

NEW ACHEULIAN LOCALITY NORTH OF GESHER BENOT YA' AQOV – CONTRIBUTION TO THE STUDY OF THE LEVANTINE ACHEULIAN

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Introduction

A new Acheulian locality was discovered north of the famous site of Gesher Benot Ya' aqov (GBY) as a result of a massive drainage operation of the Jordan River in 1999. The site comprises rich surface collection and a preliminary test excavation that enabled reconstruction of the stratigraphy of the site's layers. The lithic assemblage resembles that of the nearby GBY Acheulian site and is dominated by numerous basalt handaxes and cleavers. However, the assemblage has some marked differences from that of GBY, enlarging our understanding of the Levantine Acheulian variability. An Ar/Ar date was established for the basalt flow underling the Acheulian living floor exposed in the test excavation. This date is one of the only radiometric dates by Levant and enables better chronological control of the GBY large flake Acheulian chronology.

The NBA site

In its outlet from the Hula Valley, in the Northern Dead Sea Rift, the Jordan River cuts through layers of sediments ranging in age from the Pliocene to the Holocene. Numerous drainage operations took place in this area from the 1860s onward, with the purpose of lowering the water level of Lake Hula in order to free agriculture land. Archaeological remains retrieved from these operations lead to the identification of the area of Gesher Benot Ya' aqov (the bridge of the daughters of Jacob - GBY) as a location of great archaeological potential (Goren-Inbar *et al.* 2002; Sharon *et al.* 2002; Stekelis 1960). In the last century, drainage operations have lowered the channel of the river by more than six meters. Further drainage work during the early 1970s and most recently in 1999, has deepened the river bed even further.

During the fall of 1999, the Kinneret Drainage Authority once again undertook a large-scale operation to deepen the Jordan River at its outlet from the Hula Valley. This operation caused massive damage to the already badly disturbed archaeological and geological layers in the area (Sharon *et al.* 2002 for a detailed discussion). In the course of the work, large quantities of Acheulian tools and fossil bones were identified along the river, in the area now known as GBY North of Bridge Acheu-

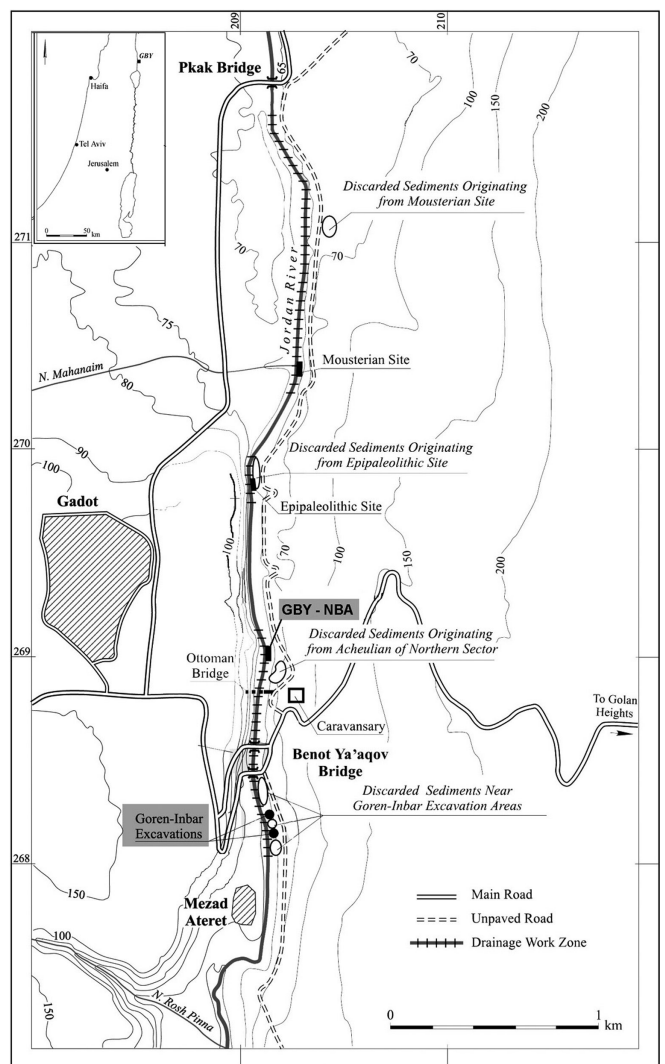


Figure 1 - Location map of NBA and other archaeological sites in the vicinity of the Benot Ya' aqov Bridge.

lian (NBA). The find spot (coordinates 33° 00' 53"N and 35° 37' 46"E) is located on both banks of the Jordan River, about 500 m north of Benot Ya' aqov Bridge, at about 60 m above sea level (fig. 1). The GBY excavation, carried out by Goren-Inbar

between 1989 and 1997 (Goren-Inbar *et al.* 2000), is located a few hundred meters south of this area (fig. 1). A detailed account of the site and its finds is published elsewhere (Sharon *et al.* 2010.). This paper aims to highlight some of the NBA lithic assemblage characteristics and their significance for our understanding the Levantine Acheulian.

Stratigraphy and Ar/Ar Dating

The geological and stratigraphic data of this study were obtained from a series of sections that were cut into the east bank of the Jordan River, geological cores that were drilled to a depth of 10 meters along the river, and from drawings and geological interpretation of the sections and cores. The Benot Ya'akov Formation (BYF) tool-bearing layers at this locality are deposited on top of a basalt flow, approximately 4 m thick. This basalt flow is covered by a layer of gray basaltic sand within which the Acheulian living floor was exposed, bearing tools and bones in mint condition (fig. 3: Layer 4 in section 02-5). The upper part of this section (fig. 3: Layer 3 in section 02-5) comprises a conglomerate of boulder-to-pebble sized basalt and small flint clasts, in which heavily rolled Acheulian artifacts are abundant. In many instances, breakage is evident on handaxe tips, and tool edges are notched, indicating transportation in a high-energy stream environment.

Hundreds of bifaces and other stone artifacts, as well as animal bones, were collected from piles of sediments resulting from the drainage operation (fig. 2). It is unknown how many archaeological layers they represent, however, based on the collections' diversity and preservation state, it is clear that the origins of the NBA assemblage lie in several different depositional environments. It can also be argued that the tools that were found in mint condition originated from a primary context, as was attested by the finds from the living floor of Section 02-5. During a geo-archaeological survey in the year 2002, three sections of the Jordan River bank were cleared, and their geology studied (fig. 3). In one of these sections (Section 02-5), an Acheulian living floor, with 10 bifacial tools, many flakes, and some bones was exposed in an area of 1.5 sq m (fig. 4). The small excavation area (2 m²) exposed at section 02-5 is the basis for many of the observations presented below. It yielded an in situ assemblage of many Acheulian tools that provided a source of observations that are not based on surface collected artifacts alone.

Three samples from the basalt flow underlying Section 02-5 were sent for radiometric Ar/Ar dating at CNRS Geosciences Laboratoris, Azur, Canada. The resulting ages for these samples enable the determination of the age of the basalt flow underlying the Section 5-02 Acheulian living floor to 664 ± 20 Ka (see Sharon *et al.* 2010 for details). In order to use the age of the underlying basalt as a constraint on the living floor age it is essential to estimate the time elapsed between the formation of the basalt flow and the occupation of the Acheulian layer in section 5-02. Since the basalt appears to be unweathered and no traces of erosion are present, it can be argued that this basalt flow was covered by sediments shortly after its formation. The tools and bones excavated from this layer are also very fresh and were most probably covered quickly by the overlying sandy sediments.

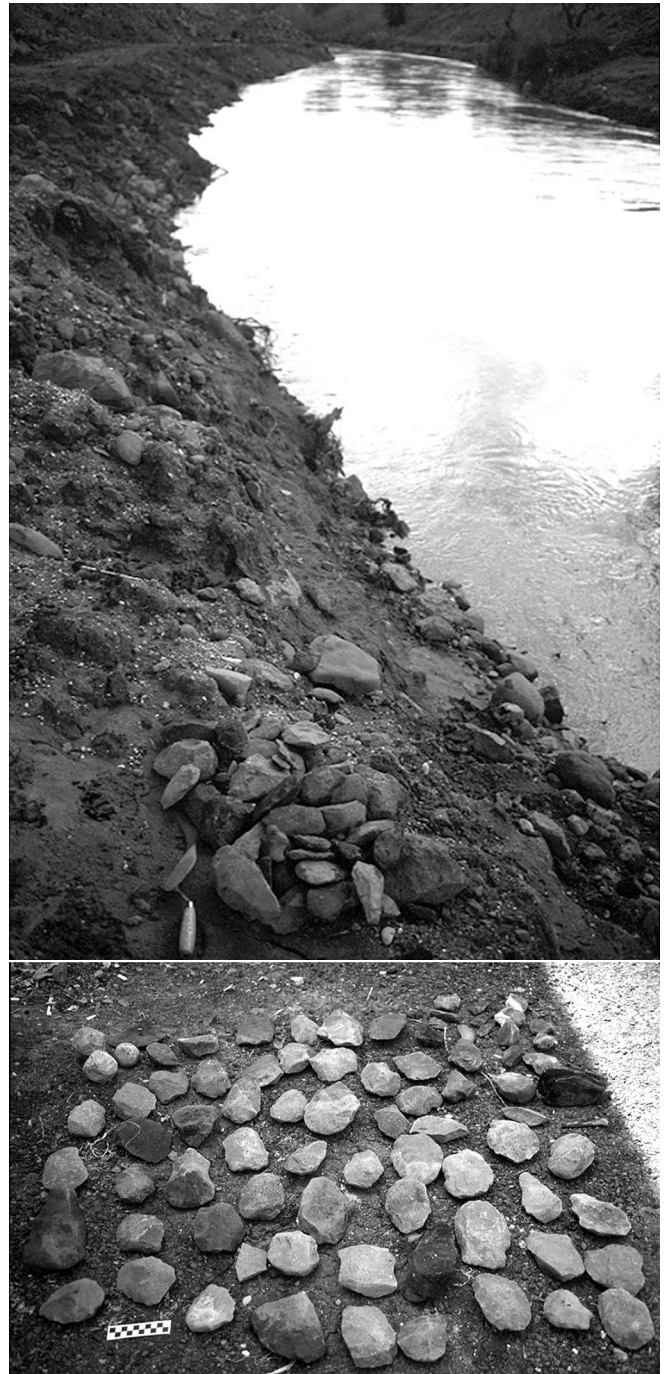


Figure 2 - Top: pile of bifacial tools on the east bank of the Jordan River at NBA, December 1999. Bottom: artifact collection (during a twenty minute visit in the summer 2000) of Acheulian bifaces, bones (upper right), and spheroids (upper left). after Sharon 2007.

The lithic assemblage from NBA resembles the assemblage excavated at GBY in most of its aspects (typology, technology, raw material preference and more). A magneto-stratigraphic study of the type section at the GBY excavation identified the Matuyama-Brunhes chron boundary in Layer II-14, 4 m below the base of Layer II-6, establishing the age of those assemblages as somewhat younger than 780,000 ka (Goren-Inbar *et al.* 2000). The overall similarity in the lithic assemblages between the Layer II-6 at GBY and the lithic assemblage from NBA, combined with the Ar/Ar dates presented here, contribute to our understanding of the span of time during which the GBY

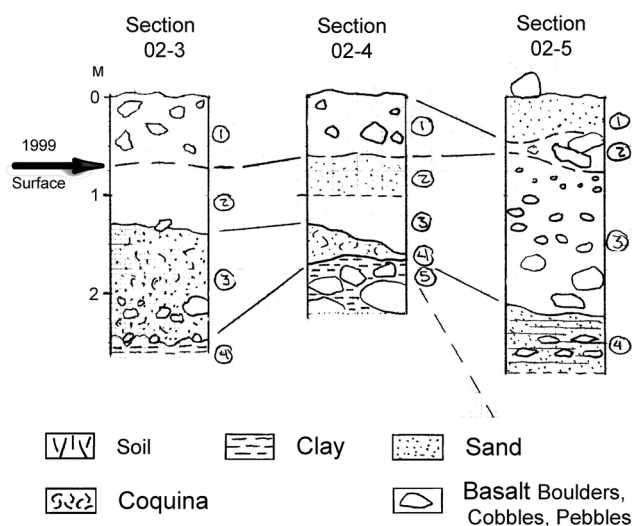


Figure 3 - Jordan River, east bank sections 02-3, 02-4 and 02-5 (drawing by C. Feibel).

type of Acheulian existed on the banks of the Paleo-Hula Lake. In summary, although at this stage we can not eliminate other possibilities, we suggest an age of ca 660 ka for the Acheulian living floor at the NBA locality.

The Lithic Assemblage

The bifacial tools

The assemblage of bifacial tools from NBA comprises 193 handaxes and 98 cleavers that were collected from the Jordan River banks and from the piles of sediments dug in this locality (figs. 5-7). In addition, 8 handaxes and 5 cleavers were excavated from Section 02-5. The tools were studied using the methodology applied to the bifacial tools from GBY (see details in Goren-Inbar & Saragusti 1996; Sharon 2007). The NBA handaxes and cleavers are similar in dimension to the bifacial tools excavated at GBY (fig. 8).

The types of raw material used for the production of bifacial tools at NBA and their frequencies are presented in table 1. The dominance of basalt as raw material used for biface production at NBA generally resembles the frequencies recorded for the excavated assemblage from the GBY Acheulian site (Goren-Inbar *et al.* 2000; Goren-Inbar & Saragusti 1996; Sharon 2007). Nevertheless, while in the excavated assemblages from GBY the percentage of flint tools never exceeds a few percent, the NBA assemblage includes over 30% flint handaxes. This fact can be explained by collection bias (flint handaxes are more notable) and perhaps also by the higher durability of flint in the accumulation condition of the NBA sediments. Indeed, many of the flint handaxes are heavily battered and probably originate from the conglomerate in the top of the section (see discussion in Grosman *et al.* in press).

The size of the NBA bifacial tools

The descriptive statistics for the bifacial tools from NBA are presented in table 2. As previously discussed elsewhere (Sharon



Figure 4 - Excavation of Acheulian living floor in NBA section 02-5, looking east (scale 10 cm) after Sharon 2007.

	Cleavers		Handaxes	
	N	%	N	%
Flint	2	1.8	68	31.3
Basalt	110	98.2	149	68.6
Total	112	100	217	99.9

Table 1 - Raw material usage at NBA bifacial tools by morpho-types.

2007), the site's bifacial tools fall well within the range of Acheulian bifaces made on large flakes worldwide. It was shown that over 90% of the complete bifacial tools sampled from many sites worldwide fall in the range between 10 and 20 cm in their maximal length. The NBA tools follow this observation.

The Technology of bifacial tool production

As with all other aspects of the biface assemblage, the technology used for the production of bifacial tools at NBA is similar to the technology applied at GBY. In general terms, giant cores were most likely knapped and large flakes were detached and later used as blanks for the production of both handaxes and cleavers by means of bifacial retouch. When suitable flakes were achieved, the bifaces were shaped by a minimal retouch that, in most cases, involved only the thinning of the bulb of percussion (Goren-

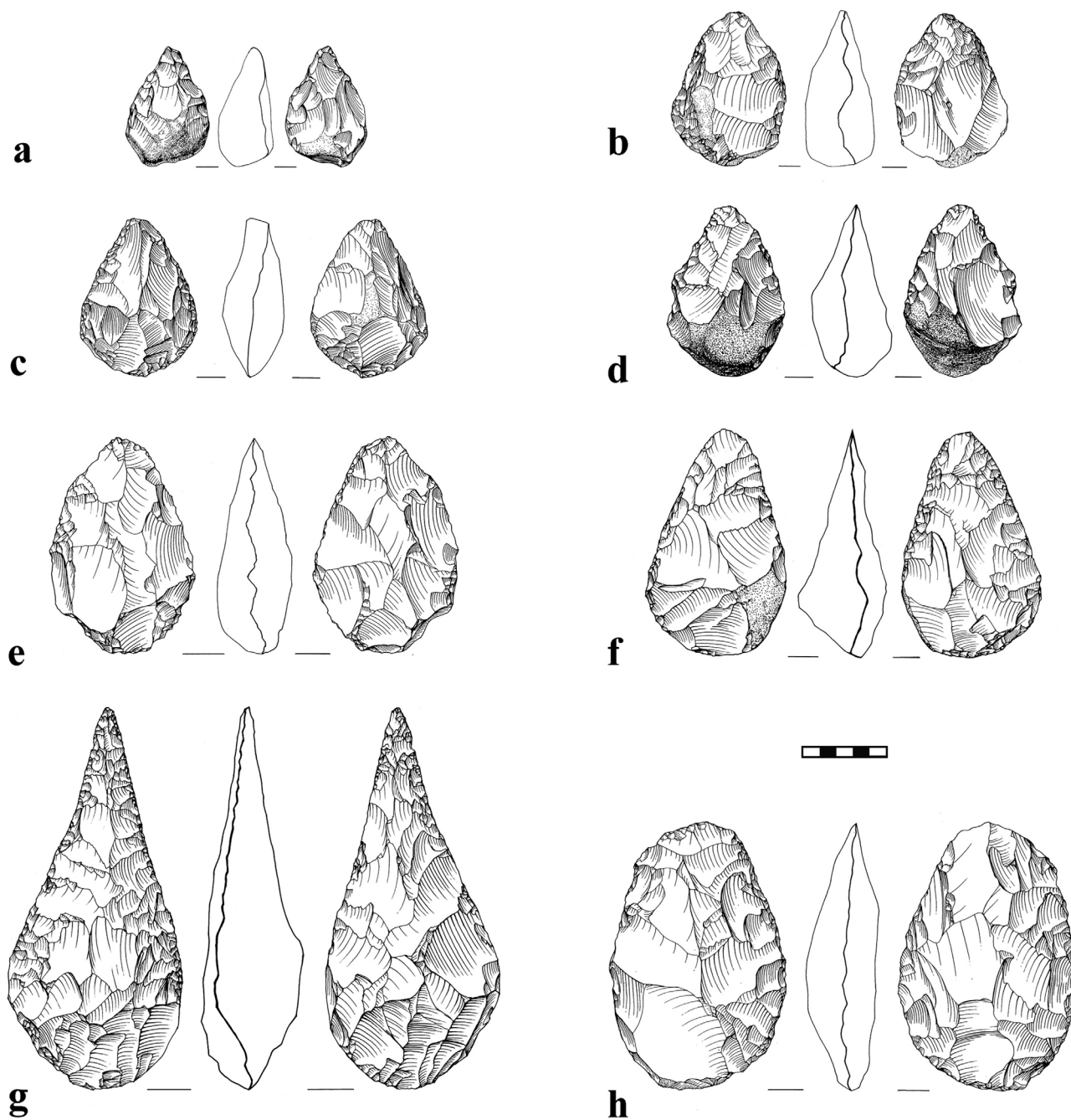


Figure 5 - Flint handaxes from NBA.

		Length (mm)	Width (mm)	Thickness (mm)	Circumference (mm)	Weight (gr.)
Handaxe	N	110	110	110	8	109
	Mean	123.79	84.13	43.11	368.63	471.4
	S.D	28.4	13.85	8.42	52.26	229.52
	Minimum	57	47	15	261	85
	Maximum	232	116	65	427	1147
Cleaver	N	83	83	83	13	83
	Mean	133.87	94.25	39.05	371.77	569.72
	S.D	20.52	11.98	6.57	48.63	183.1
	Minimum	87	64	26	261	233
	Maximum	221	154	59	463	1235

Table 2 - Descriptive statistics for NBA bifacial tools (complete tools only).

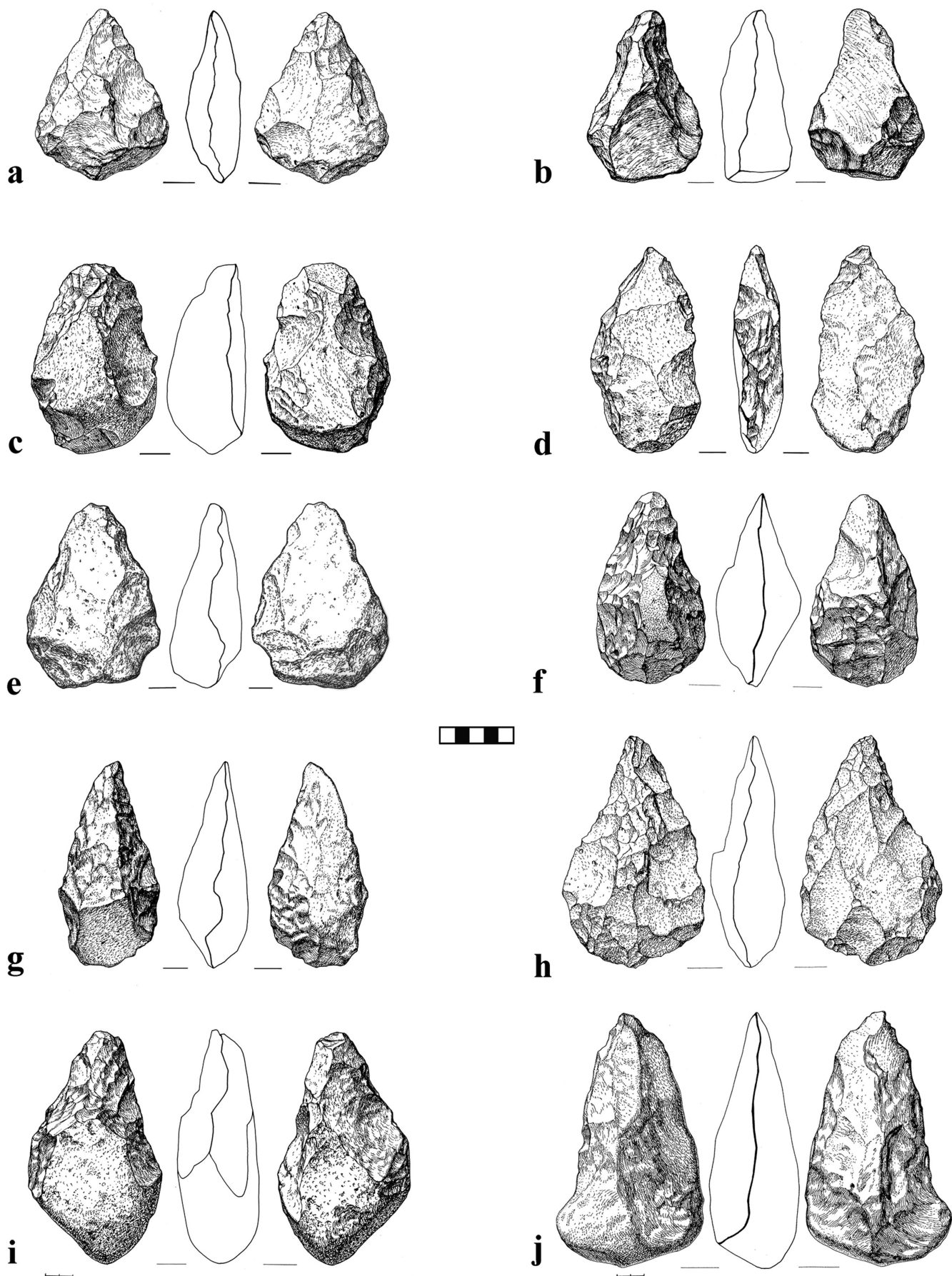


Figure 6 - Basalt cleavers from NBA.

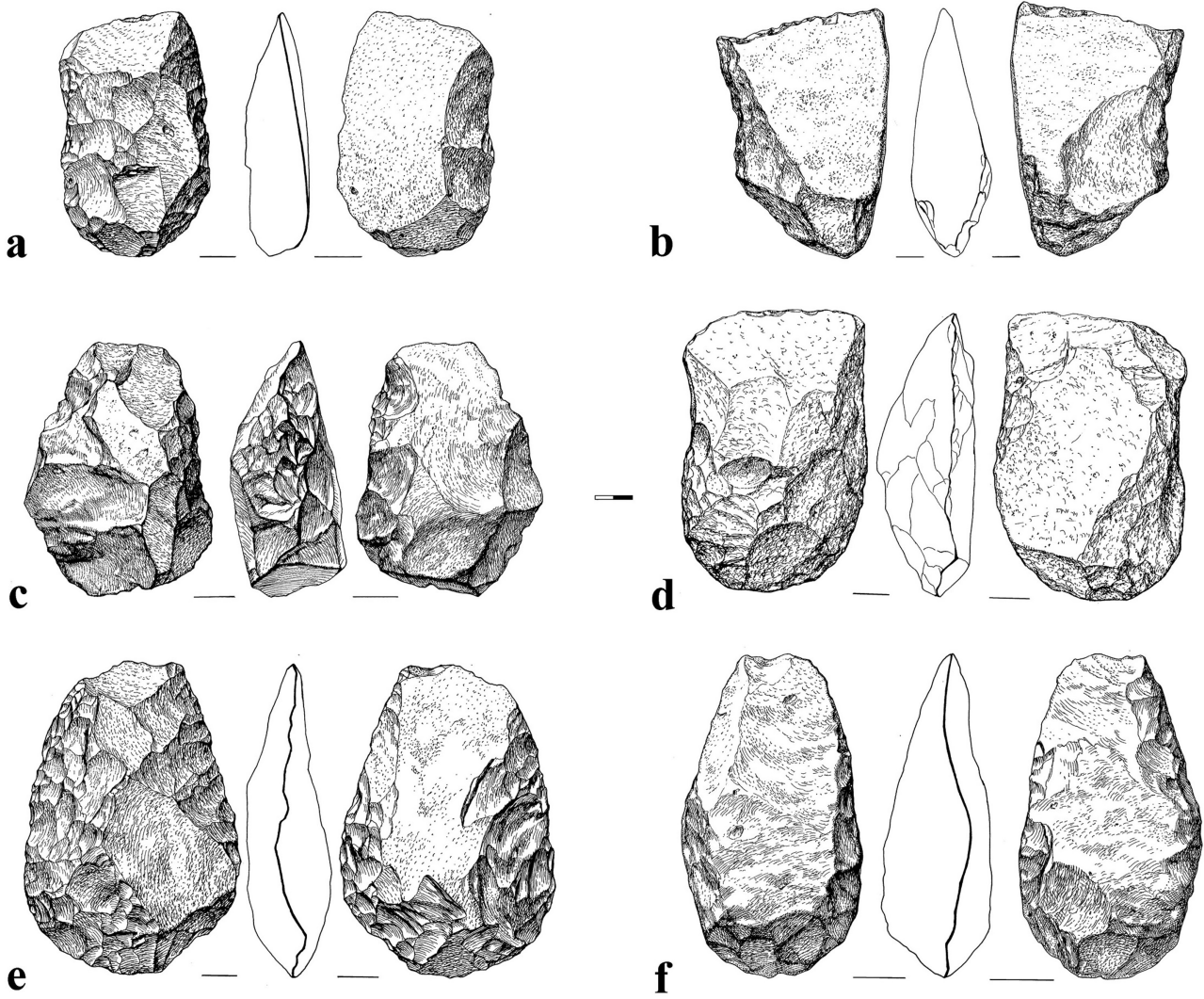


Figure 7 - Basalt handaxes from NBA.

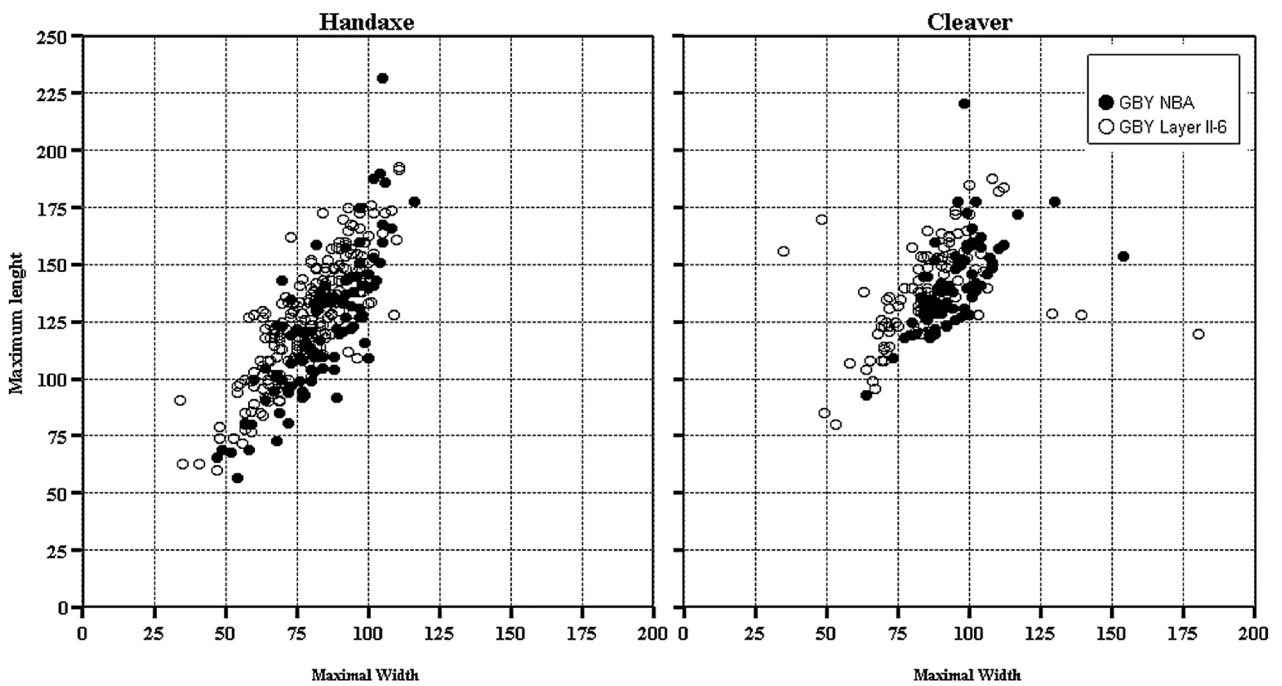


Figure 8 - Length to width scatter diagrams for bifaces from GBY and NBA.

Inbar & Saragusti 1996; Madsen & Goren-Inbar 2004; Sharon 2007). On a finer scale, some differences between the GBY and the NBA sites can be observed that can extend our knowledge of the technology used by the GBY knappers for their bifacial tool production. These aspects are discussed below.

Un-modified large flakes

The lithic assemblage of NBA is characterized by the presence of high frequencies of large basalt flakes. The small assemblage excavated from Section 5-02 is very rich considering the size of excavation. Figure 9 presents the size of the unshaped flakes from this assemblage as reflected by their length and breadth. The data clearly show that most of the flakes from Section 5-02 are larger than 8 cm. Small sized flakes seem to be nearly absent from the assemblage. The size and shape of the flakes (fig. 9) indicate that they were produced from giant cores. Such a high frequency of large, unshaped flakes was not observed in any of the GBY site layers, where small flakes are always present in much higher numbers and large flakes are scarce. Of course, both the area of excavation and the size of the sample are too small to allow any definitive conclusion, yet the high frequency of large flakes might suggest that the NBA assemblage represents a scenario in which we are closer to the source of raw material or at least to where large flakes were knapped. This is in contrast to the GBY site that represents, in most of its layers, a behavior that includes the introduction of mainly finished tools into the site, at least some distance from the place where the large flake blanks were produced (Goren-Inbar & Sharon 2006).

The spheroids from NBA

A unique find within the Acheulian assemblage of NBA is the nine spheroids and three sub-spheroids collected from the site's vicinity (Sharon *et al.* 2002). None of these tools was excavated in situ, however, their presence is the first evidence for their appearance within the GBY-area Acheulian tool kit. Six of the spheroids are modified on limestone and the other three on basalt. The spheroids (fig. 10) are of medium size and in most cases well made and rounded. They have many facets and almost no evidence for battering. The small sample size and the fact, that none of them was excavated in situ, does not permit any further discussion. Their presence at the site, especially when compared to the absolute absence of spheroids from the GBY excavated assemblage, widens our knowledge of the GBY Acheulian tool kit and might suggest that these tools were associated with special activities that were not taking place at GBY but did occur at NBA.

Significance of the NMO site

The Acheulian location north of the Benot Ya'aqov Bridge was in the 1930s and explored by all pioneering archaeologists working in the GBY area. In recent years, the research focus shifted largely to the rich locality south of the bridge. Drainage work executed in 1999 heavily damaged all of the Benot Ya'aqov vicinity and unearthed many finds from the locality north of the bridge. The results of surveys and small excavations conducted to study and evaluate the results of this drainage operation were discussed in this paper.

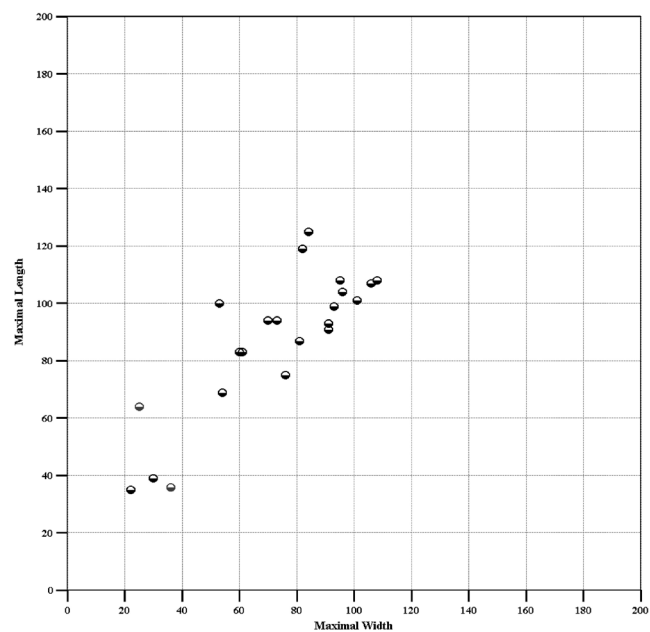


Figure 9 - Size of all (complete & broken) NBA Section 5 flakes.

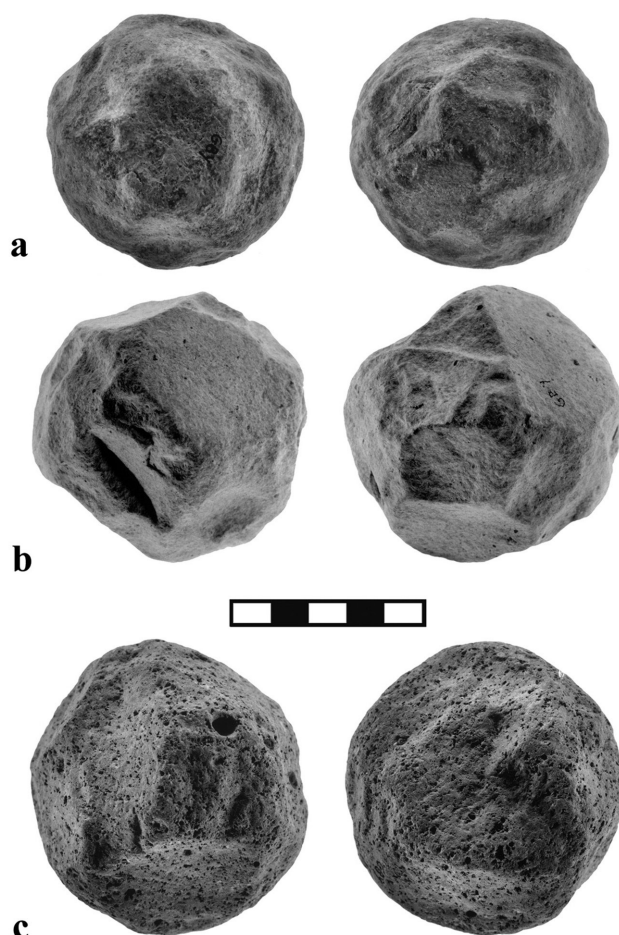


Figure 10 - Three spheroids from NBA; a & b - limestone; c - basalt.

The date established for the Acheulian site of GBY is based on the presence of the Matuyama/Brunhes chron boundary (780 Ka) in the layers of the section exposed at the site. The Ar/Ar

date of 650 Ka determined for the NBA basalt flow located immediately below the Acheulian living floor of Section 5-02 enables us to place an additional chronological marker for the large flake based Acheulian of the GBY area. It seems that the duration of the Acheulian in the GBY area was well over the original estimate of 100,000 yrs for the section known from the type site of GBY (Goren-Inbar *et al.* 2000). During this lengthy time period, the lithic tradition observed in the different localities remained unchanged.

The NBA lithic assemblage resembles that of GBY in all its main features. The sites are similar in raw material usage frequency, particularly in the use of basalt as the primary raw material for biface production. The presence of many cleavers in the assemblage and the shape of the handaxes indicate close typological resemblance between the two assemblages. Size similarity was also observed between these two assemblages (Sharon 2007). It is safe to argue, therefore, that the two assemblages belong to the same Acheulian entity known as large flake Acheulian, as described from GBY (Goren-Inbar & Saragusti 1996; Sharon 2007).

However, some differences can be observed between the NBA and the GBY assemblages, which form the main contribution of the NBA to the expansion of our knowledge of the Acheulian behavior at the site. On a technological level, the presence of many large, unmodified, basalt flakes within the excavated assemblage of Section 5-02 suggests that the NBA locality is closer to the place where large flakes were produced than GBY. The small sample size and small excavated area allow only limited conclusions at the current stage of research. The presence of spheroids at NBA, which are totally absent from GBY, adds this tool type to the GBY area Acheulian "tool kit" and suggests that their occurrence is attached to special and restricted activity areas, apparently absent from other GBY localities.

The main contribution of the NBA assemblage comes from the confirmation of some aspects of the GBY lithic industry

and from the few but marked differences that do appear between the assemblages. These differences attribute a better insight into the behavior and ways of life of Acheulian hominins on the shores of the Paleo-Hula lake during the Early Middle Pleistocene. The site of GBY has been the only example for large flake Acheulian in the Levant between the Egyptian Western Sahara Desert (Haynes *et al.* 1997; Haynes *et al.* 2001) and Turkey (Bar-Yosef 1998; Goren-Inbar 1995; Sharon 2007). Due to the Ar/Ar date retrieved for the NBA site, it is now possible to determine that large flake based Acheulian existed in the Northern Dead Sea Rift at least between 780 and 650 Ka BP. It is very unlikely that no other site belonging to the same lithic tradition existed in the Levant during this long time period. The fortunate geological and geo-morphological circumstances that exposed the GBY layers enabled a glimpse into this cultural phase of the Acheulian probably deeply buried in other parts of the Levant. The finds from the NBA site clearly place its inhabitants within the GBY Acheulian entity. They expand our knowledge of their technology, tool kit and behavior as well as the time period their culture existed. The primary challenge for our understanding of the place of the GBY Acheulian tradition in its regional context, as well as for the Out of Africa tempo and geography lies in the discovery, excavation and dating of new sites belonging to the large flake Acheulian tradition.

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