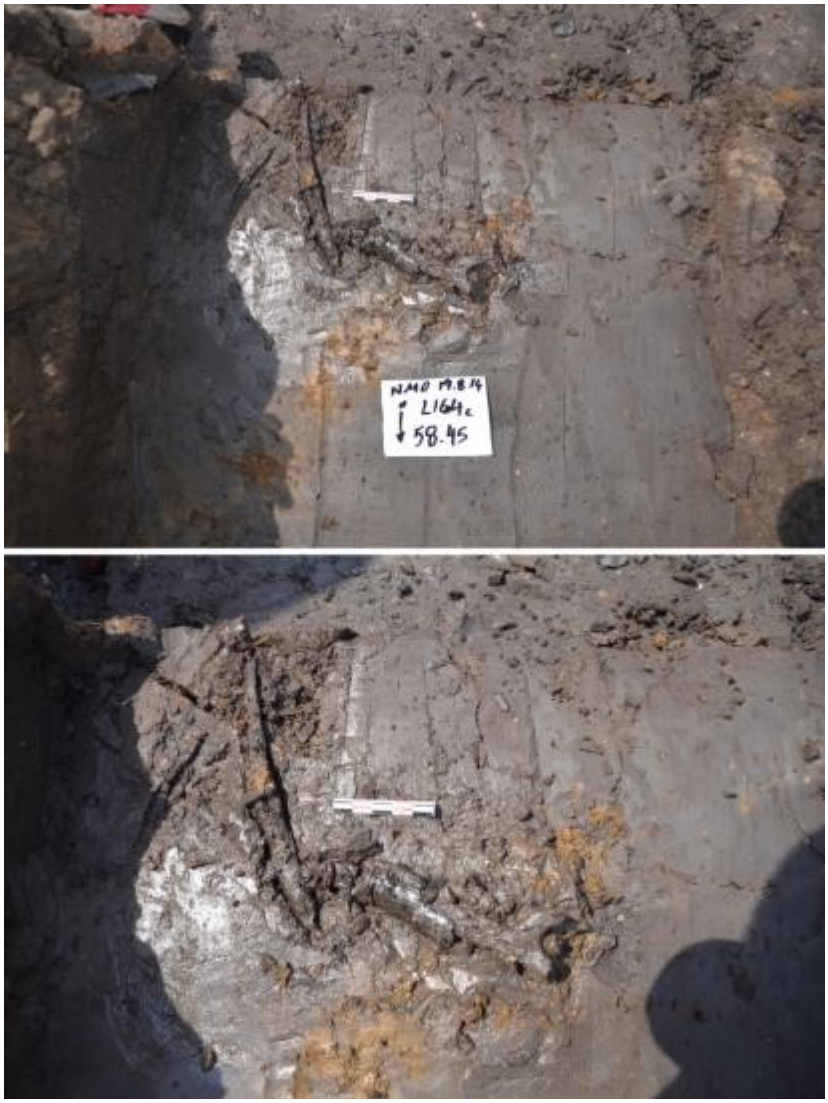


Figure 36: Wood at Square L164c Level 58:45.

Figure 37: Wood at Square L164c Level 58:45. Close-up. Note the bark remains.

Figure 38: Wood at Square M163a level 58:25.

Figure 39: Wood at Square M163a level 58:25. Close-up.

Figure 40: Wood at Square M163a level 58:25. Close up.

The fauna

The northern sector of Area D is the lowest part of the excavation and the area showing the best preservation conditions for the bones (see above). The preservation of bones exposed during the 2014 season was indeed excellent apart from the cracking that accrued on the larger bones, which in most cases we were able to deal with by applying the method of preservation as described above (Figs 43-52). The fauna here consist primary the bones of a large bovid, possibly belonging to a single individual. The 2014 exposed bones are the continuation of the bones exposed since 2012 in this part of the excavation (Fig. 52). A few observations should be presented regarding the bovid bones:

1. They are numerous and seem to belong to a single individual.
2. They are large (Figs. 43-50).
3. They are complete (Figs. 43-50). The majority of the bones are found unbroken. It seems that the NMO hunters, at least in the event documented by the bones in this northern section of Area D, did not smash the bones as part of the butchering process.
4. There are clear signs of utilization by human on the bones: cut marks (Fig. 47), the fact that the bones are not in articulation (Fig. 50), the association between the bones and the stone tools (Figs. 51).

Additional bones of smaller mammals were also found in this area, in association with stone tools and wood fragments (Fig. 51). This fact suggest that more than a single species (and a single animal) was slaughtered here, making the interpretation of the finds more complicated than a simple hunting episode.

Figure 41: Square M162 at the beginning of the 2014 season. Bone (rib?) floating in the mud.

Figure 42: Bovid rib bones at Square L162 a.

Figure 43: Rib bones at square M162a level 58:25. Note large bone starting to be exposed at the next sub-square to the east (c).

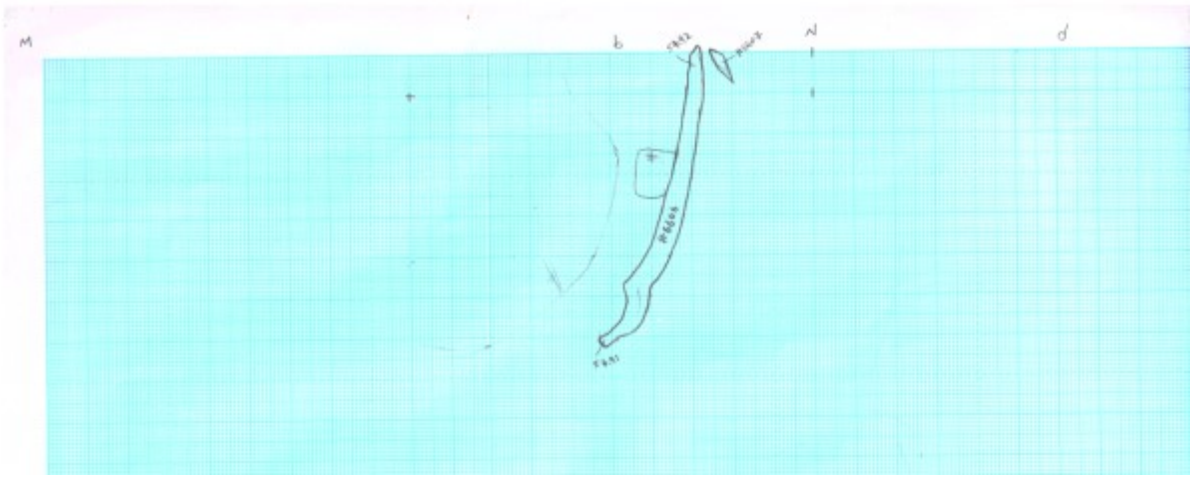


Figure 44: Rib bone at square M162a level 58:25. Draw.

Figure 45: Large bovid bones at Square L162c and N162a. Note the completeness of the bones.

Figure 46 : Bones in Square M162 during excavation.

Figure 47: Cut marks on complete bovid long-bone at square L162.

Figure 48: Large complete bovid bones in Square N162

Figure 49: Post depositions fracture on a completely buried bovid bone in Square M162c

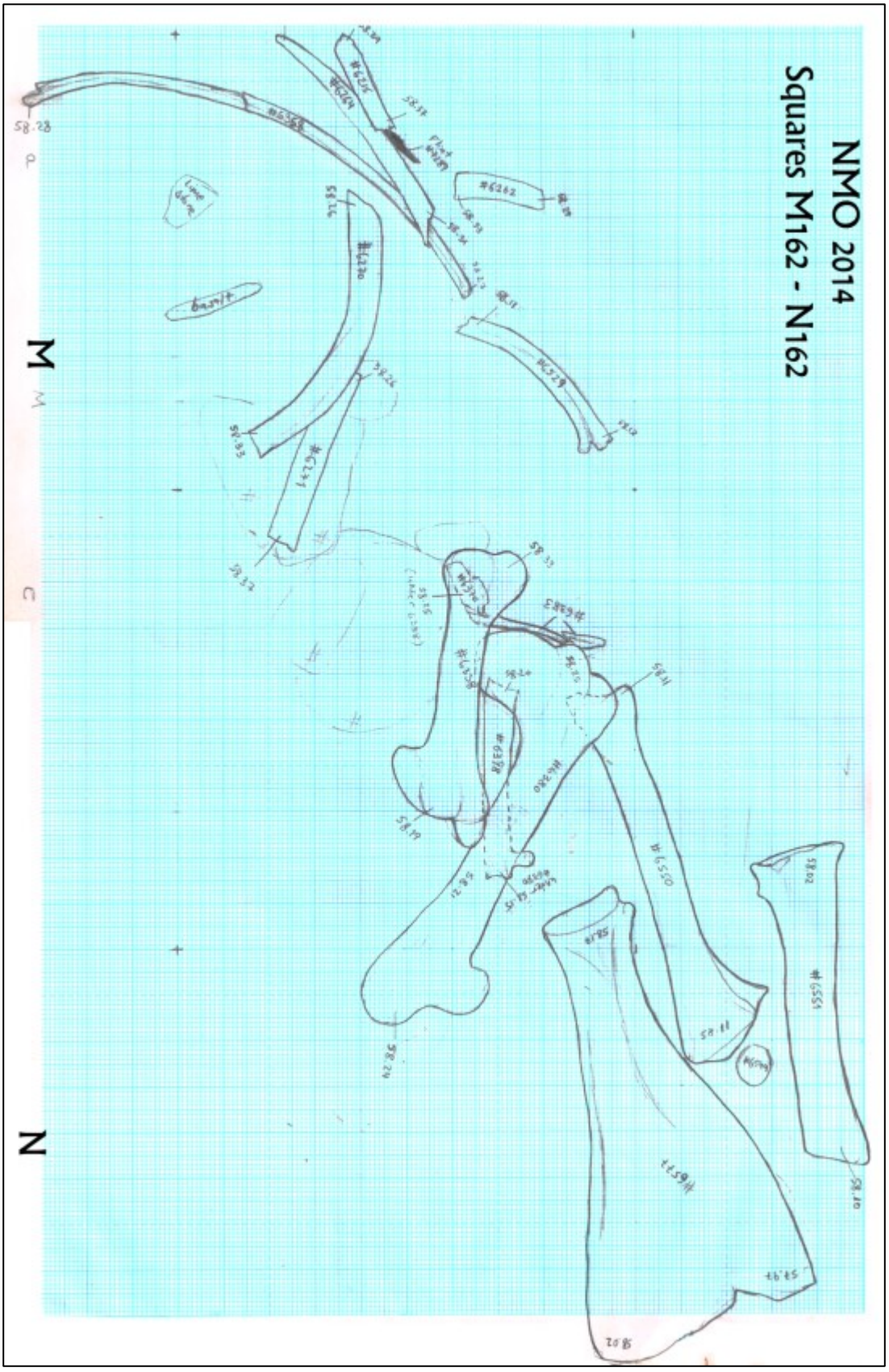


Figure 50: Drawing of the bovid bones in Area D north season 2014.

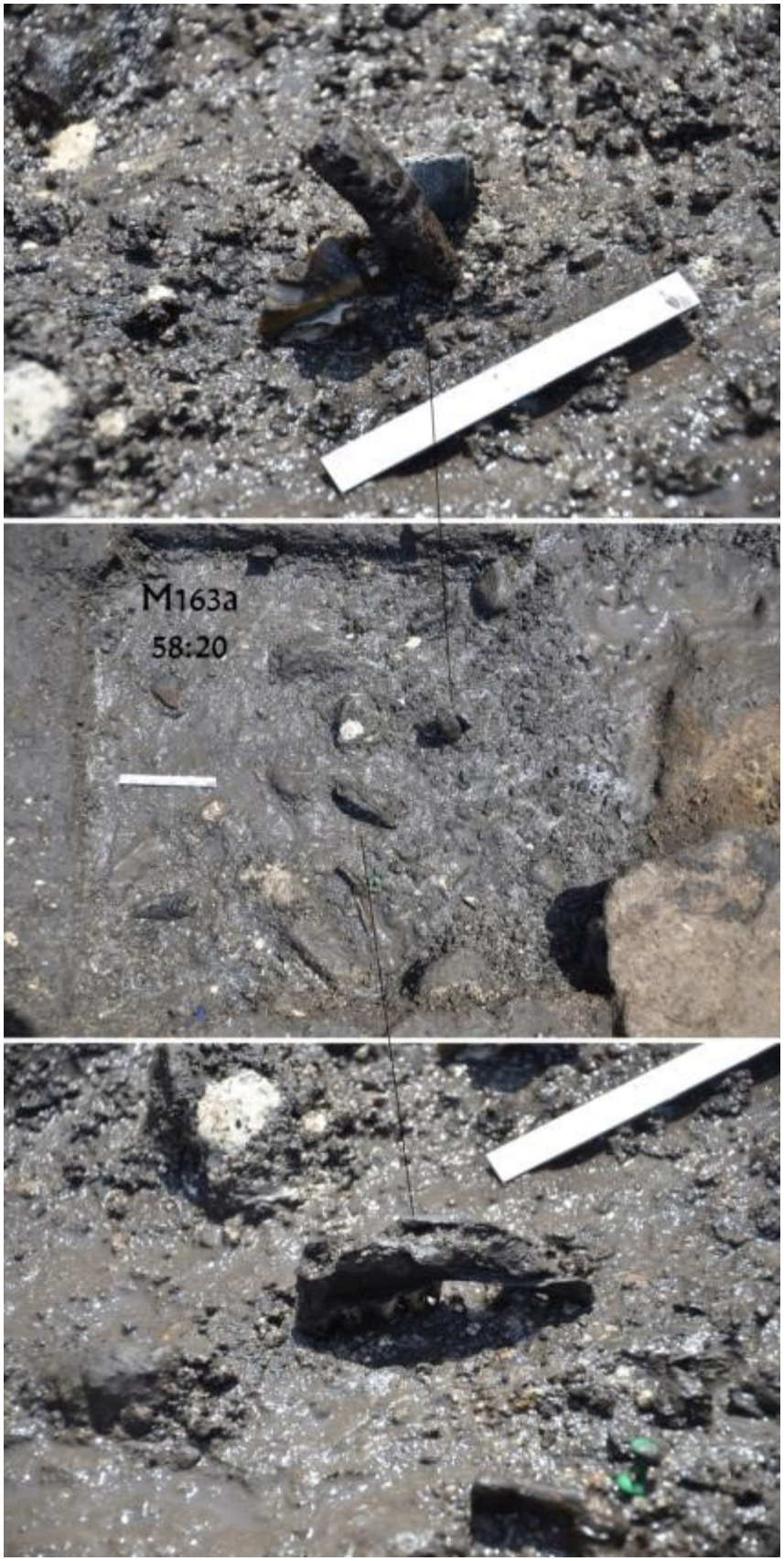


Figure 51: Square M163a level 58:20. Bones flints and wood. Up – a vertically standing wood surrounding by 2 flint flakes. Bottom – fragment of a dear jaw. Scale 10cm.

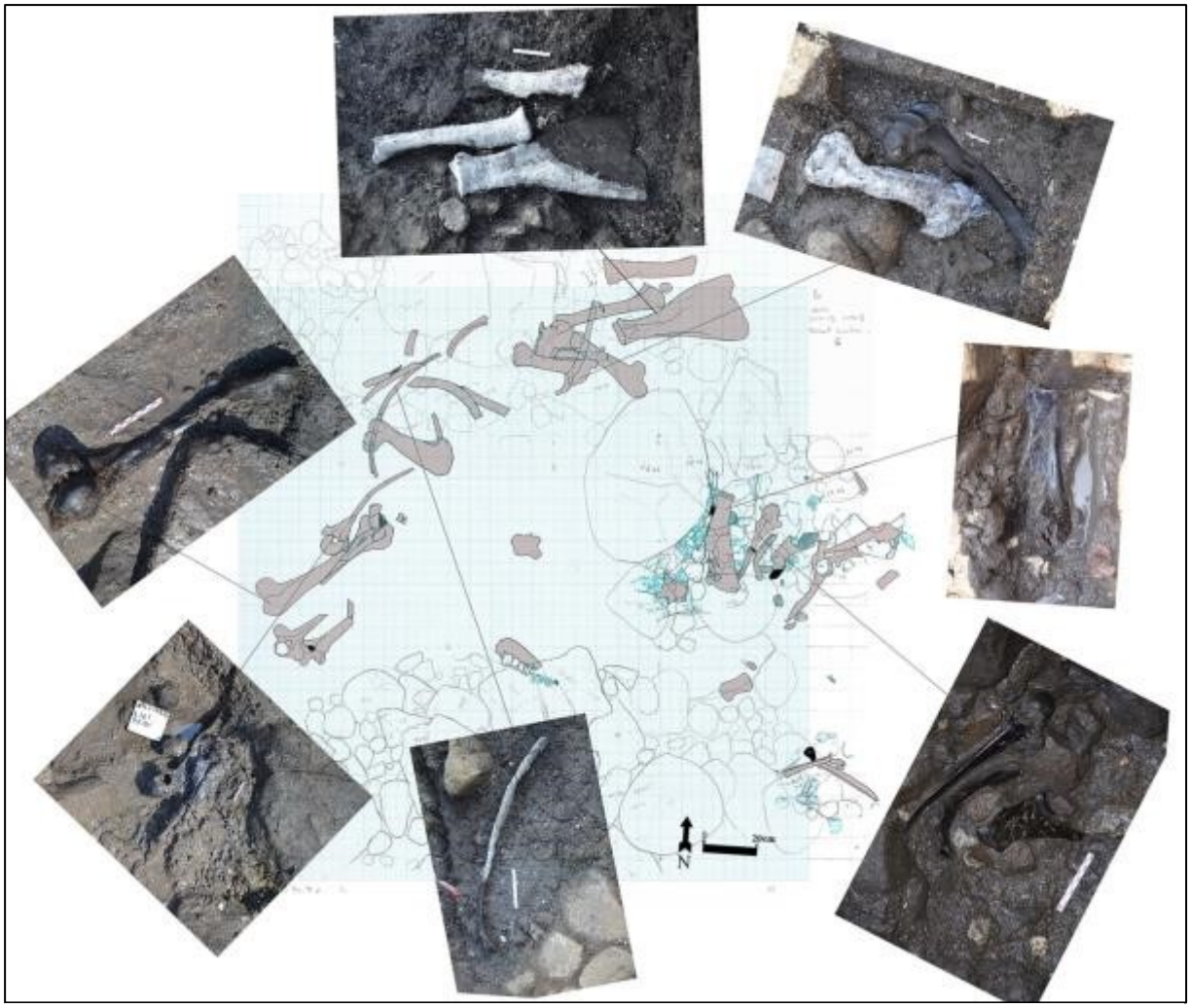


Figure 52: reconstruction of the bovid bones excavated in the northern squares of Area D during the 2012-2014 excavation seasons.

The results of the 2014 excavation in the northern sector of Area D and in particular the numerous complete bovid bones unearthed, enabled us to reconstruct the presence of a (probably) single animal with its bones scattered on the c. 4-5 square meters in this area. The bones are found lying on the basalt of Layer 5, the large bones, in particular the long-bones and the two scapula are complete. The bones are in excellent preservation state and clear cut-marks could be observed in the field. This fact indicates a very fast covering of the bones or maybe even their sinking in mud. The distribution of the bones is in correlation to the basalt arrangement suggesting that the boulders were at their present location when the bones accumulated. The potential of this bone scatter to our understanding of human behavior is obvious.

The flint from season 2014 at Area D north is similar to the picture emerging from the previous seasons. Primary pointed, non-levallois elements, and cutting tools. The numbers are

not high and the points are similar in technology and typology to the ones excavated in previous seasons. Some of the flint tools are found “floating” in the mud in up standing positions (Fig. 51).

South Section of Area D

In this section we continued excavating the squares at the top of the basalt hill, exposing the basalt and studying the nature of the accumulation of stones and archaeological finds. To the south east of Area D, few squares in the easternmost line of the grid, along the N line were excavated to complete the exposure of the surface here. For a map of the site with the 2014 excavated squares see Figure 9.

Sediments and nature of basalt

The sediment here is mostly dark colored fine mud with many red to orange oxidized veins. The oxidize horizons probably represent cracks in the clayey sediment that were dried and exposed to air in the past 9it is unknown if we see evidences for draying during the Pleistocene or only during recent years after the exposure of the sediments to air during the drainage operations. The relatively poor preservation of bones and the relative scarcity of wood remains support this draying hypothesis.

Above the basalt of layer 5 it are numerous basalt cobbles and pebbles “floating” in the mud covering Layer 5. Such cobbles to pebble basalt stones were not found in the lower, northern section of Area D and are typical to the top of the basalt pile of Layer 5.

Wood dose preserve in this pert but preservation is poor. Not many wood remains were recovered and the one that were exposed are probably roots penetrating the sediment from above at an unknown time (Fig. 54).

Figure 53: The basalt pile of layer 5 from the west. Note the "saddle" between the two high points of the pile.

Figure 54: roots at square N154. Possibly recent roots.

At the top of the basalt pile, at squares L153 and around, some very large boulders are standing at the top. The resulting topography is of a shallow "saddle" between the previously observed high spot at square K152 and here (Fig. 53). The top of the basalt hill was probably

somewhat flatter area that might have seen the repeated activity and visits by hominids to the site. See discussion below for more details.

Preliminary observations at the fauna at this part suggest that it is somewhat more diverse than the one at the lower section of Area D and the bones are less complete. Yet much more study is needed before such observations can be confirmed. It seems that the primary animal exposed here is also a large bovid, as was the case in previous seasons. Large bones and in particular vertebras were excavated in square K150. This is in agreement with the finds from this part of the site in previous years.

The flint tools from this section of the site are no different from the other parts not in frequency (still relatively low) and not in typology and technology.

Description of excavation by squares – for location of squares see map in Figure 9.

J150- This Square, at the western margins of the basalt pile of Layer 5 was excavated in order to continue the excavation of previous years. The sediment was dark mud attached to the small “cliff” of stones to the east. Not many finds were found. Fig. 55 show the primary finds.

Figure 55: Square J150 excavation and finds.

Square K149 – the next square to the south following the western merging of the basalt pile of Layer 5 was much richer here. The sediments clearly dried during the last 10 years since the drainage operation in 1999-2000. Nevertheless, both bones and wood remains were unearthed. At least 2 vertebras of a bovid as well as flint tools and many basalt cobbles and pebbles were unearthed. Figures 56-60 present the primary finds.

Figure 56: Square K149 excavation level 59.60. At this early stage finds already starting to be exposed. Note the bovid vertebra in the upper right (south-east) corner.

Figure 57: Square K149 excavation level 59.55. Note the flints and bones.

Figure 58: Square K149 excavation level 59.50. Flints and fragment of jaw.

Figure 59: Square K149 excavation level 59.45.

Figure 60: Square K149 excavation. A long root or a brunch at final level of excavation in the square.

Square L150 – this Square, at the highest point of the basalt pile contributed much data to our understanding of the nature and structure of the basalt in this part of Area D. Large boulder size basalts are unearthed here "floating" in the mud above the basalt. The presence of such giant stones within the fine mud may suggest human agency. Below these large stones the nature of basalt is similar to this of other squares in this area. Many finds including flints, bones and wood were unearthed as presented in Figures 61-64.

Figure 61: Square L150 general view. Note the large basalt boulders "floating" in the mud above the basalt floor.

Figure 62: Square L150 upper level. Fragment of long bone.

Figure 63 Square L150 Level 59:75. Large basalt boulders and flint tools.

Figure 64: Square L150 end of excavation – Level 59:50. Note the mall pebble size basalt and the presence of limestone

M151 – **M152**: The excavation here exposed the continuation of the basalt floor of layer 5 with some flints and bones on top. The nature of the basalt here is of large, boulder size scattered basalts with many small stones in between. In addition, many small stones are floating in the mud above the basalt. Again, this is similar to the surrounding squares. Figure 65 present the primary finds in this square.

Figure 65: Square M151 Level 59:50.

Figure 66: Square M153 at the end of excavation in 2014.

Figure 67: Square N153at the beginning of excavation

Figure 68: N153 at the end of excavation 2014

Square N154- This Square, excavated in the eastern margin of the basalt pile show different sediment than the one observed in the more southern squares. Here, as in all other squares in this part of Area D the sediment is very fine grained mud. It is homogenous and easy to excavate (but hard to sieve) and in most parts sterile of finds. Some basalt pebbles are floating in the mud. At the lower levels, above the basalt of Layer 5, some finds start to appear, primary flint flakes, some in upright position (see Figure 69). The square was not fully excavated and remains for future study.

Figure 69: Square N154. Note the flints in the lower photo.

General reconstruction of the stratigraphy and geology of the site

After eight excavation season we are now able to suggest a reconstruction of the stratigraphic history of the site that will explain the nature of accumulation and the human usage of the site:

The Jordan River at this vicinity cuts through sediments ageing from the Early Pleistocene to the Holocene (Kalbe et al. 2014). The regional stratigraphy is highly complex and subject to massive tectonic activity. The general stratigraphy of the NMO site was described in details by Kalbe et al. (2014). Nevertheless, the local sequence of the site holding the archaeological layers is well established and understood and can be describe as follow (Sharon & Oron 2014 ; Fig. 70):

Figure 70: Stratigraphy of NMO

At the base of the stratigraphic sequence of the site is a layer of large basalt boulders and cobbles of fluvial origin (Layer 5 - Sharon & Oron 2014). The basalt layer is formed in the form of a hill with its highest point at the South-west part and is slanting to the north and dropping dramatically to the east. We are not sure what brought this layer to its current form (fluvial activity? tectonic? A combination of these agents?), nor do we know when did it occurred. Stratigraphic, sedimentological and archaeological argument do suggest, however, that the people that occupied NMO during the Late Placetocen already found the basalt in its current form, that of a hill standing some 2-2.5 meters above the surrounding landscape (Fig. 17). This basalt hill of layer 5 is covered from the east north and south by fine, sillty, dark mud. This mud fast accumulated on the bank of a shallow, low energy water body, probably

the southernmost edge of the Paleo-Hula Lake. At the contact between the basal and the covering dark mud is the archaeologically rich layer of the site, Layer 4 (Fig. 70). The layer is comprise of flint tools, animal bones and botanical remains laying immediately on the basalt floor of layer 5 and floating in the mud above it up to 40 cm thick layer. Layer 4 is dated to ca. 60k years BP by a series of OSL dates (Kalbe et al. 2014). Above the archaeological layer is a sequence of additional mud layers, some showing a clear unconformity with the below layers. Into this sequence of muds (layer 3) cut later channels of streams and rivers (possibly the Paleo Jordan or the Paleo Mahanayeem Stream coming from the west) typically laying sand with many mollusks and small limestone, basalt and flint pebbles. These channels (Layer 2) are dated to historical times by the presence of ceramics, coins and other such finds.

Layer 4, the archaeologically rich layer, is reconstructed to represent a short term event, or more correctly, a series of two or possibly more short events of occupation. The archaeological finds are found within fine mud. Sedimentological observation suggest a very fast accumulation rate for this layer including no evidences layering or other processes indicating long time of forming (Kalbe et al. 2014). Other evidences for the fast covering of the archaeological layers are the excellent preservation of the bones and the flint tools at the site. It is evident that none of these finds was exposed to atmospheric conditions for a period measured in months or even less. Additional evidence comes from the actual preservation of the botanic remains within the sites sediments. A large number of wood remains, as well as fruits and seeds were recovered from the sediments of layer 4. Preservation of botanical remains due to waterlogged condition of the soils is well known at the prehistoric sites on the banks of the Jordan River in this vicinity (Goren-Inbar et al. 2002; Goren-Inbar et al. 2002); (Melamed et al. 2011; Melamed 2003). The actual presence of botanical remains within the layer indicates that they were not exposed on the surface after accumulation for a long period of time. Further evident for the short duration of the occupation can be seen in the presence of significant refitted artifacts demonstrating that at least few reduction sequences took place connecting the different parts of the site into a single event (Sharon & Oron 2014). It is suggested that at least some of the artifact in the archaeological layers were discarded by the sites inhabitants directly into the mud or shallow water of the lake surrounding the basalt hill of Layer 5. The stone tool assemblage of the site can also contribute to this argument. The number of artifacts excavated from the site is exceptionally low when compared to any other MP site in the Levant. At most cave sites the intensity of the fined is extremely high, but the NMO density is very low even when compared to other open air sites in the Levant (Oron &

Goren-Inbar 2013; Goren-Inbar 1990). The low number of the NMO stone tools clearly indicates a low intensity rate of the site and makes it very unlikely that it represent a long term activity zone.

The accumulation history of the site is currently reconstructed as follows (Fig. 71): At the first

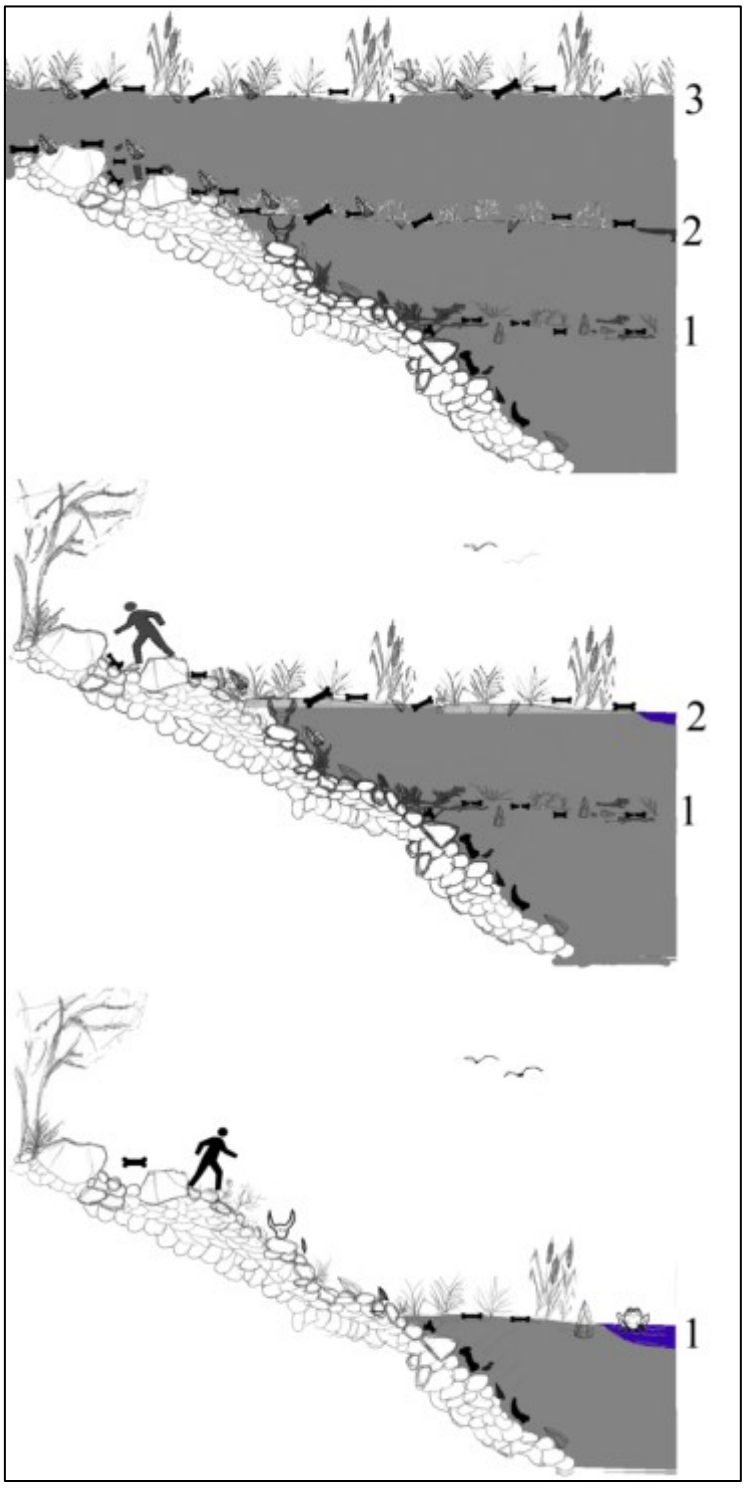


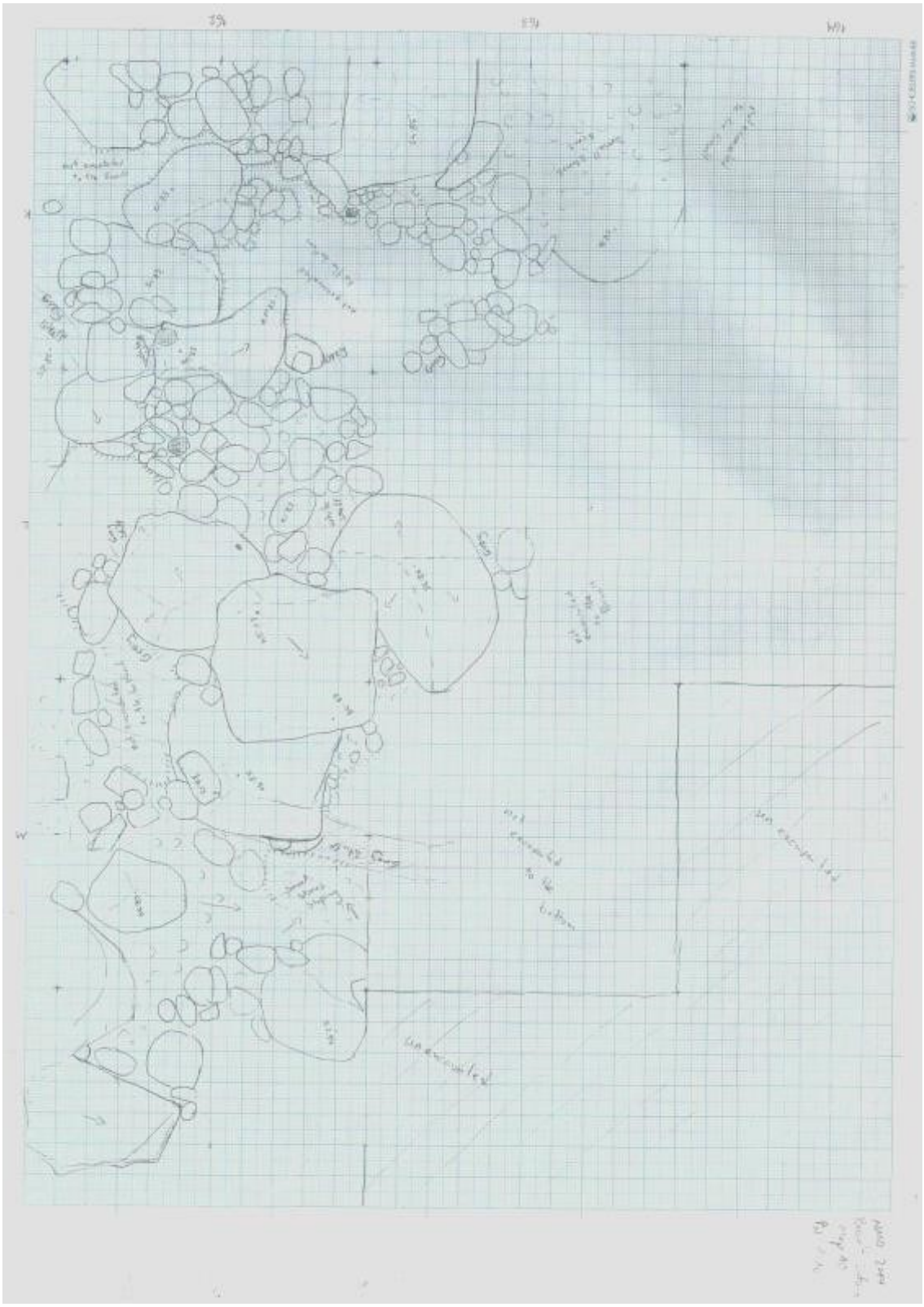
Figure 71: suggested reconstruction of the accumulation process of NMO.

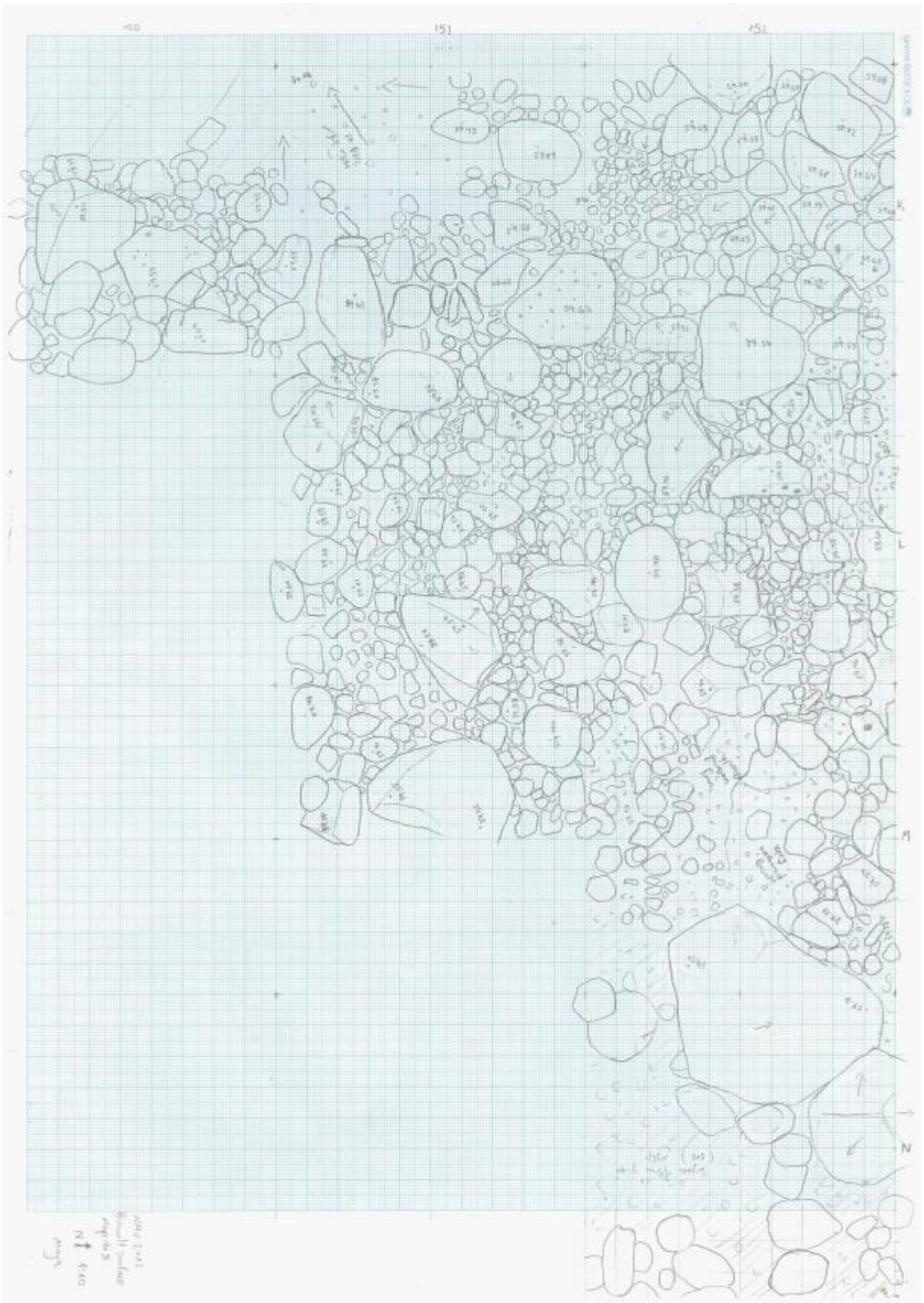
stage the basalt hills of layer 5 in were inhabited by [illegible]. The inhabitants of the site are active for a relative short time (possibly few days only) on the basalt surface and

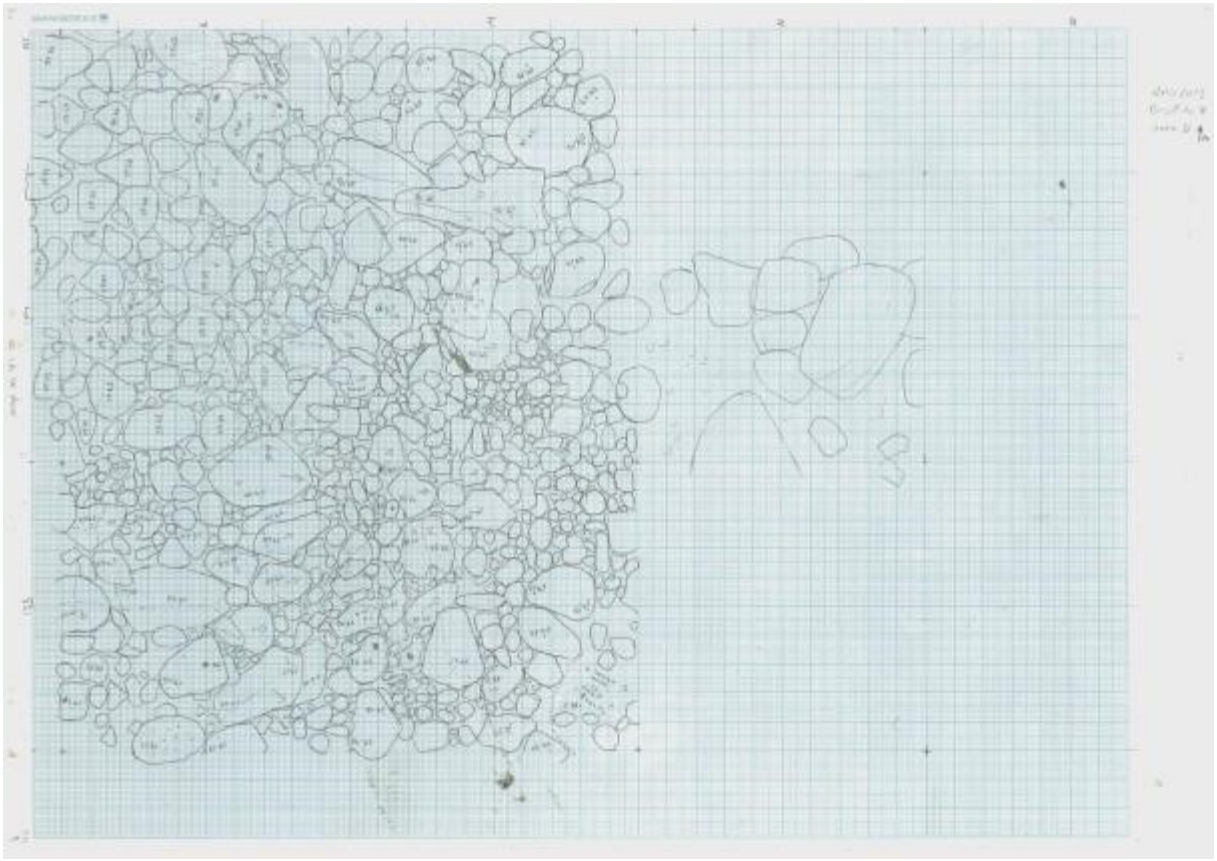
discard their stone tools and bones on the basalt as well as in the mud surrounding it. At the next stage, water level in the lake rises and covers a larger, higher section of the basalt hill. At this stage there was an additional, short phase of human occupation, possibly a visit of a hunting expedition to this location. The remains of this second occupation phase are littering the mud (at a somewhat higher level from the previous occupation) and the upper part of the basalt hill. The outcome is that the assemblage on the upper part of the basalt hill is the result of more than a single occupation while the lower part document only the first early event. This scenario of short occupation events repeats itself at least 3 times (possibly more) as demonstrated in Figure 71. The last phase of occupation documented at the site took place when the entire pile of basalt was already covered by mud. The poor preservation state of bones excavated from this stage suggests that they were possibly exposed on surface for a longer period.

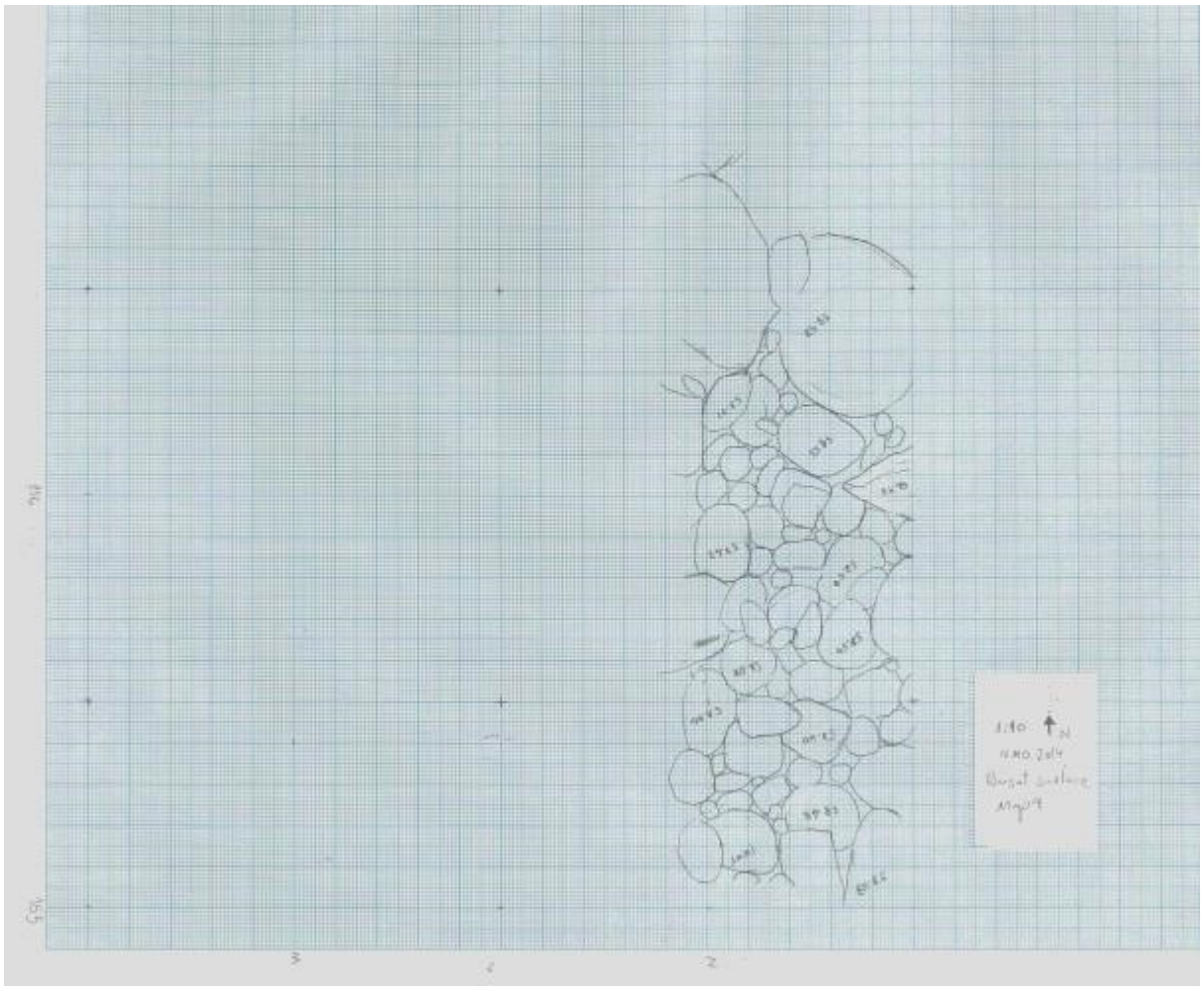
Appendixes 1

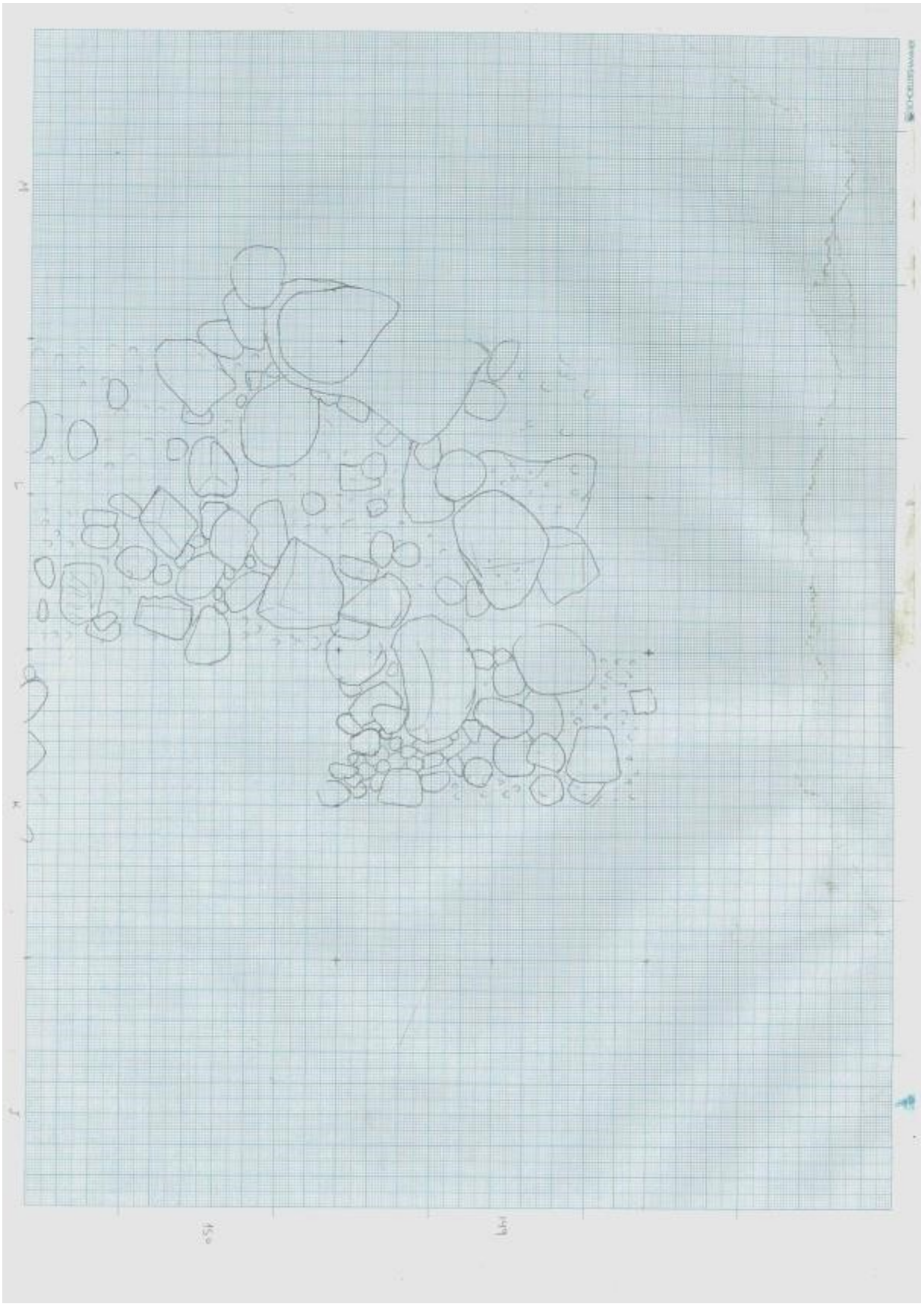
2014 Season – Plans of basalt surface of Layer 5 - draw











Appendix 2

The Wood Assemblage – Preliminary observations

Tiphanie Chica-Lefort

Introduction

Large number of macro-botanical remains were found at NMO starting at the 2008 excavation season. The collection is primary composed of woods, barks and monocotyledon pieces. The wood remains have been studied in details in the course of a master thesis in the Université Paris 1 – Panthéon-Sorbonne. The study is ongoing but some significant results can be presented. The aim of the research is to search and demonstrate the use of the wood remains at the site with the detection of technical marks on the surface's objets.

Methodology

To demonstrate whether woodworking activities occured at NMO site, an approach which combined drendrology (morphometric records), xylology (identifications with a transmission microscope), taphonomy and traceology (removal scars, striations, fracture planes evidences) was applied. The xylological study is the continuation of E. Werker's identifications (Sharon and al., 2010).

All the remains were macroscopically examined (x40 max.) and organized in accordance to their typo-morphological features. This analysis was also conduct in order to sample the pieces with the highest potential for presence of surface's modifications and cut marks; and showing a suitable wood cell's conservation for the identification of the wood's species. The sub-sample consist of 98 pieces in addition to E. Werker's identifications : 142 pieces in total.

Preliminary results

Xylological results identified ten different taxons in all the sub-sample. These included the almond (*Amygdalus* sp. ou *Prunus dulci* Mill.), the ash-tree (*Fraxinus* sp.), the syrian ash-tree (*Fraxinus syriaca* Boiss.), the pine: either aleppo pine or stone pine (*Pinus halepensis* Mill. ou *P. pinea* L.), the poplar (*Populus* sp.), the bear's plum (*Prunus ursina* K.), the oak (*Quercus ithaburensis* Decne.*, Q. infectoria* subsp. *boissieri* R.*, Q. libani* G.), the kermes oak (*Q. calliprinos* Webb.), the willow (*Salix* sp.), the tamarisk (*Tamarix* sp.) and the jujube (*Ziziphus* sp.). Further, barks, monocotulyledon plants (like canes) and indeterminate pieces were found in the collection. Table app. 1 specify the identified specimens.

Identification taxonomique	Nom commun	N	%
Amygdalus sp. (communis)	Amandier (commun)	4	3%
Amygdalus sp. (communis) ?		1	1%
Angiosperme dicotylédone		19	13%
Angiosperme dicotylédone ? (Charbon)		2	1%
Ecorce		30	21%
Fraxinus sp.	Frêne	3	2%
Fraxinus syriaca	Frêne de Syrie	3	2%
Fraxinus sp. ?		2	1%
Indéterminé		10	7%
Monocotylédone		24	17%
Pinus (halepensis ou pinea)	Pin (d'Alep ou parasol)	1	1%
Populus sp. ?	Peuplier	1	1%
Prunus ursina	"Prunier des ours"	1	1%
Quercus (ithaburensis et/ou boissieri)	Chêne (du Mont Tabor et/ou boissier)	27	19%
Quercus calliprinos	Chêne de Palestine	3	2%
Quercus calliprinos ?		2	1%
Salix sp.	Saule	5	4%
Tamarix sp.	Tamaris	3	2%
Ziziphus sp. ?	Jujubier	1	1%
Total		**142**	**100%**

Table of identifications for the subsample of the woody remains at NMO site (From T. Chica-Lefort, 2015).

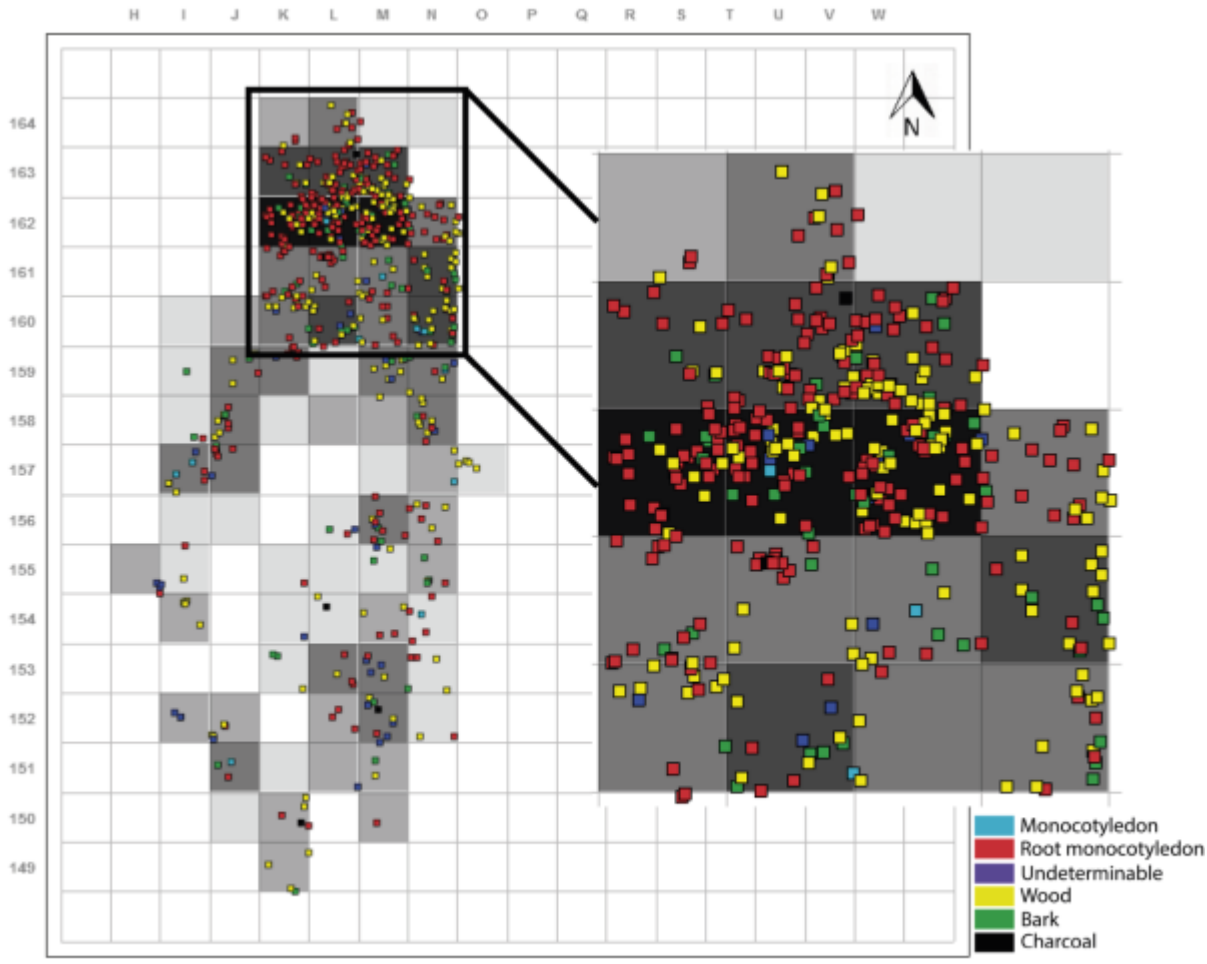
Dendrological analysis points out that fragments are mostly branches at the site. Of the 76 pieces of wood found in the collection, 32 (42%) originated from branches. The remaining specimens came from roots, truncks, barks and undeterminates.

W3 : rhyzome of monocotyledon plants, probably a cane (From T. Chica-Lefort, 2015).

Some pieces bear evidances for artificial technical cut marks consistent of transversal actions at the end of the fragments. The analysis of the technological marks is ongoing.

W152-83. A : upper face A' : detail of the distal end of the upper face B : lower face (From T. Chica-Lefort, 2015).

The spatial distribution of the remains of the entire collection in the area D reflects an important concentration at the northern part of the area. It seems that a large concentration of monocotyledon's remains, primary identified as cane's rhyzomes, form the majority of the finds in this section of the site.



Spatial repartition of the botanical remains in the area D

Discussion

The study is on-going, and preliminary results do not allow us yet to conclude if the sample is of a purely of anthropic origin or on the contrary, a natural assemblage. Of course, it may be a mixed natural/anthropic assemblage. All the identified species are also found in the palynogical sequence from NMO site (Aharonovich and al., 2014).

Nowadays the kermes oak (*Quercus calliprinos*) habitat primary in the uplands, normally found only at 500 above sea level or higher. The NMO site is found within the Hula Valley at elevation of c. 60 masl. According to environmental studies, little change can be seen in the ecology of trees of the Levant since the Middle Pleistocene. In this scenario, it is possible to suggest that *Q. calliprinos* would have been brought to the site by NMO hunter-gatherers. Furthermore, the traceological analysis bring us a fundamental evidence that woodworking occurred at NMO site. The continuation of the study will help us for a better understanding of the use of plants at Nahal Mahanayeem Outlet. All information recorded so far (taphonomic, dendrometric) will be interrelated to suggest a more accurate interpretation of this exceptional assemblage.

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Appendix 3 - Herpetofauna NMO

Rebecca Biton

This report is referring to the herpetofauna (amphibians and reptiles) remains retrieved from NMO excavations during 2007-2014 excavation seasons. Osteological remains of amphibians and reptiles make up substantial components of faunal assemblages recovered from most archaeological sites where fine-mesh sediment sieving has been undertaken. Yet because research has focused primarily on mammals, amphibians and reptiles have often been subjected to less vigorous investigation. Nahal Mahanayeem Outlet (NMO) is a unique archaeological site since it is a waterlogged site with an excellent preservation of faunal remains. Moreover all the soil samples at site were wet-sieved through fine meshes of between 2mm and 0.5mm. Therefore the research of herpetofauna remains from such site holds great potential, especially for providing significant information on a variety of environmental and anthropological-related topics.The study of the herpetofauna remains focus on three main questions:

1. As reflected in Nahal Mahanayeem Outlet (NMO) archaeological deposits, which herpetofauna taxa were present during the Pleistocene in the Hula Valley ?
2. Were herpetofauna species collected and utilized by man and, if so, how may they have been utilized?
3. Is there evidence for any major changes in the Hula Valley environment and climate between the Middle Paleolithic times to the Present?

Results

NMO was most probably located on the shore of a Paleo-Hula Lake during the Pleistocene occupation at the site. Therefore, in any work done, hydrophilous species, related to the natural biota of the Hula Basin (Dimentman *et al*.,1992 p.60) are expected to be encountered alongside terrestrial species from the adjacent Naftali Hills and the Golan Heights. The number of herpetofauna bones retrieved until now is 2130 bones. Amphibians and reptiles are both present at the site (see table 1).

1. Amphibians: A total of 669 bones were retrieved, all of the bones were taxonomically studied. Most of the skeleton bones including rare skull elements are present. The amphibian bones were assigned to four different species of (see table 1); the Levant green frog (*Pelophylax bedriagae*), the Hula painted frog (*Latonia nigriventer*), the lemon-yellow tree frog (*Hyla savignyi*) and the variable toad (*Bufotes variabilis).*Based on the pelvic bone, ilium, which is the most abundant amphibian bone at site (N= 146), the species dominating the amphibian assemblage is by far the Levant green frog with 96 ilium bones: 59 bones are right ilium and 37 are left ilium. Therefore the minimum number of Levantine frog found at the site is 59.

Table 1: Taxonomy list of herpetofauna retrieved at NMO

Class	Order	Suborder	Family	Species
AMPHIBIA	ANURA		Alitydae	*Latonia nigriventer*
			Hylidae	*Hyla savignyi*
			Ranidae	*Pelophylax bedriagae*
			Bufonidae	*Bufotes variabilis*
REPTILIA	TESTUDINES	Testudines	Testudinidae	*Testudo graeca*
			Geoemydidae	*Mauremys rivulata*
	SQUAMATA	Sauria	Anguidae	*Pseudopus apodus*
			Agamidae	*Stellagama stellio*
		Ophidia	Colubridae	*Natrix tesselata*
				Small coluber indet.
			Boidae	*Eryx jaculus*

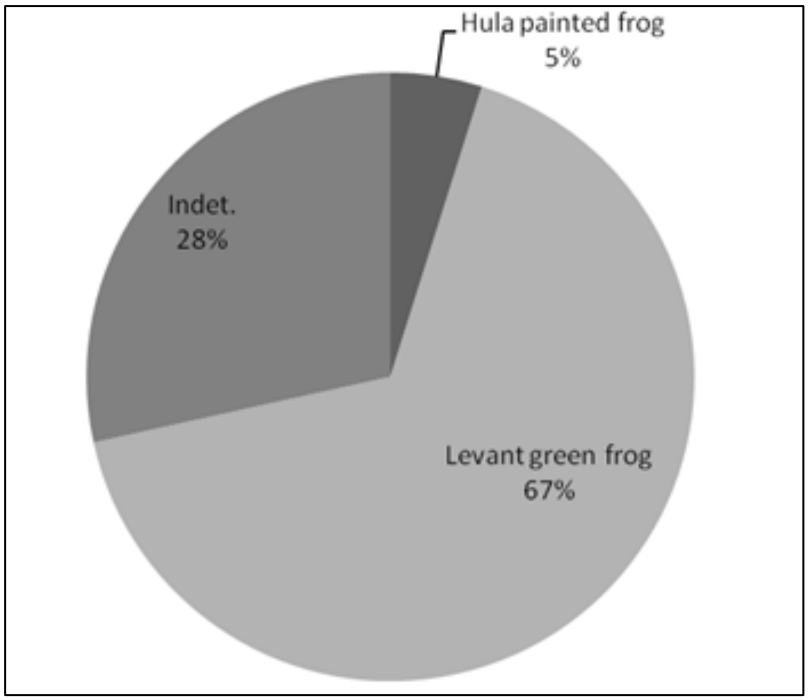

Figure 1: Distribution of amphibian species based on ilium bone (N=146)

2. Squamates: 1461 reptile's bones were retrieved from NMO sediments.

Snakes - The most abundant reptile element found is snakes vertebras N=959. Most of the snake's vertebras were not taxonomically assigned yet, however so far at least three species are present at the site: the javelin sand boa (*Eryx jaculus*), the dice snake (*Natrix tessellata*) and a medium size coluber.

Lizards – 96 bones, mainly vertebras and scutes were assigned to the European glass lizard (*Pseudopus apodus*) this is the lizard with the largest number of remains at site although the number of individuals represented is not clear yet. Another lizard identified is the roughtail rock agama (*Stellagama stellio*) identified based on a small fragment of a jaw.

3. Turtles: Two turtle species naturally occur today in the Hula Valley: the Western Caspian turtle (*Mauremys rivulata*) and the spur-thighed tortoise (*Testudo graeca*), both species were recovered at Nahal Mahanayeem Outlet (NMO). Evidence from Pleistocene archaeological sites in Israel indicates that the spur-thighed tortoise was used as a provender from the Middle Paleolithic (Bridault, *et al.*, 2008; Munro, 2009; Munro and Grosman, 2010; Speth and Tchernov, 2002; Stiner, 2005; Stiner *et al*., 2000), while their carapaces were possibly even employed as containers (Speth and Tchernov, 2002; Munro 2013). Remains of these tortoises are also associated with burial practices known from Hilazon, a Late Epipaleolithic site (Munro and Grosman, 2010). However no exploitation of the Western Caspian turtle has been reported so far in Pleistocene archaeological sites in Israel. 297 bones belonging to turtles were identified so far at NMO. In order to identify the different bones we used the comparative collections at the National Natural History Collections at The Hebrew University of Jerusalem, including both males / females young and adult individuals belonging to the Western Caspian turtle *(Mauremys rivulata)* and the spur-thighed tortoise *(Testudo graeca)*. A large number of bones are fragments of the carapace and plastron that could not be further assigned to a species (N=123 see table 2). Beside taxonomy affinity when possible precise element and side were recorded. The Number of Identified Specimens (NISP) and the Minimum Number of Elements (MNE) were both recorded. Most of the elements of the carapace (neural, costal and peripheral) and plastron elements (epiplastron, entoplastron, hyoplastron hypoplastron and xiphiplastron) are present for both turtle's species (see figure 2). However other bones are scarce, only seven limb bones assigned to both species were recovered. The Minimum Number of Individuals (MNI) was calculated based on the highest count of the MNE taking into account the completeness and size of individuals (see table 2). Only 8 turtles are represented in the assemblage five Western Caspian turtles and three spur-thighed tortoise. All turtles remains in this study were either spotted and plotted during excavation or retrieved by wet sieving and plotted later on a site map (see figure 3). Both turtle species are concentrated in the same areas and are found alongside in the same excavation unit. This is worth mentioning since naturally both species occur naturally in different habitats: the Western Caspian turtle is a pond turtle inhabiting standing and slow flowing perennial waters, while the spur-thighed

tortoise is a terrestrial species inhabiting a variety of dry, open scrubby habitats. Therefore the presence of both species together must be the result of an active accumulation. Based on taphonomic data, including breakage patterns and the presence of cutmarks combined with the lack of carnivore's signs we suggest that the accumulation of both species is due to humans that chose to catch, and transport these preys to their site (Biton *et al*., in prep.). Repeated breakages across the segments that form the bridge between the carapace and the plastron, both on the pond turtles and on tortoises, indicate that the plastron was pulled away in order to wide open the shell and expose the flesh. Each Bone was examined under a binocular zoom light microscope to identify bone surface modifications. Cut marks were identified on peripheral element ventral surfaces of both pond turtles and on tortoises, probably in order to detach the tissues connected to the carapace, yet again to ease the exposition of the flesh. Based on taxonomic and taphonomic research of the turtles recovered at NMO we report the exploitation of both the Western Caspian turtle (*Mauremys rivulata*) and the spur-thighed tortoise (*Testudo graeca*). This is the first report in the Levant of the exploitation of a pond turtle (Biton *et al.* in prep).

Environment reconstruction:

Based on the presence of the Levant green frog (*Pelophylax bedriagae*), by far the most abundant amphibian species at the site, a vegetated permanent water body or river bank was in the vicinity of the site at time of occupation (Bouskila and Amitai 2001, Disi et al. 2001). This is reinforced by the two additional amphibian species identified at the site, the Hula painted frog (Biton *et al*. 2013) and the lemon-yellow tree frog (*Hyla savignyi*). Moreover, the presence *the* dice snake (*Natrix tessellata*) a snake associated with vegetated watersides and river banks (Bouskila and Amitai, 2001; Disi *et al.*, 2001) is also indicating the presence of water body.

All the species present at site are species present in the Hula Valley nowadays, and therefore based on the herpetofauna species composition at NMO, it seems the environment conditions were probably very close in terms of temperature and precipitations to present time conditions.

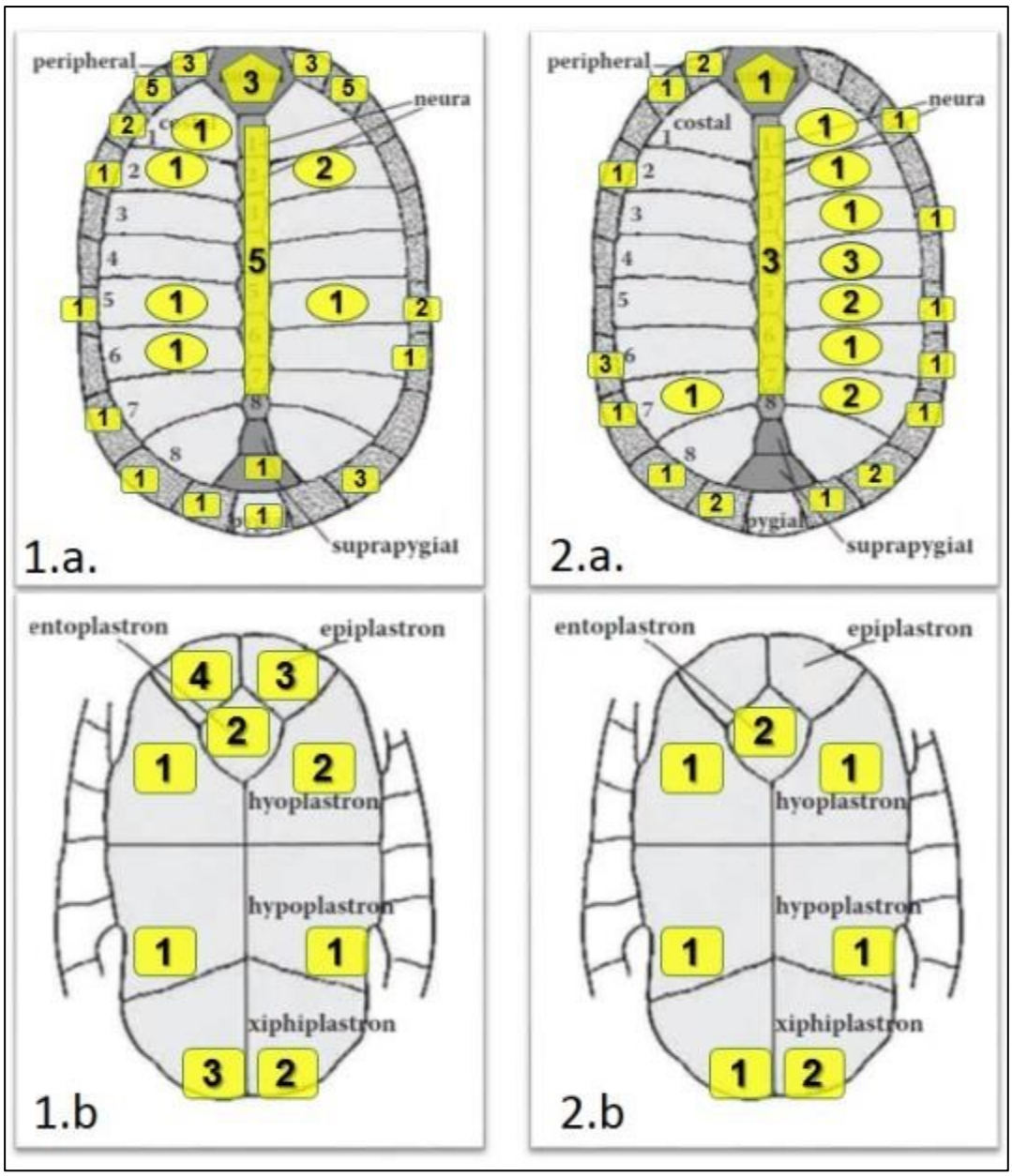

Figure 2: Turtles Minimum Number of Elements (MNE)
1.a. Carapace of Western Caspian turtle (*Mauremys rivulata*)
1.b. Plastron of Western Caspian turtle (Mauremys rivulata)
2.a. Carapace of spur-thighed tortoise (*Testudo graeca*)
2.b. Plastron of spur-thighed tortoise (*Testudo graeca*)

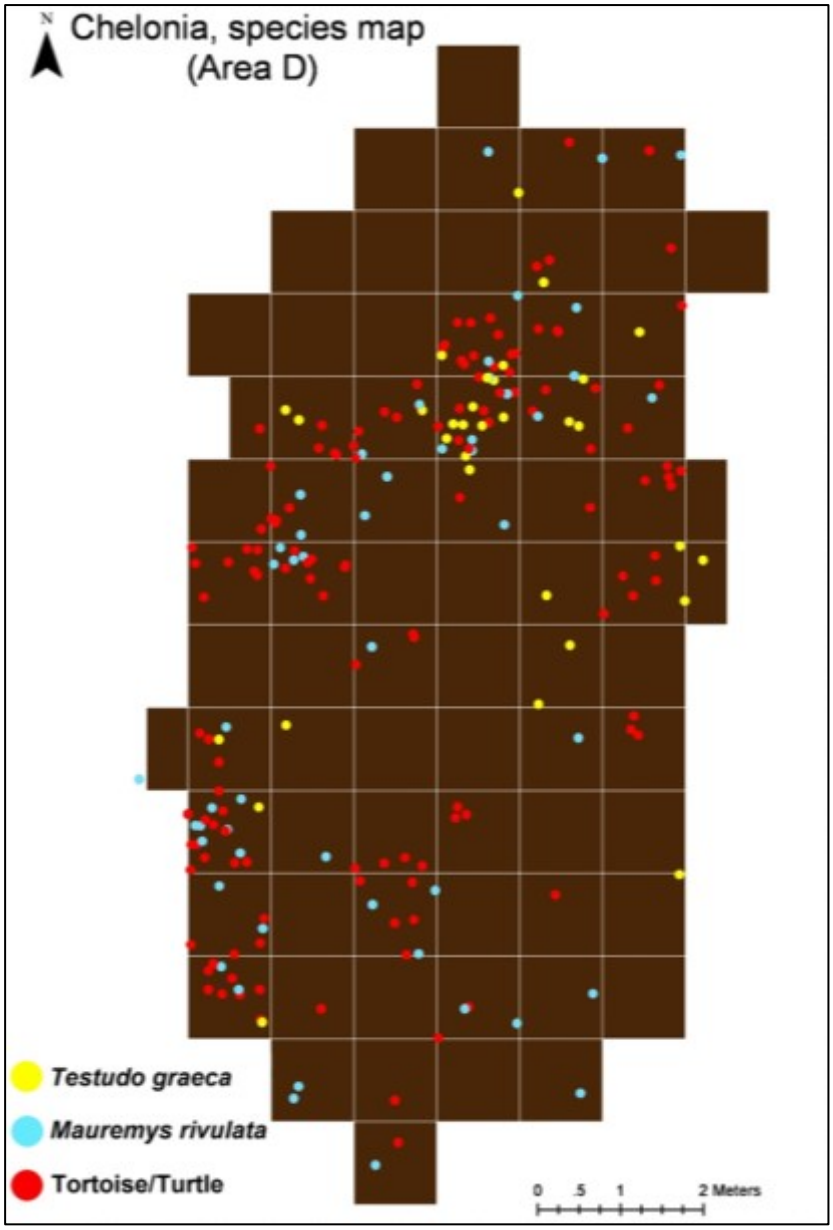

Figure 3: Turtles remains distribution map

Table 2: Frequency of turtles species at NMO

	Mediterranean Spur-thighed Tortoise	Western Caspian Turtle	Indet.	Total
NISP	71	103	123	297
MNI	3	5		8

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Appendix 4: Soil samples of the 2014 season

No on map	East	North	Elevation	Sq	Data
Fauna soil samples					
RB/14/1	3012.196	1061.771	58.478	N162	11.08.14
RB/14/2	3009.342	1060.14	58.668	N162	11.08.14
RB/14/3	3010.819	1062.852	58.387	L163	11.08.14
RB/14/4	3011.177	1062.79	58.498	M163	11.08.14
RB/14/5	3011.742	1061.737	58.401	M162	11.08.14
RB/14/6	3012.777	1054.836	58.864	N155	11.08.14
RB/14/7	3012.641	1053.151	59.386	N154	11.08.14
RB/14/8	3011.748	1050.266	59.393	M151	11.08.14
RB/14/9	3012.191	1052.269	59.033	N153	11.08.14
RB/14/10	3012.338	1061.714	58.363	N162	15.08.14
RB/14/11	3011.727	1061.298	58.311	M162	15.08.14
RB/14/12	3011.707	1062.235	58.315	M163	15.08.14
RB/14/13	3010.353	1062.23	58.333	L163	15.08.14
RB/14/14	3009.261	1060.141	58.492	K161	15.08.14
RB/14/15	3012.386	1053.186	59.274	N154	15.08.14
RB/14/16	3012.801	1051.611	59.416	N152	15.08.14
RB/14/17	3010.175	1049.886	59.791	L150	15.08.14
RB/14/18	3009.682	1061.352	58.413	K162	16.08.16
RB/14/19	3009.78	1062.311	58.434	K163	16.08.16
RB/14/20	3008.715	1049.681	59.323	J150	16.08.16
RB/14/21	3011.339	1062.297	58.254	M163	20.08.14
RB/14/22	3010.718	1062.716	58.33	M163	20.08.14
RB/14/23	3010.275	1061.735	58.198	L162	20.08.14
RB/14/24	3009.24	1061.7	58.301	K162	20.08.14
RB/14/25	3009.266	1060.102	58.421	K161	20.08.14
RB/14/26	3009.286	1062.715	58.349	K163	20.08.14
RB/14/27	3012.27	1061.203	58.285	N162	20.08.14
RB/14/28	3012.743	1055.762	58.742	N156	20.08.14
RB/14/29	3012.693	1053.683	59.209	N154	20.08.14
RB/14/30	3012.791	1051.267	59.214	N152	20.08.14
RB/14/31	3008.695	1049.179	59.205	J150	20.08.14
RB/14/32	3009.633	1048.775	59.518	K149	20.08.14
RB/14/33	3011.867	1061.433	58.221	M162	20.08.14
RB/14/34	3010.281	1049.759	59.7	L150	20.08.14
RB/14/35	3011.249	1049.326	59.876	M150	20.08.14
RB/14/36	3010.389	1061.187	57.917	L162	22.08.14
RB/14/37	3009.664	1059.874	58.398	K160	22.08.14
RB/14/38	3012.311	1061.781	58.188	N162	22.08.14
RB/14/39	3011.289	1062.245	58.222	M163	22.08.14
RB/14/40	3011.285	1049.253	59.813	M150	22.08.14
RB/14/41	3010.773	1062.818	58.294	L163	23.08.14
RB/14/42	3009.744	1062.197	58.267	K163	23.08.14
RB/14/43	3012.265	1051.15	59.159	N152	23.08.14
RB/14/44	3012.726	1054.766	58.706	N155	23.08.14
RB/14/45	3009.661	1048.228	59.446	K149	23.08.14
RB/14/46	3009.259	1061.184	58.245	K162	23.08.14

RB/14/47	3009.655	1063.723	58.286	K164	27.08.14
RB/14/48	3010.637	1063.813	58.292	L164	27.08.14
RB/14/49	3009.735	1062.679	58.188	K163	27.08.14
RB/14/50	3010.164	1062.719	58.209	L163	27.08.14
RB/14/51	3011.221	1062.739	58.169	M163	27.08.14
RB/14/52	3012.165	1061.749	57.974	N162	27.08.14
RB/14/53	3011.786	1061.742	58.012	M162	27.08.14
RB/14/54	3009.765	1061.81	58.06	K162	27.08.14
RB/14/55	3009.689	1060.106	58.287	K161	27.08.14
RB/14/56	3012.822	1055.733	58.553	N156	27.08.14
RB/14/57	3012.298	1053.565	59.087	N154	27.08.14
Archive Soil sample					
S/14/1	3011.518	1061.504	58.541	M162	09.08.14
S/14/2	3011.539	1061.485	58.484	M162	09.08.14
S/14/3	3012.5	1052.429	59.163	N153	09.08.14
S/14/4	3012.477	1052.414	59.12	N153	09.08.14
S/14/5	3012.504	1061.455	58.537	N162	12.08.14
S/14/6	3012.542	1061.446	58.496	N162	12.08.14
S/14/7	3011.505	1061.462	58.456	M162	12.08.14
S/14/8	3011.511	1062.507	58.494	M163	12.08.14
S/14/9	3012.458	1052.455	59.076	N153	12.08.14
S/14/10	3012.475	1053.468	59.448	N154	12.08.14
S/14/11	3012.486	1053.466	59.402	N154	12.08.14
S/14/12	3011.491	1061.466	58.411	M162	14.08.14
S/14/13	3010.491	1061.469	58.376	L162	14.08.14
S/14/14	3010.514	1062.515	58.432	L163	14.08.14
S/14/15	3011.519	1062.499	58.451	M163	15.08.14
S/14/16	3012.503	1061.473	58.45	N162	15.08.14
S/14/17	3012.449	1053.547	59.361	N154	15.08.14
S/14/18	3010.472	1049.425	59.886	L150	15.08.14
S/14/19	3010.463	1049.458	59.837	L150	15.08.14
S/14/20	3009.978	1061.021	58.256	L162	16.08.16
S/14/21	3011.514	1062.485	58.393	M163	18.08.14
S/14/22	3012.512	1061.471	58.411	N162	18.08.14
S/14/23	3011.473	1061.457	58.389	M162	18.08.14
S/14/24	3010.463	1061.451	58.325	L162	18.08.14
S/14/25	3010.45	1061.446	58.279	L162	18.08.14
S/14/26	3009.496	1061.511	58.449	K162	18.08.14
S/14/27	3009.534	1062.494	58.486	K163	18.08.14
S/14/28	3012.488	1051.45	59.42	N152	18.08.14
S/14/29	3012.474	1051.449	59.367	N152	18.08.14
S/14/30	3012.542	1061.47	58.347	N162	20.08.14
S/14/31	3012.54	1061.472	58.312	N162	20.08.14
S/14/32	3011.484	1061.465	58.341	M162	20.08.14
S/14/33	3011.492	1062.486	58.354	M163	20.08.14
S/14/34	3009.543	1060.008	58.534	K161	20.08.14
S/14/35	3009.565	1059.967	58.495	K161	20.08.14
S/14/36	3009.476	1061.495	58.393	K162	20.08.14
S/14/37	3009.544	1062.521	58.429	K163	20.08.14
S/14/38	3009.514	1062.506	58.41	K163	20.08.14

S/14/39	3012.455	1053.514	59.278	N154	20.08.14
S/14/40	3012.441	1051.454	59.325	N152	20.08.14
S/14/41	3012.461	1051.448	59.287	N152	20.08.14
S/14/42	3011.54	1049.257	59.954	M150	20.08.14
S/14/43	3010.534	1049.51	59.771	L150	20.08.14
S/14/44	3009.459	1048.462	59.573	K149	20.08.14
S/14/45	3008.454	1049.503	59.287	J150	20.08.14
S/14/46	3009.494	1063.518	58.443	K164	22.08.14
S/14/47	3009.492	1062.484	58.37	K163	22.08.14
S/14/48	3009.487	1062.495	58.335	K163	22.08.14
S/14/49	3009.496	1061.492	58.341	K162	22.08.14
S/14/50	3009.551	1059.961	58.461	K161	22.08.14
S/14/51	3010.503	1062.482	58.384	L163	22.08.14
S/14/52	3010.419	1061.477	58.202	L162	22.08.14
S/14/53	3011.503	1061.467	58.284	M162	22.08.14
S/14/54	3011.554	1062.473	58.341	M163	22.08.14
S/14/55	3012.469	1053.483	59.233	N154	22.08.14
S/14/56	3011.481	1049.48	59.896	M150	22.08.14
S/14/57	3009.426	1048.438	59.537	K149	22.08.14
S/14/58	3010.468	1063.549	58.47	L164	23.08.14
S/14/59	3010.494	1063.582	58.411	L164	23.08.14
S/14/60	3011.515	1061.495	58.245	M162	23.08.14
S/14/61	3012.538	1061.508	58.245	N162	23.08.14
S/14/62	3009.484	1061.488	58.307	K162	23.08.14
S/14/63	3012.412	1051.445	59.24	N152	23.08.14
S/14/64	3012.427	1051.454	59.179	N152	23.08.14
S/14/65	3011.526	1049.418	59.843	M150	23.08.14
S/14/66	3010.442	1063.508	58.356	L164	26.08.14
S/14/67	3010.513	1062.489	58.343	L163	26.08.14
S/14/68	3010.549	1062.482	58.304	L163	26.08.14
S/14/69	3011.509	1062.502	58.291	M163	26.08.14
S/14/70	3011.52	1061.455	58.199	M162	26.08.14
S/14/71	3012.541	1061.493	58.195	N162	26.08.14
S/14/72	3009.489	1061.484	58.285	K162	26.08.14
S/14/73	3009.534	1059.997	58.417	K160	26.08.14
S/14/74	3012.453	1053.47	59.187	N154	26.08.14
S/14/75	3009.378	1048.4	59.514	K149	26.08.14
S/14/76	3009.395	1048.416	59.462	K149	26.08.14
S/14/77	3009.479	1060.031	58.373	L161	27.08.14
S/14/78	3012.511	1061.491	58.132	N162	27.08.14
S/14/79	3011.527	1061.466	58.144	M162	27.08.14
S/14/80	3010.67	1061.698	58.318	L162	14.08.14
S/14/81	3010.471	1063.543	58.316	L164	28.08.14
S/14/82	3010.538	1062.503	58.232	L163	28.08.14
S/14/83	3011.454	1062.505	58.246	M163	28.08.14
S/14/84	3011.488	1062.499	58.195	M163	28.08.14
S/14/85	3012.521	1061.478	58.078	N162	28.08.14
S/14/86	3012.542	1061.478	58.005	N162	28.08.14
S/14/87	3012.47	1053.531	59.142	N154	28.08.14
S/14/88	3011.503	1049.511	59.747	M150	28.08.14

S/14/89	3011.524	1049.456	59.699	M150	28.08.14
S/14/90	3009.438	1048.452	59.42	K149	28.08.14
S/14/91	3010.535	1062.379	58.211	L163	28.08.14
S/14/92	3010.476	1061.212	58.035	L162	28.08.14
Botany soil samples					
YM/14/001	3012.196	1061.771	58.478	N162	11.08.14
YM/14/002	3009.343	1060.139	58.667	N162	11.08.14
YM/14/003	3010.819	1062.852	58.387	L163	11.08.14
YM/14/004	3011.177	1062.79	58.498	M163	11.08.14
YM/14/005	3011.741	1061.737	58.401	M162	11.08.14
YM/14/006	3012.836	1054.841	58.859	N155	11.08.14
YM/14/007	3012.642	1053.15	59.386	N154	11.08.14
YM/14/008	3011.749	1050.263	59.393	M151	11.08.14
YM/14/009	3012.204	1052.289	59.032	N153	11.08.14
YM/14/10	3012.339	1061.714	58.363	N162	15.08.14
YM/14/11	3011.726	1061.298	58.311	M162	15.08.14
YM/14/12	3011.707	1062.235	58.315	M163	15.08.14
YM/14/13	3010.354	1062.23	58.332	L163	15.08.14
YM/14/14	3009.26	1060.142	58.493	K161	15.08.14
YM/14/15	3012.386	1053.186	59.274	N154	15.08.14
YM/14/16	3012.801	1051.611	59.416	N152	15.08.14
YM/14/17	3010.175	1049.885	59.791	L150	15.08.14
YM/14/18	3009.682	1061.352	58.413	K162	16.08.16
YM/14/19	3009.78	1062.311	58.434	K163	16.08.16
YM/14/20	3008.708	1049.675	59.317	J150	16.08.16
YM/14/21	3011.339	1062.297	58.254	M163	20.08.14
YM/14/22	3010.718	1062.717	58.33	M163	20.08.14
YM/14/23	3010.275	1061.735	58.198	L162	20.08.14
YM/14/24	3009.238	1061.699	58.303	K162	20.08.14
YM/14/25	3009.268	1060.102	58.419	K161	20.08.14
YM/14/26	3009.286	1062.715	58.349	K163	20.08.14
YM/14/27	3012.27	1061.203	58.285	N162	20.08.14
YM/14/28	3012.744	1055.761	58.742	N156	20.08.14
YM/14/29	3012.693	1053.683	59.209	N154	20.08.14
YM/14/30	3012.792	1051.265	59.214	N152	20.08.14
YM/14/31	3008.695	1049.178	59.205	J150	20.08.14
YM/14/32	3009.619	1048.737	59.522	K149	20.08.14
YM/14/33	3011.867	1061.433	58.221	M162	20.08.14
YM/14/34	3010.28	1049.761	59.7	L150	20.08.14
YM/14/35	3011.249	1049.326	59.876	M150	20.08.14
YM/14/36	3010.387	1061.172	57.912	L162	22.08.14
YM/14/37	3009.663	1059.874	58.398	K160	22.08.14
YM/14/38	3012.311	1061.782	58.188	N162	22.08.14
YM/14/39	3011.289	1062.245	58.222	M163	22.08.14
YM/14/40	3011.282	1049.262	59.813	M150	22.08.14
YM/14/41	3010.772	1062.818	58.295	L163	23.08.14
YM/14/42	3009.744	1062.196	58.268	K163	23.08.14
YM/14/43	3012.266	1051.147	59.158	N152	23.08.14
YM/14/44	3012.734	1054.757	58.704	N155	23.08.14
YM/14/45	3009.661	1048.227	59.446	K149	23.08.14

YM/14/46	3009.26	1061.184	58.244	K162	23.08.14
YM/14/47	3009.656	1063.723	58.286	K164	27.08.14
YM/14/48	3010.637	1063.812	58.292	L164	27.08.14
YM/14/49	3009.734	1062.679	58.188	K163	27.08.14
YM/14/50	3010.163	1062.719	58.21	L163	27.08.14
YM/14/51	3011.221	1062.739	58.17	M163	27.08.14
YM/14/52	3012.165	1061.749	57.974	N162	27.08.14
YM/14/53	3011.787	1061.742	58.012	M162	27.08.14
YM/14/54	3009.765	1061.81	58.06	K162	27.08.14
YM/14/55	3009.689	1060.106	58.287	K161	27.08.14
YM/14/56	3012.818	1055.736	58.554	N156	27.08.14
YM/14/57	3012.298	1053.565	59.087	N154	27.08.14