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# **NAHAL KARKOM, A PRE-POTTERY NEOLITHIC B SITE IN THE SOUTHERN NEGEV, ISRAEL: ARCHAEOLOGICAL REPORT AND ARCHAOMETRIC ANALYSES**

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## **ABSTRACT**

Five seasons of researches at the Middle Pre-Pottery Neolithic B site of Nahal Karkom (Southern Negev, Israel) have highlighted a campsite consisting of a few, stonewalled curvilinear structures in a beehive arrangement. The site experienced three intermittent, seasonal occupations within a short time frame, probably starting from the first half of the VIII millennium B.C.E. It has yielded a range of typical Southern Levantine PPNB material culture: the lithic assemblage features the use of bidirectional core technology, with a preponderance of bladelets and small blades, tranchet axes, borers, tanged projectile points, ground stones. The location of the site and the nature of the findings are indicative of repeated (probably, winter-late spring) occupations of this Southern Negev marginal zone by a band carrying on a mobile foraging existence, or a logistic stop of a small group residentially based elsewhere.

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**KEYWORDS:** Middle Pre-Pottery Neolithic B, Southern Negev, bidirectional blade technology, Har Karkom

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## 1. INTRODUCTION

The Har Karkom area in Israel's southern Negev desert is the main target of the survey carried out by the Italian Archaeological Project<sup>i</sup>, directed by Emmanuel Anati and codirected by Federico Mailland. The archaeological concession lies within the Mount Karkom Natural Reserve; the mountain is reputed to have been a holy place since prehistory (Anati 1986).

During 30 years of survey, the location turned out to be a trove of archaeological findings, with about 1300 sites in an area of 200 km<sup>2</sup>. Such sites record the presence of human activities for at least a two million years, from Lower Paleolithic stations to the remains of Bedouin encampments (Mailland & Anati, 2018). The whole area is dominated by the Har Karkom massif, with a top level of 847 m a.s.l. protruding from the almost levelled plateau. The massif is surrounded by mostly eroded and crumbling precipices of difficult access. It hosts the remains of over 320 Paleolithic sites and cult sites belonging to the Chalcolithic and Early Bronze Age (Anati and Mailland, 2009). At the foot of Har Karkom, there are several valleys: the Northern valley, formed by the Nahal Karkom and including the Beer Karkom waterhole (a well of the Early Bronze Age), the Western valley with the tributaries of Nahal Karkom, the Southern valley with the tributaries of Nahal Sagi and the Eastern valley with the Nahal Paran. To the Southeast lies the Paran desert. At the Har Karkom foot, there are the remains of settlements dated to the Neolithic, Chalcolithic, Early Bronze and begin-

ning of the Middle Bronze ages. Then a hiatus occurred, with few sites of the Iron II age. The area was again settled during the Roman and Byzantine times, until the Islamic conquest.

The agricultural revolution, which involved the ancient Near East from 10,000 BP left signs of its passage at Har Karkom. Two semi-permanent settlements were identified, namely HK/361 northwest of the mountain and BK/608, some 9 km further northwest, set on an alluvial terrace, on the right side of a small gully (Anati and Mailland, 2010, pp. 133-135). The stone structures include round and rectangular stone bases. Material culture includes Pre-pottery Neolithic flint industry, grindstones and mortar pestles. The findings reflect an agricultural economy, flourished in a period when the change of climate conditions allowed agriculture in southern Negev. This period corresponds to the humid Neolithic that involved all the Northern Africa and Sahel. Beside the two mentioned sites, Neolithic material culture (mostly flints: arrowheads and bladelets, some sporadic axes, scanty potshards) was evident in nine other sites in the valleys or on the plateau.

The expedition has recently investigated HK/361, which has proved to be a Pre-Pottery Neolithic B (PPNB) site (Fig. 1). A preliminary report was provided by Mailland *I. et al.* (2009). This paper presents the final data, including the results of the last two campaigns.

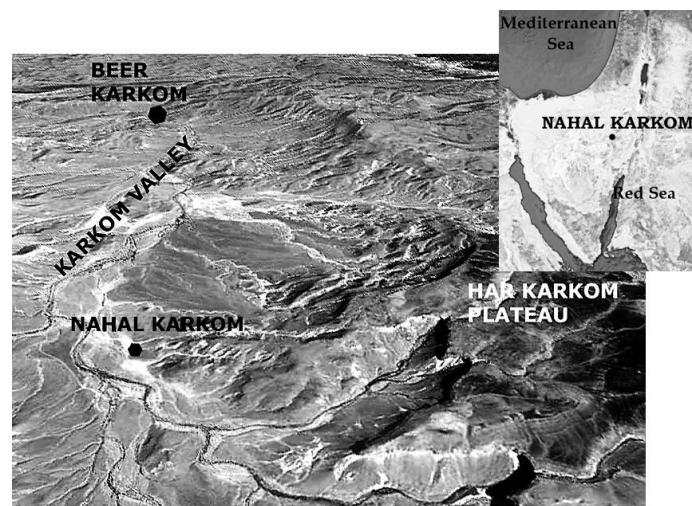


Figure 1. Geographic location of HK/361- Nahal Karkom (Negev, Israel) (Base: Google Earth)

## 2. LOCATION, GEOLOGY, AND ENVIRONMENT

The landscape of the surveyed area consists of lowlands alternating with hills formed by gently dipping sedimentary rocks that occasionally become displaced by faults. The tops of the hills consist of

small, nearly flat plateaus that conform to the strata of the formations, while the hillsides are quite steep. The HK/361 Site (henceforth Nahal Karkom) is located in one of these lowlands, the Karkom Valley, at the foot of the western slope of Har Karkom plateau. The catchment area of Nahal Karkom includes most of the mountain's western side, its formations slight-

ly dipping to the southwest. Nahal Karkom itself is oriented in a north-south direction along the eastern bank of the right-hand tributary of the main water-course. The site, measuring some 60 by 10 m, lies at a mean altitude of 635 m a.s.l. at a strategic position with a commanding view of the valley, mainly to the north in the downstream direction (Fig. 2). A few well-beaten paths still cross the area heading toward the well of Beer Karkom, 5.3 km to the north.

Three geological formations make up the bedrock of the Nahal Karkom site (Fig. 3). The base of the sequence consists of greenish-grey calcareous shale belonging to the Taqiye Formation (Danian Age, Paleocene), followed by the Mor Formation (Ypresian Age, Eocene Epoch), which is composed of biomicrites with frequent layers of brown chert. The Nizzana Formation (Lutetian, also Eocene) makes up

the topmost unit of the succession and covers a great part of the Har Karkom Plateau. In general, it consists of hard, silicified limestone with upper beds of greyish-black tabular chert (Benjamini 1980).



Figure 2. In the foreground, Nahal Karkom Site area, as originally found. In the background, the Karkom Valley draining to the north

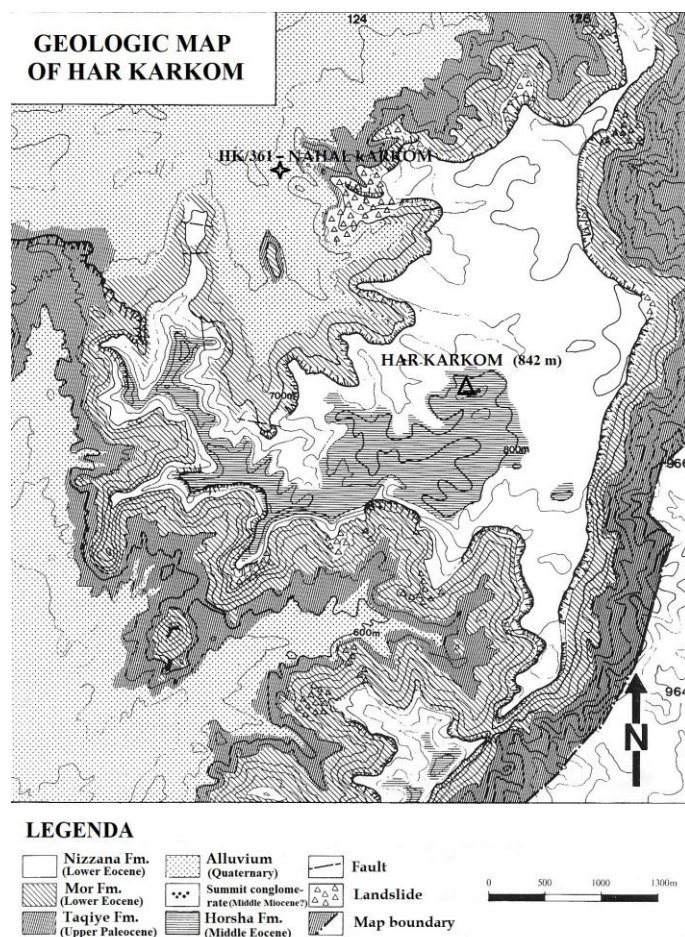


Figure 3. Geologic Map of Har Karkom area with location of Nahal Karkom Site (modified after Diamond, 1986)

From a geomorphological point of view, the site is located on an alluvial terrace deposited on the right side of a small stream that is the right tributary of the main riverbed of Nahal Karkom. The latter flows seasonally through a clearly oversized valley, for which reason it has been associated with a Tertiary fossilized stream system (Diamond 1986). The quaternary alluvial deposits seem to have been consoli-

dated by human intervention, by means of a roughly aligned row of limestone blocks placed along the stream bank. As the bank subsided, some of the stones moved from their original locations and presently rest in a recumbent position in the direction of the current alluvial plain.

Immediately above the main modern path, a talus consisting of angular limestone blocks and chert

cobbles originating in the overlying cliffs hides the underlying, softer lithotypes of the *Taqiye Formation*. The weathering of the cherty limestone favored the sourcing and exploitation of chert from along the talus slope immediately above the site, where paths are still visible. The average slope of the investigated area from the stream bank up to the eastern boundary of the excavations is about 11.5%.

This lowland of the Negev currently lies in an area with an average annual rainfall of ~30 mm, mainly in the form of flash floods, with considerable inter-annual variability (Porat *et al.* 2001). After a rainy winter, though, water persists in numerous pools in the mountain gullies for weeks or even months depending on the amount of precipitation.

Permanent vegetation in the area consists mainly of white broom (*Retama raetam*) bushes concentrated along the valley channels; small acacia trees are also present where the alluvial deposits are thicker and sandier; tamarisks (*Tamarix nilotica*) grow in narrow gorges that experience deep flooding (Danin 1983); and capers (*Capparis cartilaginea*) hang from rock fissures in humidity spots. A few pistachio trees (*Pistacia atlantica*) survive as relicts. After the winter rains, many species of flowers, edible herbs, and wild cereals sprout from the desert floor. Despite the scarce vegetation, some animals, including hares (*Lepus*

*capensis*), wild asses (*Equus hemionus* “pere”), and jerboas (*Jaculus jaculus*) are common. The Nubian ibex (*Capra ibex nubiana*) and the porcupine (*Hystrix indica*) are also present though more difficult to spot, and oryxes have begun to roam the area following their introduction into the southern Negev. Other animal denizens include small coveys of partridge and quail and numerous lizards and snakes.

### 3. FIELDWORK AND METHODS

In 1994, an area near the Mt. Karkom Campground was found to be unusually rich in bidirectional cores, blades, and bladelets and a preliminary surface collection yielded some pieces. The lithics appeared as pertaining to the Pre-Pottery Neolithic (Gopher 1994; Aurenche & Kozłowsky 1999; Kozłowsky 2001, Sampson 2016), so a survey aimed at a better understanding of the archaeological context was started in 2006.

In the same year, the GPS WGS84 coordinates were adapted to the Israeli Topographic System in order to log the site on the 1:20,000 Har Karkom Topographic Map. Old Israeli Grid coordinates were used for uniformity with the previous literature on the subject matter (Anati & Mailland, 2009).

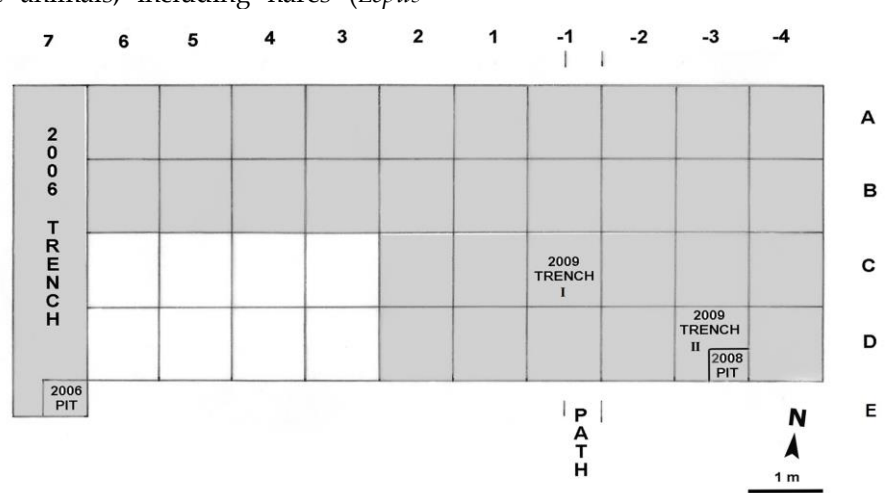


Figure 4. Nahal Karkom grid, with test trenches and pits excavated during several campaigns. Rows: A to E; Columns: -4 to 7

A new collection of deflated artifacts, focused mainly on blades, covered a surface of 600 m<sup>2</sup>, at that point 12 years after the first survey. The southernmost area, where large blocks were partially showing up, was cleaned of scree. We made a first sounding of 4.5 m (north-south) by 1 m (east-west) along the wadi shore that we dug to a depth of -15 cm in the southern section and to -25 cm in the northern (Fig. 4: 2006 Trench). We next focused on the area to the east of the Column 7 trench, selecting a 4 by 6 m section and dividing it into a grid of squares of 1 m<sup>2</sup> each,

from which we collected all of the surface artifacts. Fig. 4 illustrates the final excavation grid, with Rows A to E in east-west direction and Columns -4 to 7 in north-south direction.

Test pits or trenches for stratigraphic purposes have been excavated in squares E7, D-3, and C-1 (Figs. 4 and 5). A further test trench in squares D-2 and D-3 was done in order to investigate the extent of the archaeological remains.

A GPR survey<sup>ii</sup> excluded the presence of any massive archaeological structures beneath the moni-

tored tracks in the southwestern corner (i.e., Columns 3-6, Rows C and D; Fig. 5). Therefore, we concentrated on the northern and eastern areas, where

some significant features were becoming visible. A larger area was accordingly cleared totaling 40 m<sup>2</sup>.

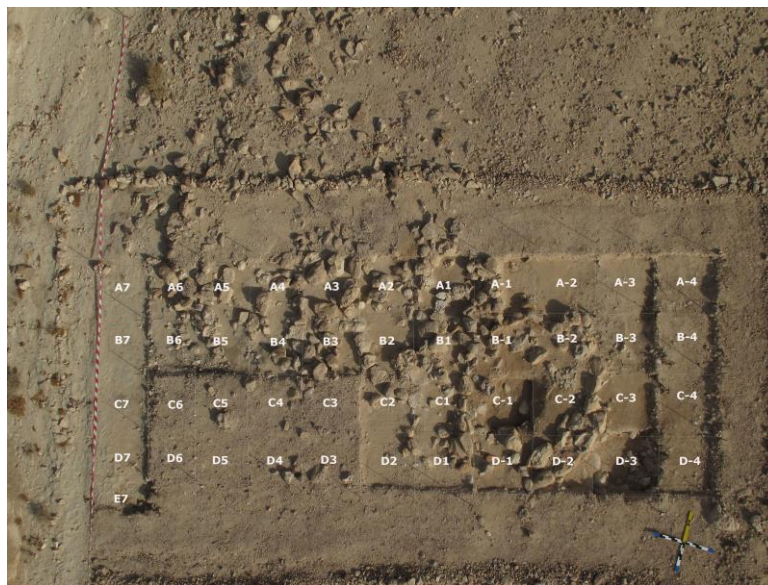


Figure 5. General plan of Nahal Karkom; aerial view.

The excavation then proceeded systematically, square-by-square, as we dug, whenever possible, 10 cm at a time in order to identify any discontinuities in the typology of artifacts or in site functions at various depths. Ultimately, we systematically excavated an area of 37 m<sup>2</sup> out of the 40 m<sup>2</sup> previously cleared, representing approximately 40-50% of the presumed entire site.

The collected material was dry-sieved through a 5 mm mesh to recover any small artifacts and to verify the presence of faunal remains and other non-lithic artifacts. All lithics were washed, inspected, and sorted at the campground. The artifacts of each level were bagged separately, and the bags were tagged with a form recording the square, stratum or level, and number of artifacts along with specific characteristics of technology, typology, and retouch. Since the quantity of collected artifacts proved much too large to process at the campground, the classification work was completed in Jerusalem. The drawings were also made there, while statistical analyses and comparisons with data in the literature were performed in Italy. The findings were further arranged to produce a series of statistics relating to the stratigraphy and unearthed structures.

The main test trench (in Square C-1) was described according to Munsell® (1994) nomenclature for color attributions, internationally used for soil and sediment descriptions (USDA Soil Science Division Staff, 2017). Though Munsell soil-color charts might present some criticism in terms of subjectivity of the results and satisfactory light conditions (Bratitsi *et al.*, 2018), these were the only valuable

tools on a remote excavation field, used by the same researcher, under the same sunlight conditions.

A set of samples of Locus 1 deposits have been collected in order to understand the paleoenvironmental context at the time of the occupation.

Samples of brown and grey chert, selected to represent the local raw material have been recovered along the slope from the outcrops closest to the site.

Micromorphological analysis of sediment and chert thin sections employed an optical petrographic microscope (Olympus BX41, equipped with a digital camera for image acquisition, Olympus E420); thin sections were observed under plane-polarized light (PPL) and cross-polarized light (XPL) according to the method recently described by Antonelli (Antonelli *et al.* 2018).

Charcoal remains from the C-1 trench were submitted for <sup>14</sup>C dating in order to obtain radiometric age range for the cultural horizon and features. These analyses were performed at the Weizmann Institute of Science and calibrated ages in calendar years have been obtained from calibration tables (Reimer *et al.* 2004) with the 2005 OxCal v. 3.10 software of Bronk Ramsey (Bronk-Ramsey 1995; Bronk-Ramsey 2001).

#### 4. TEST PITS AND TRENCHES

Test pits were small soundings of 50x50 cm, i.e. ¼ of a single square.

Test trenches were excavations, conducted in one or more adjacent squares. With the exception of the

Column7 trench, both test pits and trenches reached a depth of 50 or more cm.

*Stratum* is defined as a stratigraphic unit pertaining to a distinctive archaeological and/or sedimentary event detected during excavations.

### Column7 Trench

The whole Column7 was excavated in order to identify the western boundary of the site (Fig. 4: 2006 TRENCH). Only fine colluvial deposits were found, consisting mainly of loose silt mixed with fine sand and cultural remains. Artifacts appeared throughout the entire sequence, but at a remarkably higher frequency in the uppermost 10 cm.

### E7 Pit

This 50-cm-deep test pit (Fig. 4: 2006 PIT) revealed the presence of three different alluvial events underlying the colluvial silts and indicated a trend of decreasing energy of the watercourse over time (Mail-

land *et al.* 2009: 55, fig. 24). The alluvial deposits yielded no clues regarding their age.

### D-3 Pit

The stratigraphy of this 60 cm-deep test pit (Fig. 4: 2008 PIT) showed that the Neolithic strata lay atop the alluvial events that had built the terrace (Mailand *et al.* 2009: 56, fig. 25). Within the intermediate alluvium, a cluster of calcareous fragments, some showing Middle Paleolithic retouching, provided evidence of previous occupation of the area in the Late Pleistocene.

### C-1 Trench

This trench was excavated within Locus 1 and extended to Locus 5 at Stratum VI (Fig. 4: 2009 TRENCH I). There was little variation within the Stratum I colluvial materials, 16 cm thick, which consisted of sandy silt (7.5YR, 6/4 *light brown*) with lithics (Fig. 6).

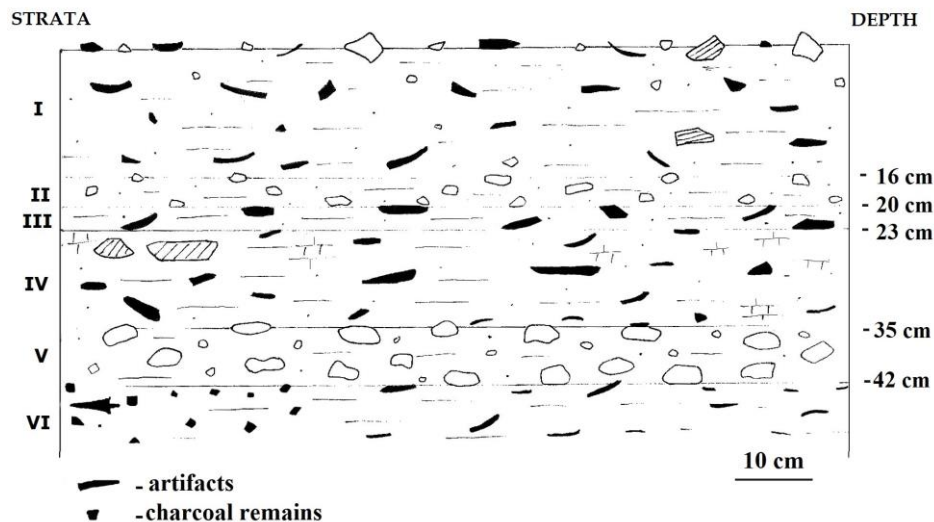


Figure 6. Square C-1 stratigraphy. I: Sandy silt with lithics; II: Silt and gravel, barren; III: Sandy silt with lithics; IV: Sandy silt, in places with concretions; V: Sterile with silt and loose gravel; VI: ashy clay with lithics and charcoals

Stratum II, between -17 and -20 cm, produced mixed materials, mainly silt with pebbles that apparently formed in the same period as the material in the Square D-3. These findings suggest a flooding episode associated with a short hiatus in human occupation. In Stratum III, between -21 and -23 cm, artifacts reappeared embedded in thin, silty layers. Within Stratum IV, between -24 and -35 cm, the same matrix was present but, here and there, the loose colluvium showed concretions and percolated salts that were often encrusting the lithics. At Stratum V, the stratigraphy between -36 and -42 cm outlined a silty gravel deposit with no lithics that bears witness to a weak alluvial event. Stratum VI, which extended from -43 cm to the attained depth of -50 cm and probably to a greater depth, showed features

different from the more recent ones above it, being made of very compact ashy clay (10YR, 6/4; *light yellowish brown*) and holding crumbs of wood charcoal near which lay some artifacts, including a Jericho point. We investigated to a depth of -50 cm without reaching the underlying alluvial deposits.

No living floors were identified within the excavated trench, either with the naked eye or with a microscope. At a depth of -25 cm, however, a stone was found associated with a concentration of unexhausted bidirectional cores that could be interpreted as a *dépôt* (Astruc *et al.* 2003), and small crumbs of charcoal at -45 cm hinted at a nearby hearth. The features described in this section are illustrated in Figure 7 for Locus 1 and in Figure 8 for Locus 5.

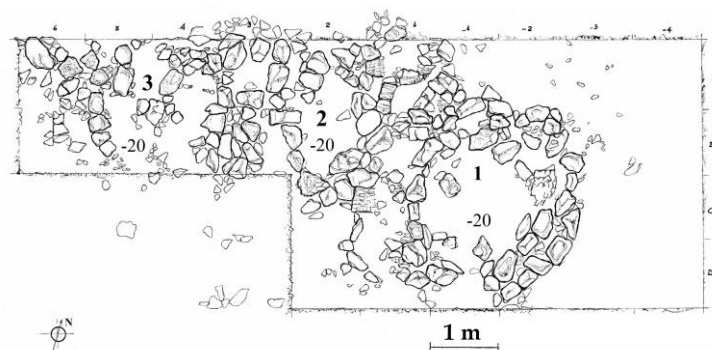


Figure 7. Architectural features of Nahal Karkom brought to light

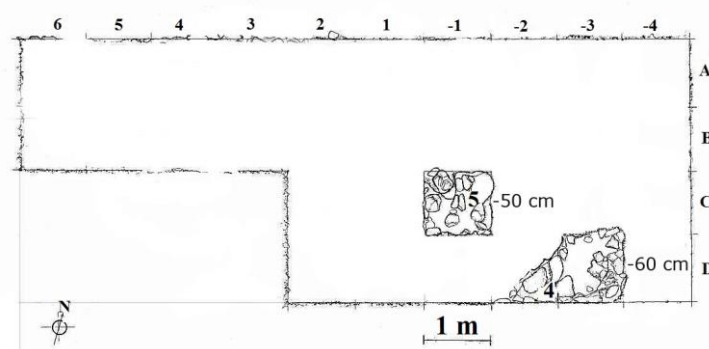


Figure 8. Stones/stone structures in the strata IV, V (sterile) and VI witness two different levels of occupation of the site during earlier episodes. Locus 4 in D-2 and D-3, Locus 5 in C-1 (under Locus 1)



Figure 9. The wall of Locus 1 at its SE edge

#### D-2 AND D-3 Trench

The trench encompassed all of Square D-3 and extended into D-2, reaching a depth of -60 cm only in D-3 (Fig. 4: 2009 TRENCH II). Here, Locus 1 was found to rest upon a 11 cm-thick bank of silts replete with artifacts lacking any clear stratification; this was probably a leveling and strengthening layer representing a workshop dump, and, at least in this corner, it reached -25 cm (Fig. 9). At this depth, on the southern side of D-2, a large, concave limestone slab lay horizontally, its dressed edges measuring 40 by 25 cm but of an unknown thickness; the slab continued under the stone structure of Locus 1 and may have served as a grinding stone. The chert-rich silty bank extended downward to a depth of -35 cm,

where a layer of small stones, apparently purposely arranged, could not be fully investigated because it lay underneath Locus 1. Another large rounded slab was found at the same depth. From -36 to -48 was a layer of pebbles with an average diameter of 6 cm similar to the ones found in Unit 5 of the 2008 pit, which were considered part of an alluvial deposit (Mailland *et al.* 2009: 55, fig. 24). A coarse alluvium with rare small pebbles was found at a depth of -49 cm and continued to the ultimate depth of -60 cm. A large, rounded boulder at the base of the trench that was incongruous with the alluvial deposits may have been brought from elsewhere and placed in the alluvial terrain.

Subsequent excavations of the eastern end of the site confirmed the impression that a great many artifacts were concentrated in this area, especially in the -3 and -4 columns (excavated at -20 and -10 cm, respectively). This may accordingly have been the location of a working area also connected with the narrow slab in Square D-3 (at -20 cm), which resembles the one found at the Nahal Reu'el PPNB Site (Ronen *et al.* 2000) and assumed to be an anvil still resting in place.

#### 5. ARCHITECTURE

The settlement features small round and oval structures in a beehive arrangement (Fig. 7) that are poorly preserved, probably owing to runoff and

flash floods occurred since their original placement. The main architectural feature unearthed was an oval structure (Locus 1) measuring 3.30 by 2.20 m, with an entrance to the south (Figs. 7 and 10). The internal measurements were 2.10 by 1.60 m, and the walls were quite thick (50-80 cm). The rough blocks of local limestone used to build this structure varied in length from about 50 cm to less than 20 cm; there appears to have been no preference for a particular shape. In Square D-2, the stones seem to have been set above the flint-rich embankment.



Figure 10. Aerial view of Locus 1

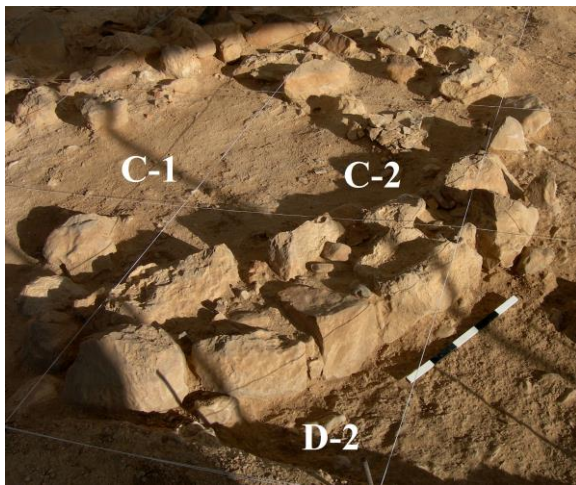


Figure 11. The wall of Locus 1 at its SE edge before the excavation of test trenches

The wall in the less-disturbed area (i.e., the section in C-3, C-2, and D-2) shows a double row of large stones filled in with cobbles and of a maximum height of 30 cm (Fig. 11). The oval structure has partially collapsed at its western side. The walls seem to rest on Stratum IV, though no floor is evident, since other stones appeared at a greater depth (Locus 5). Locus 1 should accordingly be dated to the time during which Stratum III was occupied and refurbished following the flooding episode evident in Stratum II; the site was most probably then later reutilized during the occupation of Stratum I.

Locus 2 is a complex structure with pole holes and stone circles that we excavated to a depth of -20 cm. It occupies Squares A1, A-1, and B2 and seems to have served as a small courtyard that was covered by a roof between Locus 1 and Locus 3. Locus 2, which is very rich in cores, debris, and artifacts, may have been used for flint knapping. Statistics regarding the material culture of Locus 2 are provided in Table 2.

Locus 3 is a round structure, lying in Squares A and B, 3 to 6 that was investigated only partially (from 0 to -20 cm) because it extends beyond the limits of the excavations. It seems to have been built with a double row of stones filled in with cobbles and is slightly larger than Locus 1. The presence of a paved platform and a possible fireplace suggests that Locus 3 may have been a hut; and indeed, in Squares B5 and B6, the cultural deposit was stained grey with powdered charcoal, indicating a nearby hearth. In Square B2, grinding equipment lay on the floor at a depth of -10 cm.

Locus 4 is a room unearthed within the trench of Squares D-2 and D-3 (Fig. 8) as indicated by a large slab and smaller stones beneath the wall of Locus 1. The trench was too narrow to infer the function of the room, but enlarging the trench would have destroyed the wall of Locus 1. Locus 4 appears to have been constructed in the first phase (Stratum VI) of the settlement directly on sterile ground and reutilized during the time period associated with Stratum IV and after the flooding episode associated with Stratum V.

Locus 5 indicates the presence of two earlier occupational levels beneath Locus 1, at Strata IV and VI. This finding confirms the observations made in connection with Locus 4 concerning the lithic industry.

## 6. MATERIAL CULTURE

Evidence of material culture was collected both on the surface and within the excavations. These finds were recorded separately by stratigraphy within each square to assess any qualitative or quantitative differences in typology, but none were detected among the materials collected from the excavation layers and areas. The typology of the lithic industry is shown in Figures 12 to 15 (which represent only the new findings; for a complete typology, see Mailand *et al.* 2009, figs. 27-38). Descriptive statistics for this material (a full analysis set) are provided in Tables 1-3 and summarized in Figures 16-19. Overall, more than 49,000 artifacts were collected (Table 1), including over 32,800 debris elements. Blades largely overcame flakes in the debitage and in the tools as well. Of note, there was a large proportion of distal



and distolateral blades of any length, whose supposed function is discussed in the following pages.

Over 30% of the flints were identified typologically as implements (including unretouched artifacts with a definite shape), while 70% of the flints were identified as processing waste. Of the flint tools,

nearly all were made on laminar support (92.6%), while only 551 (3.7%) were on flakes; 434 were cores; and 109 artifacts, made of tabular chert or from a reutilization of debitage, were grouped together under the latter definition.

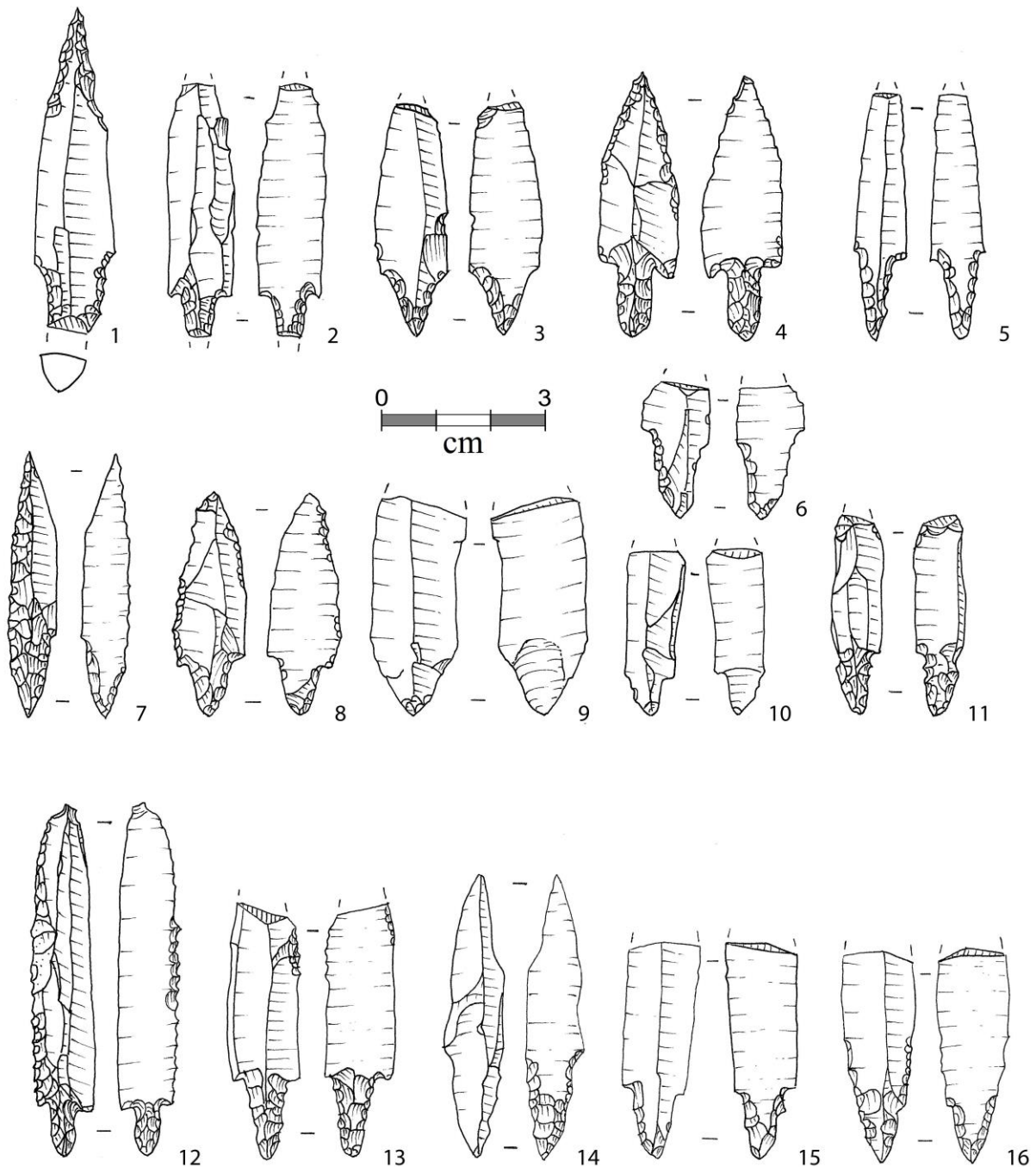
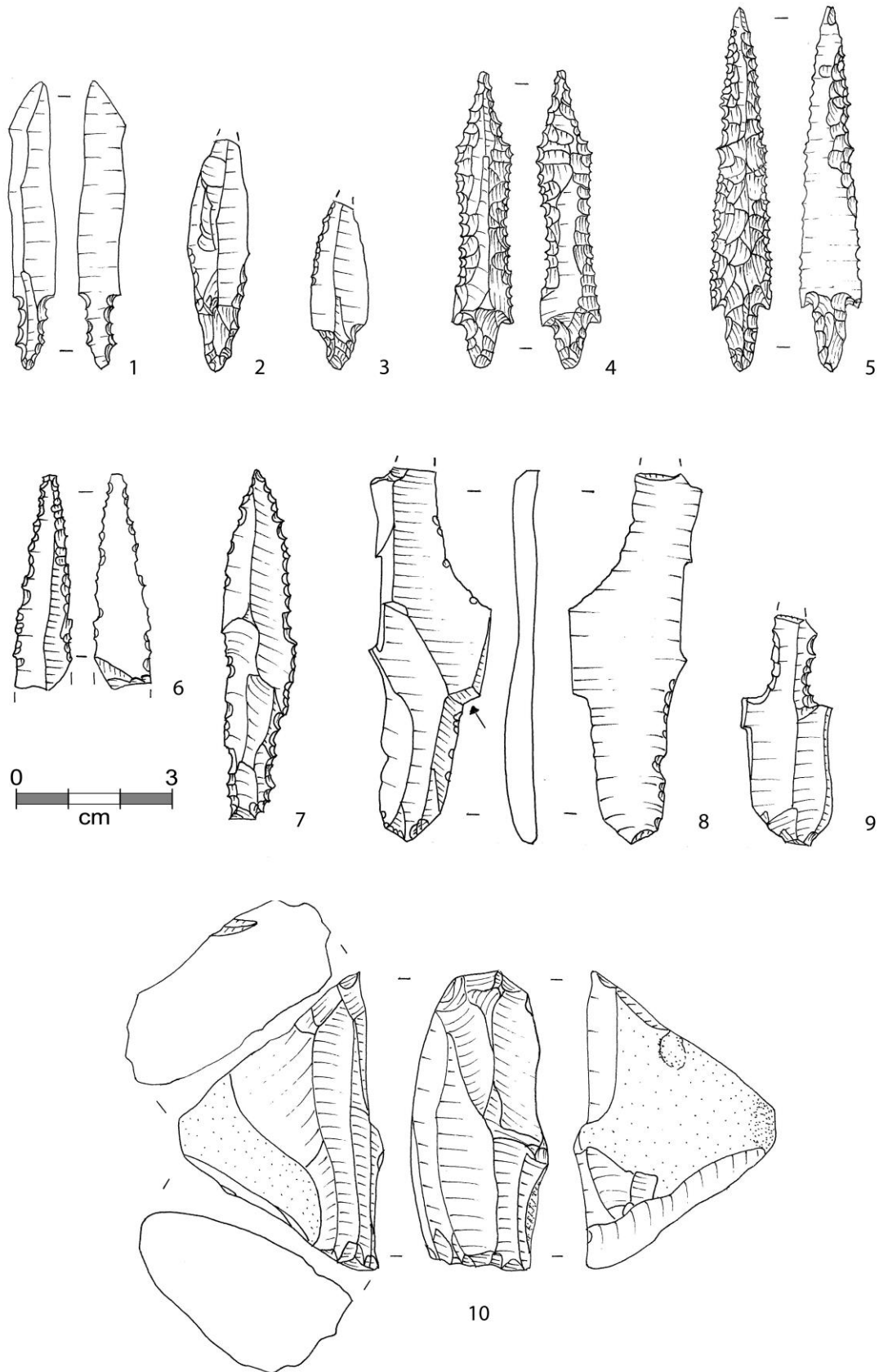


Figure 12. Lithic typology from Nahal Karkom. 1: tanged borer; 2-6, 8, 11-13, 15: Jericho points; 7, 14, 16: Amuq points; 9-10: pseudopedunculate tools with removed platform



**Figure 13.** Lithic typology from Nahal Karkom. 1, 4, 5: Jericho points; 3: point; 2: Amuq point; 6, 7: points with denticulate retouch; 8: burin; 9: borer, denticulate retouch; 10: bipolar core

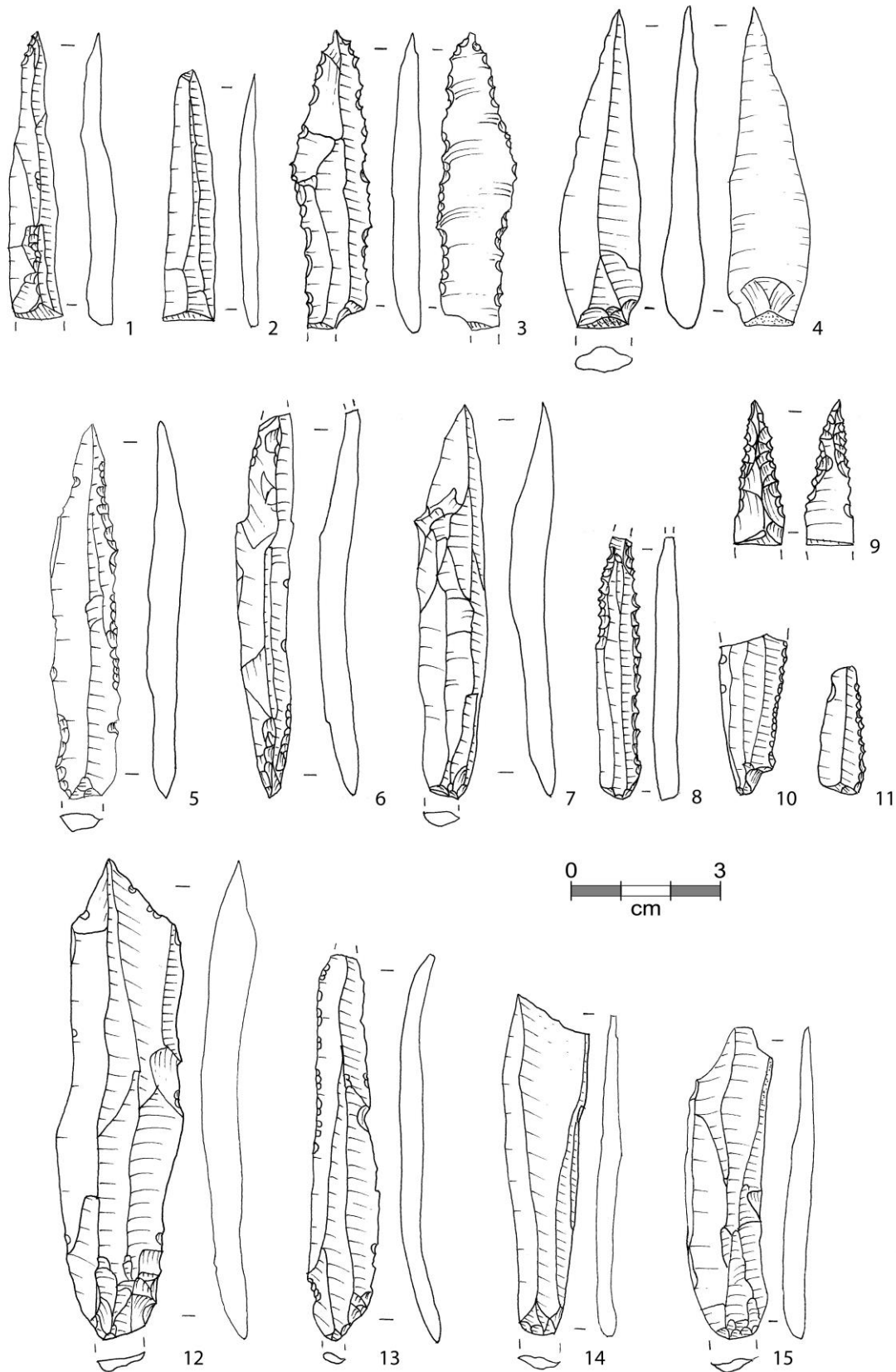


Figure 14. Lithic typology from Nahal Karkom. 1, 2, 4, 6-7: points; 3, 5, 8-9: points, denticulate retouch; 10, 11, 13: fragments (points?) denticulate retouch; 12, 14-15: distal blades, proximal retouch

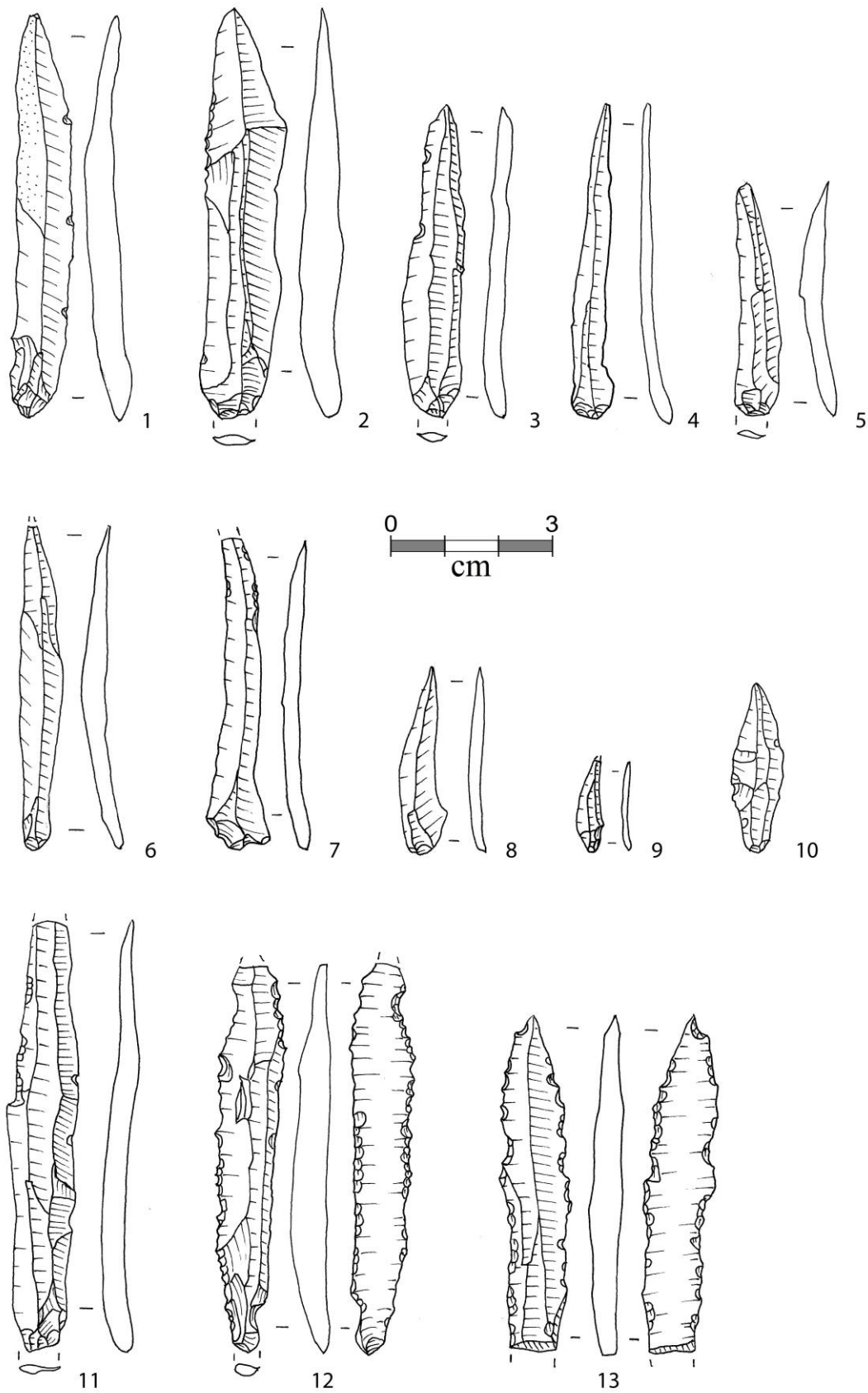


Figure 15. Lithic typology from Nahal Karkom. 1-11: points on laminar flaking; 12-13: points on denticulate blades

## 6.1 Definitions and descriptions

The artifacts have been defined and described as follows:

- Blades were defined according to the standard of displaying a length/width ratio of greater than or equal to 2:1. They have been divided into four groups according to their length as either blades (> 6 cm, n=1016), small blades ( $\leq 6 - > 4$  cm, n=2412), bladelets ( $\leq 4 - \geq 2$  cm, n=6745), or microblades and microliths (< 2 cm, n=3523). Blades of various sizes presented finely retouched or naturally sharp margins; some also showed signs of an inverse retouch.

- Distal blades, particularly abundant, were characterized by a sharp distal edge perpendicular to the blade's central axis, in some cases denticulated, that was achieved by detaching a flake along the blade's central axis or through partial detachment. The resulting distal edge may be either oblique (defined as disto-lateral, when the angle with the central blade axis is  $< 90^\circ$ ) or double (defined as a double disto-lateral blade when two opposite oblique distal edges are present). Distal and disto-lateral typologies were abundant among blades of all sizes, representing 22.64% of blades, 31.09% of small blades, 18.38% of bladelets, and 10.73% of microblades. These implements, which were as sharp as knives, may have been used for activities such as cutting animal skin or sectioning meat.

- Backed blades were defined as having a triangular section. The percentage of these kinds of blades within the laminar flaking was inversely proportional to the blade size class (tools + debitage), ranging from 1.28% of blades to 2.99% of small blades, 5.49% of bladelets, and 6.76% of microblades.

- Points on the blades mostly presented with naturally sharp margins. Some of them showed a finely denticulate retouch and notches, others a marginal retouch. The backed points were rare and retouched. There were also a few points on flake, in some cases retouched; also found were triangles, Levallois-type points without retouch, and, in particular, a point on grey quartzite. Tanged tools included Jericho points in the form of ten blades (6.49% of all points on blades) and one small blade (0.33% of all points on small blades) with a retouched tang and, frequently, accurate side retouches. The findings also included four Amuq points with a tip on the central axis, retouched tangs, and, on occasion, marginal retouching. Of the points on the bladelets, two were Harif points and two others Byblos points, each representing 0.32% of all points on bladelets.

- Pseudopendunculates were defined as tools with a false tang. A few were present on backed blades, being pseudopendunculated at the proximal, unretouched end.

- Cores were classified according to the detaching technique. Of the 434 cores analyzed for this study, 127 (29%) were bidirectional, being represented by bipolar, naviform *sensu stricto*, and postero-lateral types according to Barzilai (2013). The cores were obtained from either tabular chert or from small and even cylinder-shaped nodules; they consisted mainly of grey chert, with rare examples of the brown variety. Most nodules were fully exploited, and some of the cores still showed portions of their original cortices; others were in addition retouched at both ends and apparently reused as implements. Other cores, of a pyramidal shape, featured a single striking platform used for the detachment of both blades or bladelets and flakes. The detachment method always combined pressure and heating. Non-bidirectional cores numbered 307 (71%); they had been used mainly for laminar knapping. Some of the cores were disk-shaped, having been used for the detachment of flakes and microblades. A few of the cores showed more than two striking platforms.

- Reutilization (reuse) of debitage included artifacts with evident retouching on cores, on tabular flint, or on atypical flaking.

- Eleven picks were recovered in total, mainly from tabular flint, which together represented 10.09% of reused debitage.

- Denticulates, notches, small axes, and picks were defined as in general usage. All of these implements were used in the collection and processing of plant resources.

- Denticulation was the most common retouch among the various technologies and typologies. Denticulate retouch of laminar tools, apart from that already described for Jericho points, correlated directly with laminar size, being present (tools + debitage) on 3.74% of blades, 3.40% of small blades, 2.28% of bladelets and 1.50% of microblades. Denticulate was also present on 1.63% of flakes and 10.09% of reused debitage.

- Notches were present on blades of all sizes and on flakes, even being associated with denticulate retouch. Overall, they were found (tools + debitage) on 0.79% of blades, 1.12% of small blades, 0.73% of bladelets, 0.45% of microblades, 1.81% of flakes, and 5.50% of reused debitage.

- Axes were obtained from reused debitage and from tabular flint. Overall, 37 of 109 total tools were classified as axes (33.94%). They presented with a triangular section and a straight cutting edge; some were side-transverse and retouched, while in other cases, the retouch was inverse and one edge was left natural. Most of the platforms were thick, the sides showing a steep retouch, though some had an unretouched ventral face.

- Sickle blades were rare, only two having been identified, both with denticulate retouch.

- Awls, or borers, are tools from a flake, blade, or core retouched to a point. Overall, 13 of the borers were made from flakes (2.36%) and one from reused debitage (0.98%). Ten borers were on blades, most of them at the corners of distal blades (0.98%). Very few awls were on the smaller laminar support.

- Burins were rare, their frequency being less than 1% in all technology groups. They are in part associated with other implements, including a distal pseudopedunculate, a double burin on a notched end-scraper, an end-scraper, a distal bladelet, a point on backed blade, a borer, and a naviform core with denticulate retouch.

- Side-scrapers: six transverse side-scrapers were identified (1.09% of flakes).

- End-scrapers: three end-scrapers were integrated into bladelets and one into a blade; seven were round scrapers (1.27% of flakes).

- Limestone tools: one shaped disk and one big ring (a fragment; Fig. 20); of the ground stone tools recovered, four used for pounding lay in pairs in the vicinity of a broken quern in Square B2 (Locus 2).

Interestingly, at Nahal Issaron as well, “mullers were frequently found in pairs and/or in association with the querns” (Goring-Morris and Gopher 1983: 156). Other limestone tools collected included a prismatic handstone in Square B-3 at a depth of -10 cm and two broken slabs, one in C2 and the other in D2.

- Sandstone tools: 1 disto-lateral bladelet and 12 fragments.

- Preserved cortex: this type of surface covers the entire dorsal face of a primary flint and may be present in secondary flaking. In our investigation, cortex preservation was systematically evaluated for 8250 artifacts, including flakes and blades from debitage and tools during the most recent campaigns, which constitute a representative sample of the full set of 14,791 tools + debitage artifacts. No significant differences were noticed among the various *loci*; the data are presented for full analysis in the following figure. These data indicated that cortex was preserved in about 25% of flakes and 10% of laminar flaking. In our investigation, cortex preservation was systematically evaluated for 8250 artifacts, including flakes and blades from debitage and tools during the most recent campaigns, which constitute a representative sample of the full set of 14,791 tools + debitage artifacts. No significant differences were noticed among the various *loci*; the data are presented for full analysis in the following figure. These data indicated that cortex was preserved in about 25% of flakes and 10% of laminar flaking; as expected, the preservation of cortex was directly proportional to blade length: blades (about 30%), small blades (17%), bladelets (11%) and microbladelets (5%) (Fig. 17).

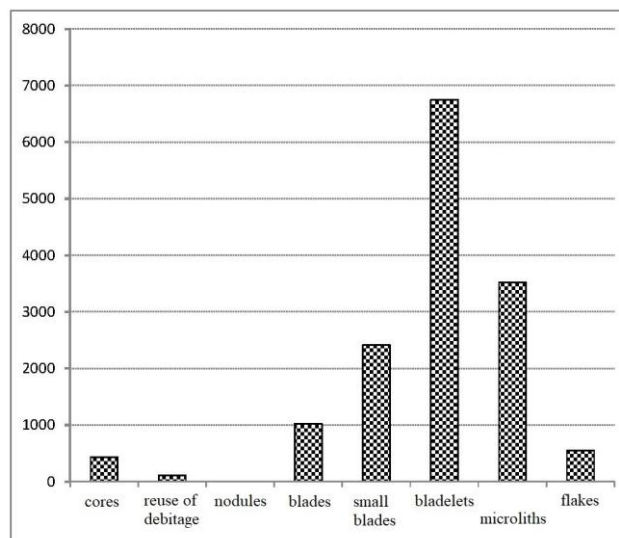


Figure 16. Typological composition (data = n, full analysis set)

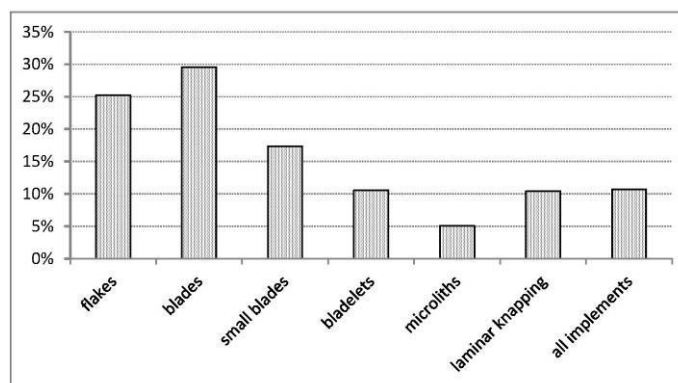


Figure 17. Proportion of cortex preservation by flint and by technology

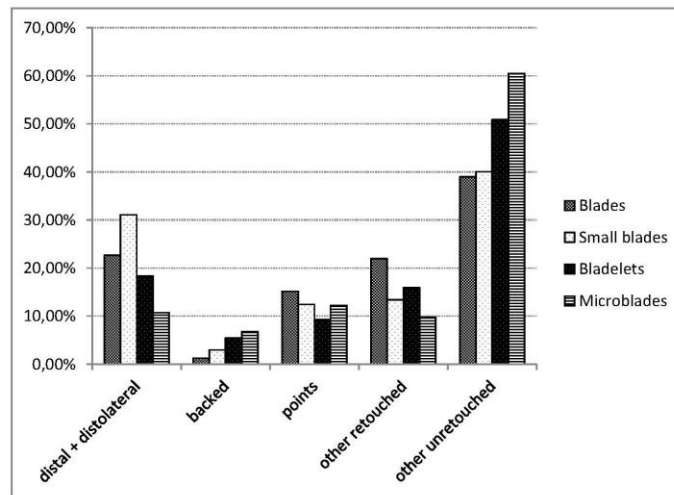


Figure 18. Blade typology frequencies by tool length (full analysis set; n= 1016 blades, 2412 small blades, 6745 bladelets and 3523 microblades)

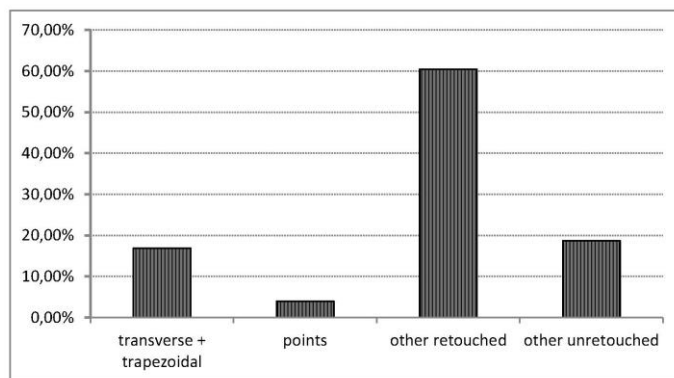


Figure 19. Flake typology frequencies

Table 1. Overview of the lithic assemblage

<i>total flint artifacts</i>	49208
<i>debitage flakes</i>	103
<i>debitage blades</i>	6930
<i>debris</i>	32810
<i>cores</i>	434
<i>reutilization of debitage</i>	109
<i>distal/distolateral blades</i>	2598
<i>tools</i>	4616

Table 2. Descriptive statistics of lithic assemblage by technology and typology within the different loci and areas

Technology	Statistics on the lithic assemblage	Locus 1-5 strata I, III, IV, VI, VII										Total all strata
		Total surface stratum I	Est A-D 4-3 strata I, III	Locus 1 strata I, III	Locus 2 strata I, III	Locus 3 strata I, III	Locus 4 stratum IV	Locus 4 stratum VI	Locus 5 strata IV, VI	Ovest A7-E7 stratum I	E7 pit stratum IV	
Debitage	core trimming elements	1,02%	9,64%	7,65%	7,77%	56,20%	30,20%	52,96%	38,64%	6,82%	0,00%	18,60%
	flakes	7,03%	0,84%	0,00%	0,75%	0,35%	0,00%	0,00%	0,00%	0,00%	0,00%	1,19%
Debris	blades	91,95%	89,52%	92,35%	91,48%	43,45%	69,80%	47,04%	61,36%	93,18%	100,00%	80,21%
	Total debitage	882	3112	745	1338	1420	351	304	132	308	48	8640
Cores	chips	70,74%	82,59%	82,12%	73,23%	95,93%	99,27%	98,02%	99,15%	54,73%	100,00%	82,14%
	chunks	29,26%	17,41%	17,88%	26,77%	4,07%	0,73%	1,98%	0,85%	45,27%	0,00%	17,86%
Nodules	Total debits	1097	16172	2909	7470	1966	1508	858	587	201	42	32810
	naviform	33,75%	27,15%	36,17%	23,81%	31,91%	33,33%	0,00%	0,00%	29,41%	50,00%	29,26%
Blades	other	66,25%	72,85%	63,83%	76,19%	68,09%	66,67%	100,00%	100,00%	70,59%	50,00%	70,74%
	Total cores	80	151	47	84	47	3	3	0	17	2	434
Small blades	on core	20,00%	4,08%	6,67%	0,00%	28,57%	0,00%	16,67%	0,00%	0,00%	0,00%	6,42%
	on tabular flint	20,00%	26,53%	60,00%	55,56%	14,29%	0,00%	16,67%	100,00%	0,00%	0,00%	33,03%
Flakes	other	60,00%	69,39%	33,33%	44,44%	57,14%	100,00%	66,67%	0,00%	100,00%	100,00%	60,55%
	Total deb. reuse	5	49	15	18	7	5	6	1	3	0	109
Bladelets	hammerstone	100,00%										
	Total modules	1	0	0	0	0	0	0	0	0	0	1
Total blades	distal + dislateral	15,77%	57,75%	66,67%	47,42%	60,71%	50,00%	66,67%	66,67%	0,00%	33,33%	37,10%
	backed	0,41%	2,82%	0,00%	8,25%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	2,10%
Total small blades	points	25,31%	28,17%	13,33%	26,80%	21,43%	40,00%	33,33%	33,33%	2,86%	33,33%	24,84%
	other retouched	58,51%	11,27%	20,00%	17,53%	17,86%	10,00%	0,00%	0,00%	97,14%	33,33%	35,97%
Total blades	Total blades	241	142	15	97	56	10	6	15	35	3	620
	distal + dislateral	11,21%	64,00%	50,00%	54,32%	60,00%	38,89%	57,69%	50,00%	0,00%	66,67%	51,87%
Total small blades	backed	2,80%	7,45%	2,33%	3,60%	0,00%	22,22%	3,85%	14,29%	0,00%	0,00%	4,98%
	points	8,41%	18,91%	25,58%	21,94%	26,67%	38,89%	38,46%	35,71%	33,33%	0,00%	20,75%
Total bladelets	other retouched	77,57%	9,64%	22,09%	20,14%	13,33%	0,00%	0,00%	0,00%	97,14%	0,00%	22,41%
	Total small blades	214	550	86	278	225	36	26	28	0	3	1446
Total bladelets	distal + dislateral	7,88%	49,12%	36,99%	39,02%	44,05%	44,59%	47,92%	60,94%	0,00%	0,00%	37,47%
	backed	0,35%	13,87%	6,51%	15,41%	16,67%	13,51%	25,00%	17,19%	0,00%	0,00%	11,18%
Total bladelets	points	2,10%	23,14%	23,63%	22,79%	23,81%	33,78%	18,75%	21,88%	0,00%	0,00%	18,86%
	other retouched	89,67%	13,87%	32,88%	22,79%	15,48%	8,11%	8,33%	0,00%	100,00%	100,00%	32,49%
Total bladelets	Total bladelets	571	1413	292	610	84	74	96	64	104	1	3309
	distal + dislateral	0,00%	28,86%	41,40%	9,12%	41,67%	28,33%	44,90%	26,09%	0,00%	0,00%	27,17%
Total microliths	backed	0,00%	15,07%	16,13%	21,17%	0,00%	31,67%	14,29%	26,09%	0,00%	0,00%	17,11%
	points	75,00%	34,23%	22,04%	25,91%	16,67%	33,33%	30,61%	47,83%	0,00%	0,00%	30,98%
Total microliths	other retouched	25,00%	21,84%	20,43%	43,80%	41,67%	6,67%	10,20%	0,00%	0,00%	0,00%	24,73%
	Total microliths	4	783	186	274	12	60	49	23	0	0	1391
Total flakes	transverse + trapezoidal	0,95%	43,00%	41,38%	38,46%	21,05%	75,00%	0,00%	0,00%	0,00%	0,00%	20,76%
	points	0,00%	9,00%	10,34%	7,69%	10,53%	0,00%	0,00%	0,00%	0,00%	0,00%	4,91%
Total flakes	other retouched	99,05%	48,00%	48,28%	53,85%	68,42%	25,00%	25,00%	0,00%	50,00%	50,00%	74,33%
	Total flakes	210	100	29	65	38	0	4	0	0	2	448



Table 3. Counts and frequencies (full analysis set)

Technology	Retouch	n	%	
Reutilization of debitage	denticulate	11	10,09%	
	burin	1	0,92%	
	axe	37	33,94%	
	notch	6	5,50%	
	steep	7	6,42%	
	hammerstone	5	4,59%	
	dagger	2	1,83%	
	pick	11	10,09%	
	borer	1	0,92%	
	distal	24	22,02%	
	end-scraper	2	1,83%	
	other retouched	2	1,83%	
	<b>Total</b>	<b>109</b>	<b>100,00%</b>	
	Blades	end-scraper	1	0,10%
Jericho points		10	0,98%	
other denticulate		38	3,74%	
burin		9	0,89%	
borer		10	0,98%	
notch		8	0,79%	
steep		2	0,20%	
alternate		1	0,10%	
invasive		1	0,10%	
tanged		2	0,20%	
pseudopedunculate		4	0,39%	
retouched platform		1	0,10%	
total retouched		480	47,24%	
unretouched		536	52,76%	
<b>Total</b>		<b>1016</b>	<b>100,00%</b>	
Small blades		Jericho points	1	0,04%
		Amuq points	4	0,17%
	other denticulate	82	3,40%	
	burin	4	0,17%	
	borer	5	0,21%	
	notch	27	1,12%	
	alternate	2	0,08%	
	truncation	1	0,04%	
	sickle	1	0,04%	
	tanged	8	0,33%	
	pseudopedunculate	7	0,29%	
	retouched platform	2	0,08%	
	total retouched	725	30,06%	
	unretouched	1687	69,94%	
<b>Total</b>	<b>2412</b>	<b>100,00%</b>		
Bladelets	Arif points	2	0,03%	
	Byblos points	2	0,03%	
	denticulate	154	2,28%	
	burin	3	0,04%	
	borer	5	0,07%	
	notch	49	0,73%	
	end-scraper	3	0,04%	
	invasive	1	0,01%	
	tanged	10	0,15%	
	pseudopedunculate	9	0,13%	
	retouched platform	9	0,13%	
	total retouched	1768	26,21%	
	unretouched	4977	73,79%	
	<b>Total</b>	<b>6745</b>	<b>100,00%</b>	
Microblades	denticulate	53	1,50%	
	burin	2	0,06%	
	borer	2	0,06%	
	notch	16	0,45%	
	tanged	4	0,11%	
	pseudopedunculate	3	0,09%	
	geometric	28	0,79%	
	total retouched	744	21,12%	
	unretouched	2779	78,88%	
	<b>Total</b>	<b>3523</b>	<b>100,00%</b>	
Flakes	denticulate	9	1,63%	
	burin	2	0,36%	
	borer	13	2,36%	
	notch	10	1,81%	
	transverse scraper	6	1,09%	
	round scraper	7	1,27%	
	invasive	1	0,18%	
	steep	1	0,18%	
	sickle	1	0,18%	
	direct and inverse	1	0,18%	
	retouched platform	2	0,36%	
	total retouched	448	81,31%	
	unretouched	103	18,69%	
<b>Total</b>	<b>551</b>	<b>100,00%</b>		



Figure 20. Limestone perforated disk (a fragment)

The majority of flint artifacts (22,472 in total) came from the -4 and -3 rows of sectors A, B, C, and D, an area devoid of structures for Strata I and III east of Locus 1. This area, and in particular Square D-3, may have served as a knapping center for the preparation of tools. The second largest area per number of artifacts recovered (10,234 in total) was Locus 2 (the courtyard). Overall, 4,324 artifacts were unearthed in the oval hut structure designated Locus 1.

In Locus 3 (Strata I and III), 3,855 artifacts were collected. Within the lower strata, Locus 4 revealed the remains of a possible structure with a large concentration of artifacts in Strata IV and Locus 5, situated under the hut of Locus 1, showed a moderate concentration of flint artifacts. Almost negligible was the collection of flints from A7 to E7 in Stratum 1, along the bank of the creek, where finds were probably deposited during repeated seasonal flooding. Interestingly, the concentration of arrowheads was greater in the deeper strata, mainly in Loci 4 and 5, even given the smaller number of total artifacts compared with Strata I and III.

Figure 18 presents the frequency of blade typologies according to tool length. The smaller percentage of pointy in comparison with distal blades within the same lithic industry may suggest an economy in transition to animal husbandry and the collection of wild cereals. Figure 19 illustrates the occurrence of flake typologies. The notable frequency of transverse + trapezoidal tools (within the limit of flake production for this lithic assemblage) may account for the use of this kind of flake in ways similar to that of distal blades, i.e., to remove tree bark or to peel skin. The blades were apparently held by hand for this use, while the flakes were likely hafted.

## 7. REMAINS AND ANALYSES

### 7.1 Charcoal remains

Three charcoal samples were recovered during the excavations. The first came from the southeastern corner outside Locus 1 (D -3) at a depth of -45

cm; a second was found in Square A 2 at -10 cm; and the third came from Stratum VI (i.e., Locus 5 at -43 cm) in Square C -1 (Fig. 8). Four small pieces of the latter were collected for  $^{14}\text{C}$  analysis, yielding an average age of  $8648 \pm 37$  radiocarbon years B.P. (Table 4). These dates may correspond to the beginning of

the PPNB presence at HK361; they very likely belong to the first PPNB occupation above the Pleistocene gravels found in Square D -3. All charcoal remains proved to be far too charred for SEM analysis, which could have identified the original wood were the charring less complete (Lipshitz, pers. com.).

Table 4.  $^{14}\text{C}$  ages (E. Boaretto; Weizmann Institute, Israel)

RTK #	TYPE	$^{14}\text{C}$ age $\pm 1\sigma$ year BP	Calibrated age $\pm 1\sigma$	Calibrated age $\pm 2\sigma$	Collection site	Sample ID	$^{13}\text{C}$ ‰PDB
6076-1	charcoal	8580 $\pm$ 70	9610BP (68.2%) 490BP	9735BP (0.7%) 9720BP 9705BP (94.7%) 9460BP	Har Karkom	HK/361	-25.1
6076-2	charcoal	8710 $\pm$ 75	9775BP (68.2%) 9550BP	10100BP (2.4%) 10070BP 9925BP (93.0%) 9535BP	Har Karkom	HK/361	-23.2
6076-3	charcoal	8670 $\pm$ 75	9730BP (2.2%) 9720BP 9705BP (66.6%) 9540BP	9900BP (95.4%) 9530BP	Har Karkom	HK/361	-22.9
6076-4	charcoal	8605 $\pm$ 70	9665BP (8.1%) 9640BP 9635BP (60.1%) 9525BP	9765BP (95.4%) 9470BP	Har Karkom	HK/361	-23.3
Average		8648 $\pm$ 37	9656BP (68.2%) 9545BP	9685 (95.4%) 9540BP			

## 7.2 Faunal remains

Three small gastropod shells were recovered. Two of them, found in Squares B1 and A-1 at a depth of -10 cm, belong to *Cypraea* spp. The third shell, from an immature *Nerita albicilla* (M. Leonardi, pers. com.), was found in D-3 at -15 cm (Fig. 21). All the above seashells had likely been sourced from the Red Sea.



Figure 21. The three specimens of gastropods recovered

## 7.3 Petrographic analysis of raw material

Thin section analyses of the two different kinds of chert used for tools were performed using an optical petrographic microscope. Sample SG10 was of grey chert collected from the outcrop of the *Nizzana Formation* in the small gully above Nahal Karkom Site, and SB10 was of brown chert collected from the *Mor Formation* outcrop in the same gully but at a lower altitude. Both outcrops are located along a still-visible path. Analysis of the brown chert sample SB10 indicated a groundmass made up of approximately 95% microcrystalline chalcedony, the remaining portion being carbonate, representing a mimetic substitution by the chalcedony of the original micrite (Figs. 22-23).

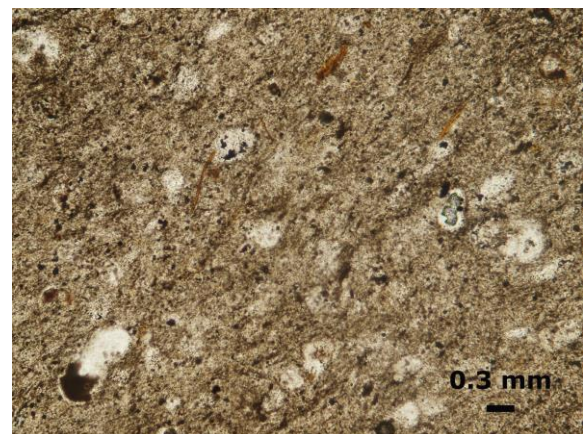


Figure 22. Photomicrograph of SB10 thin section: the groundmass is made of microcrystalline chalcedony (40x; cross-polarized light)

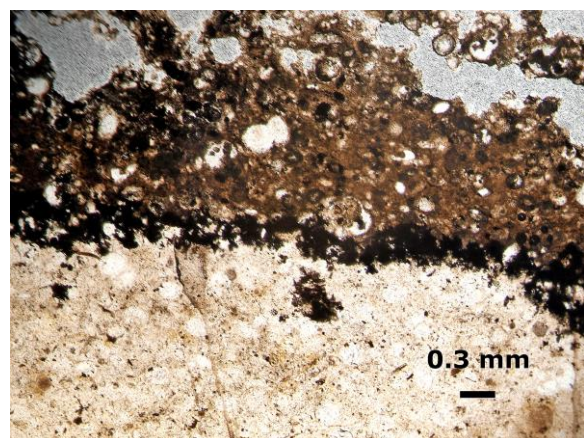


Figure 23. Photomicrograph of SB10 thin section (40x; cross-polarized light): the black cortex (above) of the brown chert (below)

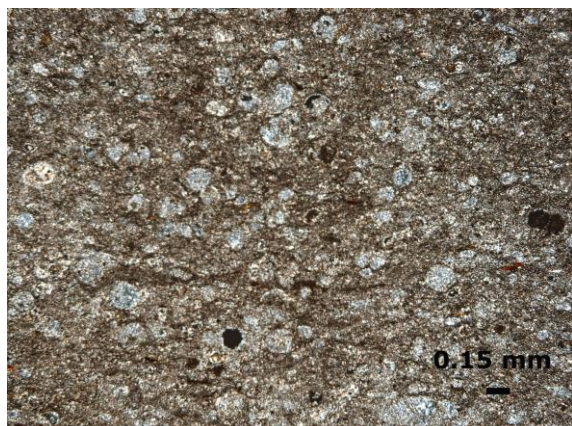


Figure 24. Photomicrograph of SG10 thin section (40x; plane-polarized light) showing up very thin laminae

The silicification was most probably biogenic, the product of the spicules of sponges and radiolarians. Fossils consisted mainly of foraminifers with an average diameter of 0.3 or, exceptionally, of 0.4 mm and, to a lesser extent, of radiolarians. It is noteworthy that the presence of frustules indicates organic matter, possibly vegetal remains. Some opaque minerals were also present, probably pyrite. In the boundary zone between the chert and the limestone (or cortex) lay a black layer of organic matter, likely bitumen. The brown color of the chert was due to the content of the organic matter.

The specimen of grey chert (SG10) showed a more argillaceous groundmass than SB10, though still rich in chalcedony, consisting of radiolarian-bearing mudstone. In addition to radiolarians, fossils included pelagic ostracods and foraminifers and angular and elongated phosphate elements resembling teeth or the bones of fish; opaque minerals were also found throughout the specimen (Fig. 24). The size of radiolarians varied from 0.15 to 0.3 mm. The thin section revealed broken and crushed microfossils and very thin *laminae* indicating that the sediment had been subjected to high pressure. It thus appears that the original SG10 sediment was more rich in marl, and thus of a lighter color, following the diagenetic process.

Both rocks had similar textures, with SB10 containing in addition some coarser elements. The main differences between the two cherty rocks seem to reflect differences in their groundmasses and the pressure to which they were subjected. The finer SG10 groundmass and its thin, oriented *laminae* rendered it fissile, which explains the preference of Neolithic people for this material in the production of thin and sharp implements. On the other hand, the greater isotropy of the brown chert, coupled with its greater shear resistance, made it a better raw material for “strong” tools, such as backed blades or scrapers.

#### 7.4 Micromorphological analysis of site deposits

Four samples of deposits recovered during the excavations were consolidated and cut to obtain thin sections. The more coherent sediment areas were selected for analysis, the material extracted being in general much too loose to work with. The samples were from Squares B2 (at -10 cm; Locus 2), C-1 (at -10 cm, Locus 1, and at -26 cm), and D-1 (at -16 cm). In general, they shared some common elements, their groundmass being made up of silt of more or less clayey or sandy, fine gravel.

The sandy fraction shows the peculiar characteristic that its constituent minerals derived almost totally from rocks of the Precambrian basement. Among the grains, in fact quartz, plagioclases, and orthoclase were prevalent, followed by microcline and biotite; tourmaline and opaque minerals were also represented. These findings suggest that, originally, the fine fraction was part of the “desert” loess (Crouvi *et al.* 2010). In the case of Nahal Karkom site, the dust had been reworked and deposited as thin colluvial layers. Because sand grains are transported only over very short distances, through saltation and short-termed suspension, their source must have been in proximity. We suggest here that the original Aeolian dust could have come from the Southern Arava Valley, where outcrops of the late Precambrian basement are found, a hypothesis that is supported by the observations of Porat *et al.* (2001) regarding quaternary deposits north of Eilat.

The gravelly fraction consisted, by contrast, of local material, such as limestone, chalk, microfossils, chert, and sulfide fragments. All of this material derived from the weathering of the parent rocks. The deepest C-1 sample, coming from a level (within Stratum IV) rich in concretions, also contained gypsum nodules and crystals and was impregnated with calcite.

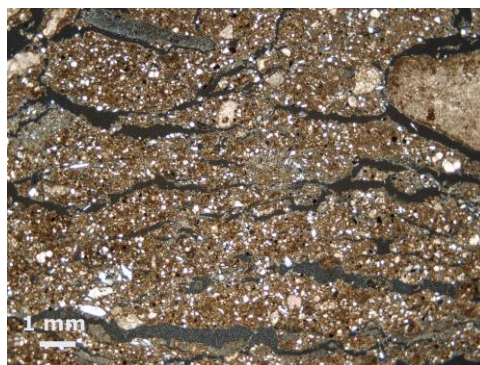


Figure 25. Photomicrograph of D-1 soil sample showing thin planar voids (16x; cross polarized light)

None of the above-mentioned samples suggested post-depositional processes excepted the D-1 speci-

men, which did present with numerous thin layers alternating with large planar voids that were partially coated in a thin brown film (Fig. 25). These layers were sub-parallel, concave to undulating. Such features, since they were not observed in the other soil samples, could be the result of either continuous human or animal trampling through the entrance passage of Locus 1. No organic remains were preserved in the four samples.

## 8. DISCUSSION

Over the past twenty years, the study of the Pre-Pottery Neolithic B has been the subject of renewed interest among archaeologists. It is abundantly clear that PPNB populations and cultures were quite well integrated across the Fertile Crescent and Levant. There is in particular some well-known, specific evidence from the Southern Levant for intense contact and exchange at various social, economic, and demographic levels along well-established trade routes (Gopher and Gophna 1993).

Previous research has demonstrated that the Early Holocene was the wettest period in the last 25,000 years in the Southern Levant; this at least has been the unanimous conclusion of pollen analyses, isotopic records, fluvial deposits, and soil sequences (Rambeau 2010). Palaeoclimatological studies estimate the annual rainfall in the southern Negev during the PPNB at about 100 mm. Later, a warming trend and aridification in the form of rainy winters and hot, dry summers (Horwitz *et al.* 1999) probably led to the collapse of at least the larger PPNB villages around 8500 B.P. (Rambeau 2010). According to the archaeological excavations, the stage of abandonment due to climatic changes in Palestine and in the Jordan valley, including the sites of Munhata, Jericho and Beidha, had a duration of about a millennium, from 8500 to 7500 uncalibrated (Kafafi 2001). Our observations at Nahal Karkom are in accordance with those data. In fact, both the stratigraphic section of Pleistocene *alluvia* in square D-3 ½ and the stratigraphic section in E7 indicate a decreasing energy of local watercourses. Moreover, the deposits of Square C-1 testify to a weak energy of the occasional (seasonal?) floods. The only exception could be represented by Stratum III, where the presence of calcareous encrustations suggests the presence of a notable quantity of water.

Our preliminary report on the Nahal Karkom investigations (Mailland I. *et al.* 2009) has already outlined the evidence for seasonal occupation of the site during the PPNB. Following the last two campaigns, new information was added, including the precise attribution to the MPPNB, radiocarbon dating of the earliest occupation, and evidence of at least three distinct occupations separated by brief flooding epi-

sodes. In fact, the material culture across the various occupations did not differ substantively. In addition to all this, the last two campaigns led to a better understanding of the site structures. Finally, a number of new sites in the Negev similar to Nahal Karkom have been published in the meantime, the evidence from which suggests that such short-lived sites were more widespread in this peripheral area than was thought to be the case only a decade ago.

The radiometric dating of 8648 ±37 B.P. of Nahal Karkom makes it possible to date the oldest recovered archaeological unit at 7656 ±45 cal B.C.<sup>iii</sup>, placing it within the MPPNB (Aurenche *et al.* 2001; Kuijt and Goring-Morris 2002), as mentioned. Among the available <sup>14</sup>C-dated sites of the Negev, Nahal Karkom appears to be almost contemporary with Nahal Reu'el<sup>iv</sup>, Nahal Issaron<sup>v</sup>, Layer 6 at Nahal Divshon<sup>vi</sup>, and Nahal Efe (Borrell *et al.* 2015). Furthermore, it appears very similar to Nahal Hava I (Birkenfeld and Goring-Morris 2013), Wadi Jibba I and Wadi Tbeik (Tchernov and Bar-Yosef 1982), and to the nearby site of Abu Salem (Gopher and Goring-Morris 1998), as for pertains to both architectural features and material culture. The lithics especially compare with those found at Nahal Re'uel (Ronen *et al.* 2000), Nahal Hava Site 50 (Govrin 2010, figs. 58-59; later, Nahal Hava I) and at Nahal Lavan 1021 (Barzilai and Goring-Morris, 2011).

Furthermore, if we take into consideration the large villages of Transjordan and Jericho, Nahal Karkom is almost coeval, among others, to Wadi Hamarash<sup>vii</sup>, Ain Abu Nukhayla (specifically, Locus 22, Level 11, Phase 2)<sup>viii</sup>, Level II at Beidha,<sup>ix</sup> Shu'eib,<sup>x</sup> Locus 143 at el Hemmeh, Unit 448E/224N,<sup>xi</sup> Hemar<sup>xii</sup>, Ghwair<sup>xiii</sup>, and to Level XV A xxxviii<sup>a</sup> at Jericho<sup>xiv</sup> (Fig. 26).

The lithic assemblage indicates that the primary knapping and full reduction sequence took place at the site. The differences in the ratios of implements to total artifacts may point to the specific locations of the primary activities, e.g., flint knapping in the area southeast of Locus 1 and animal skin cutting and meat preparation in Locus 1 itself. The projectile points at Nahal Karkom are typical of the period in both typology and frequency. A peculiarity of the lithics found at the site is the abundance of distal blades, i.e., those provided with a distal or distolateral cutting edge. This edge was generally unretouched, though it sometimes showed a denticulate retouch or traces of use. The presence of such blades was evident also in Nahal Lavan (Goring-Morris *et al.* 2006) and Nahal Hava (Birkenfeld and Goring-Morris 2013), though their occurrence was not highlighted by the excavators. Their function was probably similar to that of the "Upsilon" blades found at Kfar HaHoresh (Barzilai 2010), though the

Upsilon shape was not common among the evidence from Nahal Karkom. The presence of a few grinding slabs and saddles and one quern suggests that some kind of grinding and pounding took place, but the intended purpose of these implements remains open for debate. Still, the various typologies and sizes of the grinding equipment suggest specialized uses for these tools.



Figure 26. Location of Nahal Karkom in relation to other contemporary ( $^{14}\text{C}$  dated) sites in the region

Judging from the surface evidence, Nahal Karkom was not a large site; the PPNB artifacts were scattered over an area of approximately 600 m<sup>2</sup>, but the actual area may have been much less. The open view and proximity to a stream are features that Nahal Karkom shared with other MPPNB sites and encampments of the Southern Levant that were occupied by groups of hunters-gatherers. This is especially true for Nahal Re'uel and Abu Salem. All these seasonal sites occupied the boundary between the transitional areas and the marginal environmental zones (Kuijt and Goring-Morris 2002, fig. 7).

The selection of the location was probably, as suggested earlier, due to its uninterrupted view over the Karkom valley, where game would assemble for watering and grazing, and to the proximity of flat expanses where greenery would grow uncultivated and "wild cereals could be harvested in late spring and processed on site" (Scott 1977). Such an interpretation would also be in accordance with Simmons's (1981: 36) paleo-subsistence model, according to which areas identified as "wadi-riparian" were perhaps the richest seasonal zones in the Negev at the

time. All of this evidence points to Nahal Karkom being a favorable location for winter-late spring quarters of a MPPNB band. The *felicitas loci* was further enhanced by the availability of high-quality chert.

The presence of shells confirms that Nahal Karkom dwellers were either very mobile or interacted with populations in nearby regions (Gopher and Goring-Morris 1998). The site is in fact located along ancient trails connecting the Red Sea, Mediterranean, and Siro-Palestinian regions (Anati 1986). The discovery of certain mollusks, which have been found at the southernmost MPPNB sites as well, confirms that the Red Sea was the main source for the shells used in bead production (Kuijt and Goring-Morris 2002).

In the absence of other faunal remains, data pertaining to the local paleoenvironment came mainly from Nahal Issaron and Abu Salem (Harifian occupation). Based on the findings from those sites (Carmi *et al.* 1994; Marks 1976), it appears that ibexes, gazelles, onagers, hares, reptiles, and the same avifauna would have been present at Nahal Karkom. Even richer faunal remains from the PPNB sites of Wadi Tbeik and Ujrat el-Mehed in the southern Sinai (Dayan *et al.* 1986), though not exactly contemporaneous with Nahal Karkom, testify to the availability of diverse food resources, especially through hunting.

While the charcoal samples from Nahal Karkom proved unusable for wood identification, some from Nahal Issaron were found to contain the remains of *Haloxylon persicum* and *Retama raetam* at the PPNB levels and *Tamarix* spp., *Anabasis articulata*, and *Acacia tortilis* at the PPNA levels, an array of arboreal vegetation similar to that presently found in the area (Liphschitz 2007). Further support for the continuity of the plant cover has been discovered at the newly investigated MPPNB site of Nahal Efe (Borrell *et al.*, 2015) in the eastern Negev highlands. At the latter site, a charred sample of *Retama raetam* recovered from inside an architectural structure has provided a  $^{14}\text{C}$  date around the first half of the tenth millennium cal. B.P.

Our findings, then, indicate three occupation phases at the site. The earlier phase (perhaps an open-air campsite), was evidenced by charcoal remains, a grinding slab, and lithics. The middle phase was associated with a grinding slab, lithics, and stones. In the most recent phase, the two round structures (one, partially unearthed, a possible hut with a hearth and a storeroom) separated by a courtyard with a roof and other stone structures were built. Since the lithic industry remained unchanged across these three phases, they must all date to a relatively brief span of the same MPPNB phase, with

hunting likely to have been the main food source during the first occupational phase and increasing plant usage to have characterized the last. Based on our analysis, we conclude that the site may have been exploited on a seasonal basis, specifically in the winter to late spring, its use perhaps feasible only during a period in which the climate was relatively favorable but that is not detectable at a macroclimatic scale.

Goring-Morris and Belfer-Cohen (2013) have postulated that inhabitants of the southern Negev interacted mainly with those of the southern Edom through the southern Arava but, given the geographical location of Nahal Karkom (Anati 1986) and the similarity of its lithic industry with sites such as Nahal Lavan 1021 and primarily Abu Salem, where a migration on a seasonal basis from the Mediterranean zone is hypothesized (Gopher and Goring Morris 1998), connections with the Mediterranean coast cannot be excluded. On the other hand, the seasonal

character of the site, the rather short-term phases of occupation, the beehive architectural structure and the scarce seashell findings rather witness at least some contacts with the Red Sea.

This being the case, longstanding questions regarding settlement patterns and subsistence strategies of PPNB bands living in the arid periphery of the Levant are relevant to Nahal Karkom as well. These questions include whether the site was a “small, seasonal encampment and hunting camp of a band continuing a mobile foraging existence” or perhaps rather “a logistical hunting foray of a group” (Kuijt and Goring-Morris 2002: 389) that resided elsewhere. Maybe the question will be answered by further investigations; still, the discovery of Nahal Karkom adds a small but significant *tessera* to the mosaic of the development and diffusion of Middle Pre-Pottery Neolithic B people in the desert zones of the Southern Levant.

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## Endnotes

- <sup>i</sup> A joint project of Centro Camuno di Studi Preistorici (Italy) and the Israel Department of Antiquities and Archaeological Survey, under the auspices of the Italian Ministry of Foreign Affairs
- <sup>ii</sup> Performed by Prof. Harry M. Jol (University of Wisconsin – Eau Claire) and Prof. Philip P. Reeder (University of Florida)
- <sup>iii</sup> CalCurve: CalPal\_2007\_HULU; <http://www.calpal-online.de>
- <sup>iv</sup> Pta 3137: 8620±70 B.P. and Pta 2848: 8670±60 BP., Ronen et al. 2000
- <sup>v</sup> RT-1512: 8650±85 and RT-1609: 8685±70 B.P., Carmi et al. 1994
- <sup>vi</sup> 8620±140 B.P., Böhner and Schyle 2002-2006
- <sup>vii</sup> 8660±45 B.P., Giannopoulou 2013
- <sup>viii</sup> A-12230: 8650±55 B.P., Henry and Beaver 2014
- <sup>ix</sup> 8550±160 B.P., Böhner and Schyle 2002-2006
- <sup>x</sup> Beta-35081NS-2: 8600±100 B.P., Simmons et al. 2001
- <sup>xi</sup> OS- 48490: 8670 ± 45 B.P., Makarewicz et al. 2006
- <sup>xii</sup> 8600±120 B.P., Böhner and Schyle 2002-2006
- <sup>xiii</sup> Hd-17220/-17550: 8627±46 B.P., Simmons and Najjar 1998
- <sup>xiv</sup> 8610±75 B.P., Böhner and Schyle 2002-2006