1999 Jordan River Drainage Project Damages Gesher Benot Ya'aqov: A Preliminary Study of the Archaeological and Geological Implications

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Introduction

During the fall of 1999, the Kinneret Drainage Authority undertook a large-scale operation to deepen the Jordan River between the Pqaq Bridge (also known as the Shen Bridge) and the crusader fortress Mezad 'Ateret (Figs. 1–3). In this area, where the water from the Huleh Basin drains into the river, massive basalt flows block the river creating a "bottleneck". This part of the upper Jordan River has undergone extensive modification work in the past and as a result, the present Jordan River is now flowing much lower than its course at the beginning of the 20th century.

The large scale drainage works carried out along the Jordan river in the fall of 1999 damaged the pre – historic site at Gesher Benot Ya'aqov. As a result, new geological, archaeological and faunal data was revealed as well as an previously unknown Mousterian site to the north.

The 1999 drainage operation destroyed unique geological layers bearing rich archaeological assemblages ranging in time from the Lower Pleistocene to the Holocene. It severely damaged the Acheulian sites of Gesher Benot Ya'aqov (Feibel et al. 1998; Goren-Inbar et al. 2000). In addition, two previously unknown sites, one ascribed to the Middle Paleolithic and the other to the Epipaleolithic, were dug out from the Jordan River bed. The aim of this paper is to briefly describe the damage as reference for future research and to describe some of the new archaeological and geological data obtained in fieldwork before and after the destruction of the area.[1]

Fig. 1: Aerial photo of Jordan River at Gesher Benot Ya'aqov.

Archaeology and Drainage Work in the Area of Gesher Benot Ya'aqov – a Brief History

The southern Ḥuleh Basin was occupied until the 1950's by the shallow Ḥuleh Lake, which changed in size and depth according to annual weather conditions and human activity (Karmon 1956). The basalt flows in the vicinity of Gesher Benot Ya'aqov (henceforth GBY) have always been recognized as the primary element forcing the Jordan to flow in a low, narrow gradient channel blocking the outlet from the Ḥuleh Lake.

As the lake and the swamps to its north were always a source of malaria and a barrier to agricultural activity, there were many efforts to drain the area, beginning in the 19th century. The earliest documented attempt to lower the Ḥuleh Lake water level by deepening the Jordan River in the vicinity of GBY took place in the 1830's, when explosives were used on the basalt flows (Ritter 1850; Karmon 1956). In the late 19th century, Ottoman engineers lowered the water level in the Ḥuleh Lake by one meter by adding an arch to the stone Benot Ya'aqov Bridge (Karmon 1956).

The archaeological and geological deposits of GBY were discovered during the engineering and drainage work in this area. The Acheulian site was first recognized during the construction of a new bridge by the British Mandate in 1933 (Stekelis 1960). Garrod, Gardner, Bate, Solomonica and Picard all took part in the early study of this site (Goren-Inbar et al. 1992a). The primary research was conducted by Stekelis in the 1930's (Stekelis 1960:61) and by Gilead in the late 1960's (Gilead 1968; 1970). The

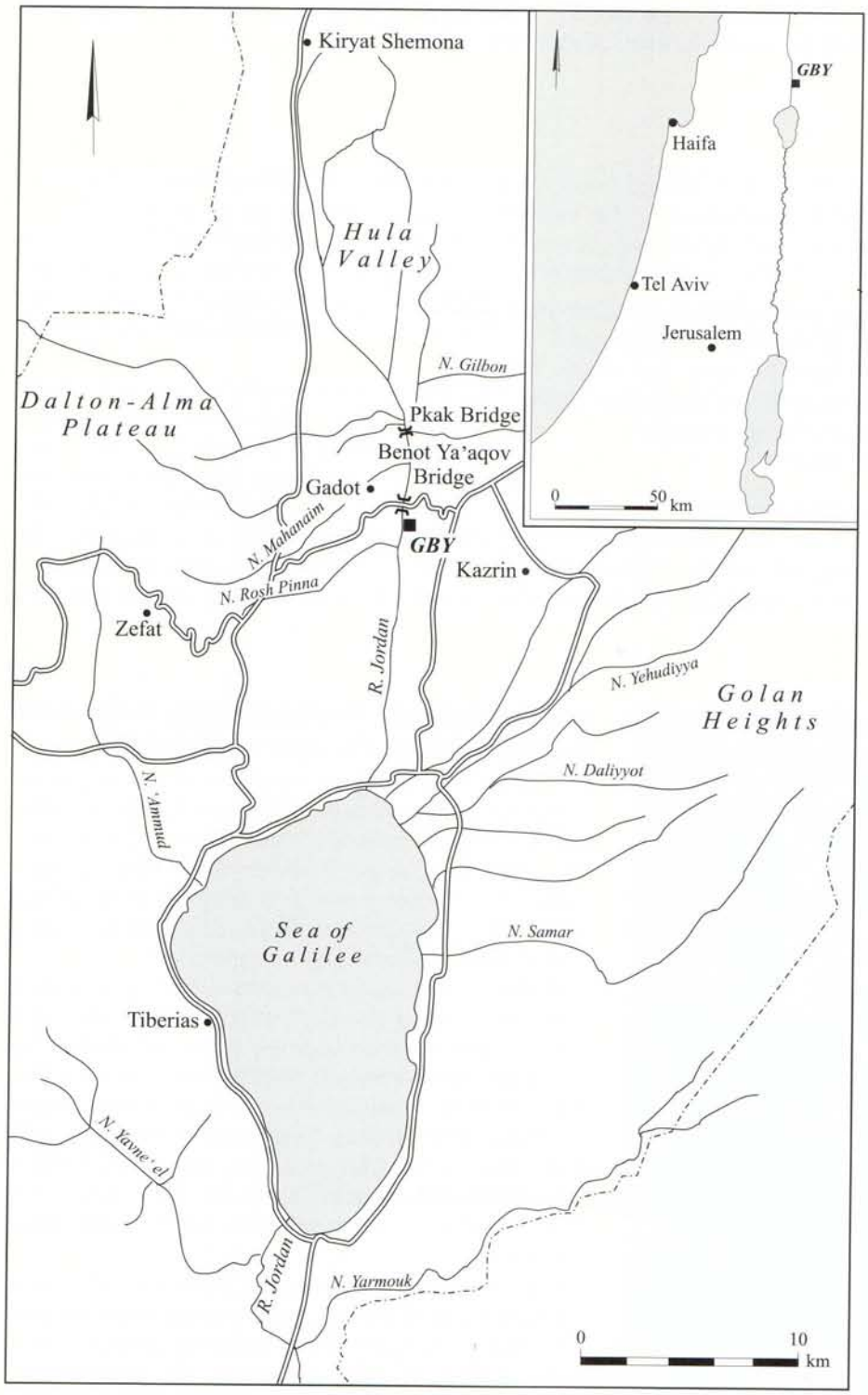

Fig. 2: Location of GBY and drainage work .

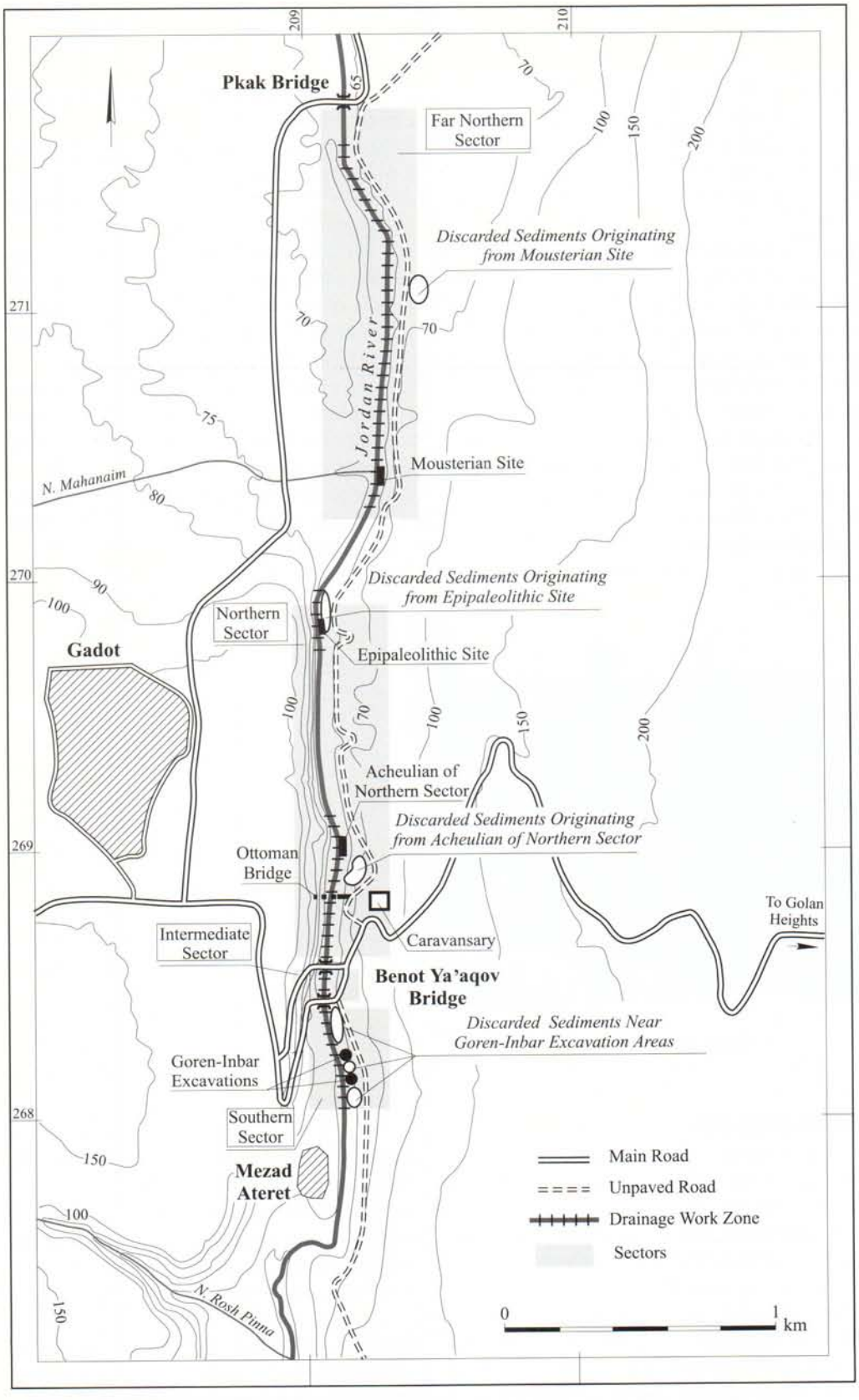

Fig. 3: 1999 drainage work at Gesher Benot Ya'aqov by sectors and new archaeological data.

renewed Gesher Benot Ya'aqov project under the direction of Prof. N. Goren-Inbar began in 1989 and seven excavation seasons were completed south of the Benot Ya'aqov Bridge (Fig. 3).

All archaeological studies at GBY faced the problem of distinguishing *in situ* material from artificial sediment piles. Stekelis noted that when trying to locate a place for his sounding excavation, he faced a situation where "for many kilometers the banks were mostly covered by heaps of gravel and mud left there after completion of the drainage work..." (1960:63).

The main drainage work in this part of the Jordan River took place during the Ḥuleh Lake drainage project in the 1950's. The deepening of the Jordan River at its outlet south of the lake was the most important part of the project. In 1951 the Pqaq Bridge was constructed some half-kilometer south of the Ḥuleh Lake. In the first stage of deepening the river, 0.3 million cu m of sediments were removed. However, the planned outline of the riverbed, needed for the desired water-flow rate of 80 cu m per second, had not been achieved (Livne 1990:93).

In 1959, a second and more extensive stage of deepening took place. An additional 0.88 million cu m of sediments were removed and dumped some 3–4 km west of the river. The west bank was modified into a series of large terraces 27 m in height so as to prevent earth slides and collapsing (these terraces are still visible today–Fig. 4). Stekelis mentioned that "The river bed was excavated more than six meters deep..." (1960:68).

After the Six Day War in 1967 further deepening and widening of the river bed took place. This stage of the work was finished in 1971. Altogether, some 2 million cu m of sediments and rocks were removed (Livne 1990:93). There is no documentation of the loss of archaeological material during this huge project.

Fig. 4: West bank of the Jordan River north of the Benot Ya'aqov Bridge.

The 1999 Destruction

At the beginning of summer 1999, the Kinneret Drainage Authority initiated a long-planned project to deepen the Jordan River south of the Ḥuleh Valley, from the Pqaq Bridge to the crusader fortress Mezad 'Ateret (Fig. 3).

A large part of the project was designated to be carried out in an area declared as an antiquity site (map ref. of declared area: 209.05/267.70 to 209.20/269.90). Pursuant to Israeli antiquity law, all work was suspended until the Israel Antiquities Authority (IAA) and the Hebrew University conducted a thorough survey of the prehistoric site of GBY and its vicinity. The survey results (some of which are presented in this paper) were used to define the terms and limitations of the work permit to be issued.

In late 1999 heavy mechanical equipment dug out the riverbed and banks and piled up the excavated material on the banks. These sediments were later collected and dumped at various spots on the eastern bank of the Jordan at some distance from the river (Fig. 3). During the deepening, previously unknown Middle Paleolithic (Mousterian) and Epipaleolithic sites were exposed and heavily damaged (Figs. 3, 5).

Fig. 5: Jordan River near the Mousterian site in the northern sector during drainage work (looking east).

Following damage to the Acheulian site north of the Benot Ya'aqov Bridge, the IAA issued an order halting all work. However, further work was carried out in the area, including the prohibited part to the south of the Benot Ya'aqov Bridge, causing massive damage to the archaeological and geological strata. The work in the declared archaeological area was halted by court order and the area has remained untouched as of this writing. However, work continued to the north of the declared area and the newly discovered Mousterian site was further damaged.

Results of the 1999 Dredging Operation

The earth-moving operations primarily affected the channel and the eastern bank of the river (although cutting of the west bank was locally undertaken), and were concentrated in four sectors: 1) Southern Sector, a 500-m stretch south of the southern Benot Ya'aaqov Bridge span; 2) Intermediate Sector, the approximately 100-m stretch between the two spans of the Benot Ya'aqov Bridge; 3) Northern Sector, an interval stretching about 1.5 km north of the northern span; and 4) Far Northern Sector, beginning another 800 m farther north yet ending at the Pqaq Bridge on Route 918 (Fig. 3).

Judging from the recently disturbed material, archaeological layers were encountered in all four sectors. It is also clear that *in situ* material was encountered both in dredging the channel of the river and in modifying the adjacent floodplain. As the characteristics of the disturbance and the materials encountered differs in each sector, they will be described briefly below.

Southern Sector

This portion of the Jordan River bank is well known for the archaeological excavations undertaken there (Goren-Inbar et al. 1992a; 1992b; 1994; 2000; Goren-Inbar and Saragusti 1996; Feibel et al. 1998; Verosub et al. 1998a). Although an attempt was made to avoid disrupting the recent archaeological excavations, this was not wholly successful. In this area, sediments from the deepening of the Jordan River channel were dumped a) along the channel margin, b) in piles adjacent to the channel, or c) spread across large areas of the adjacent floodplain (Fig. 3).

In the southernmost part of this area, cobble-to-boulder-conglomerates of the upper part of the local Benot Ya'aqov Formation floor the river channel. These gravels were excavated and dumped in mounds one to two m high adjacent to the channel, or spread farther back. In the process, much of the archaeological feature known as "The Bar" (Goren-Inbar et al. 1992a) was either destroyed or buried in spoils. The outlet channel to the small lagoon behind this feature was blocked.

A gap in the impact of the drainage project on the east bank of the river occurs in the vicinity of the 1996–7 archaeological excavations known as Area C (see Goren-Inbar et al. 2000 for detailed map of excavation).

Fig. 6: Jordan River bank between Area B and Area C after destruction.

Presumably due to the obvious archaeological features, this segment was left relatively undisturbed, although the adjacent channel was apparently deepened. Beginning some 5 m north of Area C, a heavy mantle of coquina and gravel was dumped on the floodplain and packed against the riverbank (Fig. 6). This appears to mark a heavy machinery access cut through the riverbank, centered approximately at the (former) fossil mammal and stone tools concentration known as the Jordan River Bank excavation area (Goren-Inbar et al. 2000). The unconsolidated coquina and gravel used to reconstruct the riverbank at this point is already eroding away rapidly.

North of this cut, a second gap in floodplain modification spared much of the archaeological excavations and geological trenches of Area B. Again, the river channel adjacent to this interval appears to have been deepened, but the spoils were moved either north or south. Spoils from the disturbed area to the north covered Trench III and the northern end of Trench IV (Goren-Inbar, et al. 1994; 2000).

Between Area B and the southern bridge span, much of the former floodplain is now mantled with a layer of coquinas, clays and gravels excavated from the channel and dumped on the bank, ranging in thickness from 0.5–4 m. Another artificial placement of coquina and gravel along the bank some 200 m south of the bridge suggests another access cut here. Again the unconsolidated fill is rapidly eroding.

An additional aspect of the modifications to this southern sector is the extensive near-vertical cutting of the western bank of the river, beginning about 100 m south of the southern bridge span, and continuing to the north of this bridge. Where the bank is formed by whitish marls this may be a stable configuration, but where the bank is formed of conglomerates it is already slumping into the river.

Intermediate Sector

Prior to late 1999, this area was inaccessible except by boat, and so had not been systematically prospected for archaeological materials. Modification to this stretch of the river consists of steep cutting of the western bank, dredging of the channel, and dumping of the spoils in a thick mantle on the eastern bank. The accumulated material consists largely of gravels and coquina, with a low density of rolled artifacts. Impact on this area was minimal, although both banks are likely oversteepened and will suffer some slumping.

Northern Sector

In this segment of the Jordan River Stekelis, Garrod and Gilead found fossils and artifacts (Stekelis 1960; Gilead 1968; 1970; Goren-Inbar, et al. 1992a). The lowering of the Jordan River channel since the 1950's has already destroyed or buried many of these localities. Exposures of the Lower-Middle Pleistocene Benot Ya'aqov Formation were documented here at river level during the survey that preceded the 1999 destruction, and so the potential for encountering additional archaeological sites along this stretch was great.

Activities of the recent drainage project along this segment involved deepening of the channel, some cutting of the western bank, and piling of spoils along the eastern floodplain. The removal of basalt from the channel in the

vicinity of the Ottoman Bridge (Fig. 3) resulted in the largest spoil pile encountered (*c.* 5 m high). Most of the excavated material strewn over the floodplain in this area is coquina and gravel. One locality revealed artifacts in association with the fossil mollusk *Viviparus apameae*, guide fossil for the Benot Ya'aqov Formation. This is the northernmost exposure of the Benot Ya'aqov Formation found in this area. A long, fairly linear stretch of undisturbed channel separates this area from the far northern sector.

Far Northern Sector

Although sedimentary strata thought to be younger than the Benot Ya'aqov Formation were known to occur in this northernmost segment of the river (Horowitz 1979), no prehistoric sites were discovered until the disturbances of 1999. An attempt to widen the river at the southern end of this sector encountered a rich Mousterian artifact assemblage (Figs. 3, 5). The spoils removed from this site contain a variety of artifacts, bones, teeth and fossil wood within a coquina and clay matrix. Dredging activities continued for a distance of *c.* 800 m to the north, where clays removed from the channel were used to construct an artificial terrace. In at least one area, a large block of this material is slumping back into the river, marked by a swarm of large arcuate fractures.

New Data From Gesher Benot Ya'aqov

The data presented here was collected during surveys of the Jordan River in the vicinity of GBY before and after the 1999 drainage project.[2] The survey previous to the destruction focused on the river banks north of the Benot Ya'aqov Bridge, as the area south of the bridge had been previously surveyed by Goren-Inbar and no drainage work was to be allowed in this area. This survey included an examination of the river banks by foot as well as by boat. Geological sections were noted, soil samples and archaeological finds were collected.

After the destruction, C. Feibel carried out an additional boat survey documenting the new geological information revealed. The archaeological sites were visited many times and the stone tools and bones were collected from the surface to prevent their loss by water erosion or antiquity collectors.

The sediments and gravel excavated from the Jordan River during the 1999 drainage project were dumped in different localities east of the river. The piles containing archaeological material are described below according to their archaeological origin in order to prevent them from misleading future studies of the area around GBY. It should be noted that the origin of the material in the piles from all sectors is not absolutely certain. The location map (Fig. 3) presented here is based on the archaeological material observed or collected from the piles. However, due to the tremendous upheaval caused by the heavy machinery, the material could have been transported from different (unknown?) sites along the Jordan River. The overall result is a severe, uncontrolled mixture of archaeological material from many different periods contaminating this part of the Jordan River.

The Benot Ya'aqov Formation – New Geological Data

The Benot Ya'aqov Formation (BY Formation) was first defined by Horowitz (1979:135). Exposures revealed in the study area south of the Benot Ya'aqov Bridge during the archaeological excavations of 1989–1997 (Feibel et al. 1998; Goren-Inbar et al. 2000) comprise some 34 m of lake margin and fluvial deposits, and preserve a detailed record of the Paleo-Huleh Lake. The strata include three dominant lithofacies: (1) coquinas, sands and gravels of the beach facies; (2) calcerous muds of shallow-water lacustrine facies; (3) conglomerates of the fluvial channel facies (Feibel et al. 1998). The lacustrine-fluvial strata of the BY Formation south of the bridge are of 0.78 MA years of age (Verosub, et al. 1998a; 1998b; Goren-Inbar et al. 2000).

At the GBY archaeological site the lowermost exposed section of the BY Formation consists of basalt boulders and pebbles, covered conformably by lacustrine strata. The exposed lacustrine sequence begins with marls and peat, intercalated with horizons of basaltic pebbles and boulders, and occasionally boulders of limestone and scoria.

Outcrops to the North of the Benot Ya'aqov Bridge

A small geological section (Section I; Fig. 7) of lacustrine-fluvial strata of the BY Formation was discovered during the 1999 survey conducted prior to the drainage project, on the eastern bank of the Jordan River some 30 m north of the northern span (map ref. 268.61/209.09; Figs. 7, 8). The lower part of the outcrop was concealed under water. The exposed section, just above the water, first reveals dark organic mud with scarce mollusks. This is overlaid

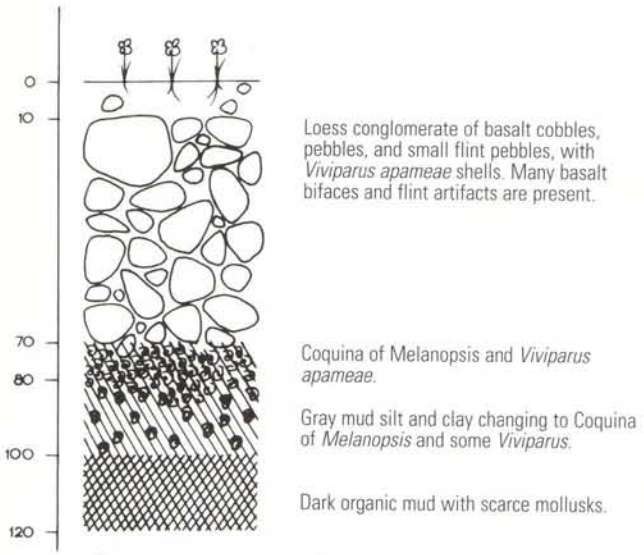

Fig. 7: Section of Jordan River bank north of Benot Ya'aqov Bridge (Section I).

unconformably by a 20-cm layer of gray mud silt and clay containing some mollusk shells that gradually changes into a 10-cm layer of coquina composed mainly of *Melanopsis* with some presence of *Viviparus apameae* shells. The coquina is topped by 60 cm of loose conglomerate that consists mainly of basalt cobbles and pebbles and small flint pebbles with some *Viviparus apameae* shells that occur in a sandy matrix.

Eleven basalt bifaces were collected from less than one sq m of this conglomerate, together with small flint artifacts (Fig. 9). All the lithic artifacts are rolled. This indicates that some of the Acheulian bifaces in the GBY area underwent transportation and redeposition, while others remain fresh and *in situ*, as evidenced by the findings from the archaeological excavation (Goren-Inbar and Saragusti 1996).

This BY Formation section, providing such great potential for understanding the structural and stratigraphic relations between the southern and northern exposures of the BY Formation and their surroundings, was completely destroyed by the drainage works. Future study of the bank section north of this locality (see below *'Acheulian of* GBY') may help in interpreting this destroyed section.

An additional exposure of BY Formation sediments was detected during the same 1999 survey, some 300 m north of the northern bridge span (Figs. 8, 10). Several tens of centimeters of coquina rich in *Viviparus apameae* shells, containing some bones, overlie basaltic flows on both banks of the Jordan River. Large amounts of freshwater fossils, including numerous *Viviparus apameae* shells and fresh basaltic artifacts were observed in sediments from the Jordan River bed derived during the drainage operation in this section, suggesting that the BY Formation sediments can also be found to underlie the basaltic flows.

A previously unknown outcrop of the BY Formation was discovered *c.* 900 m north of the Benot Ya'aqov Bridge during the survey preceding the 1999 drainage works (map ref. 269.37/209.06; Fig. 8). The strata are exposed for at least 17 m along the western bank of the Jordan River, strongly tilted ~60 degrees to the WNW (Fig. 11). This is the northernmost known exposure of the BY Formation. The lower portion of the outcrop was concealed under water. The exposed section, just above the water, contains sandy strata rich in *Melanopsis*. Fossil bone fragments and flint artifacts were collected from this sandy strata. A 10-cm thick layer of dark clay conformably overlies the sandy strata. The clay is overlaid by a coquina layer dominated by the shells of the fossil mollusk *Viviparus apameae*. Large basalt boulders occur sporadically in the uppermost portion of the coquina layer at the top of the exposed sequence. These preliminary observations suggest that the strata in this exposure are similar to those of the BY Formation described in southern localities in previous studies (Feibel et al. 1998; Goren-Inbar et al. 2000).

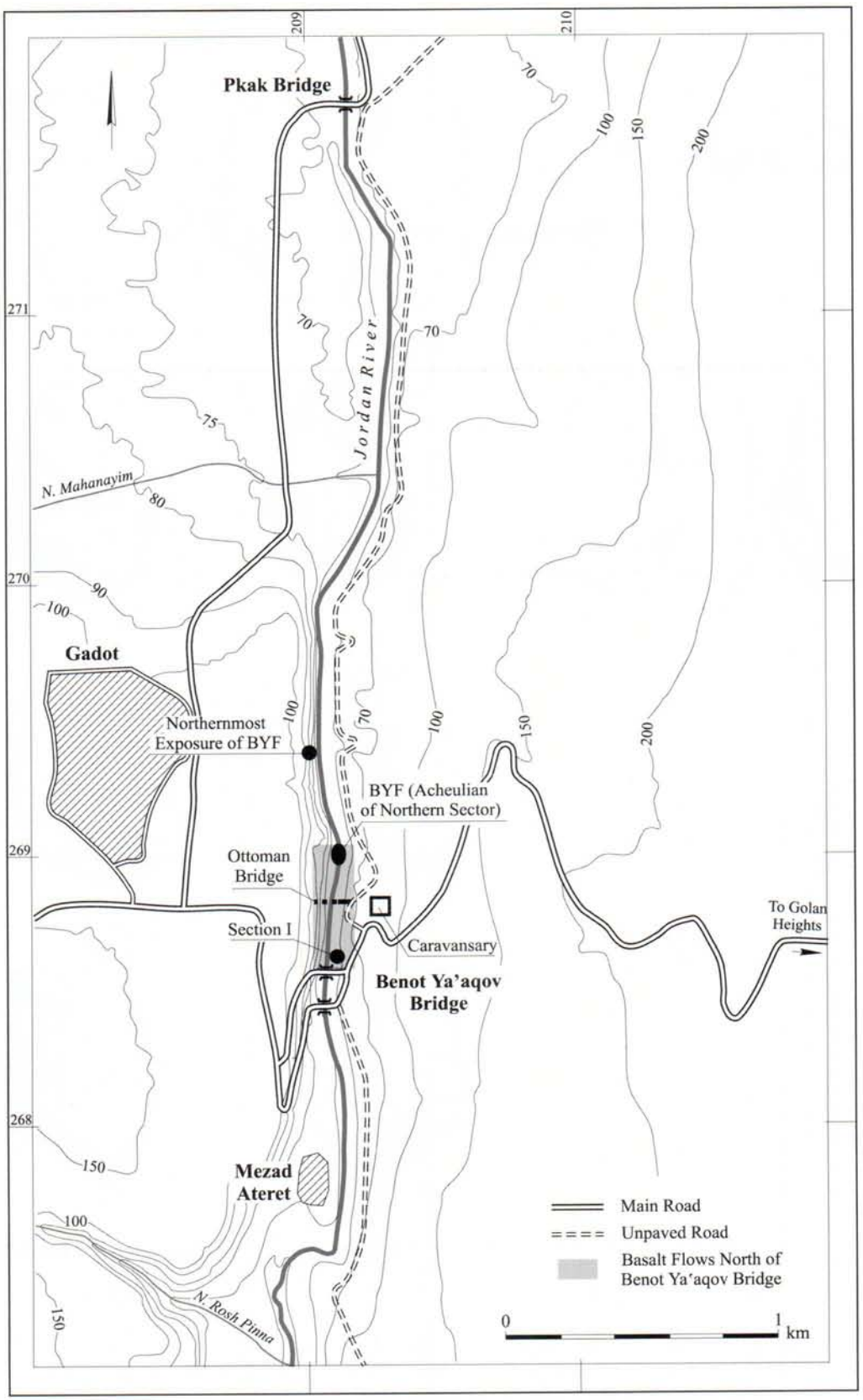

Fig. 8: Location of geological exposures and new data at Gesher Benot Ya'aqov.

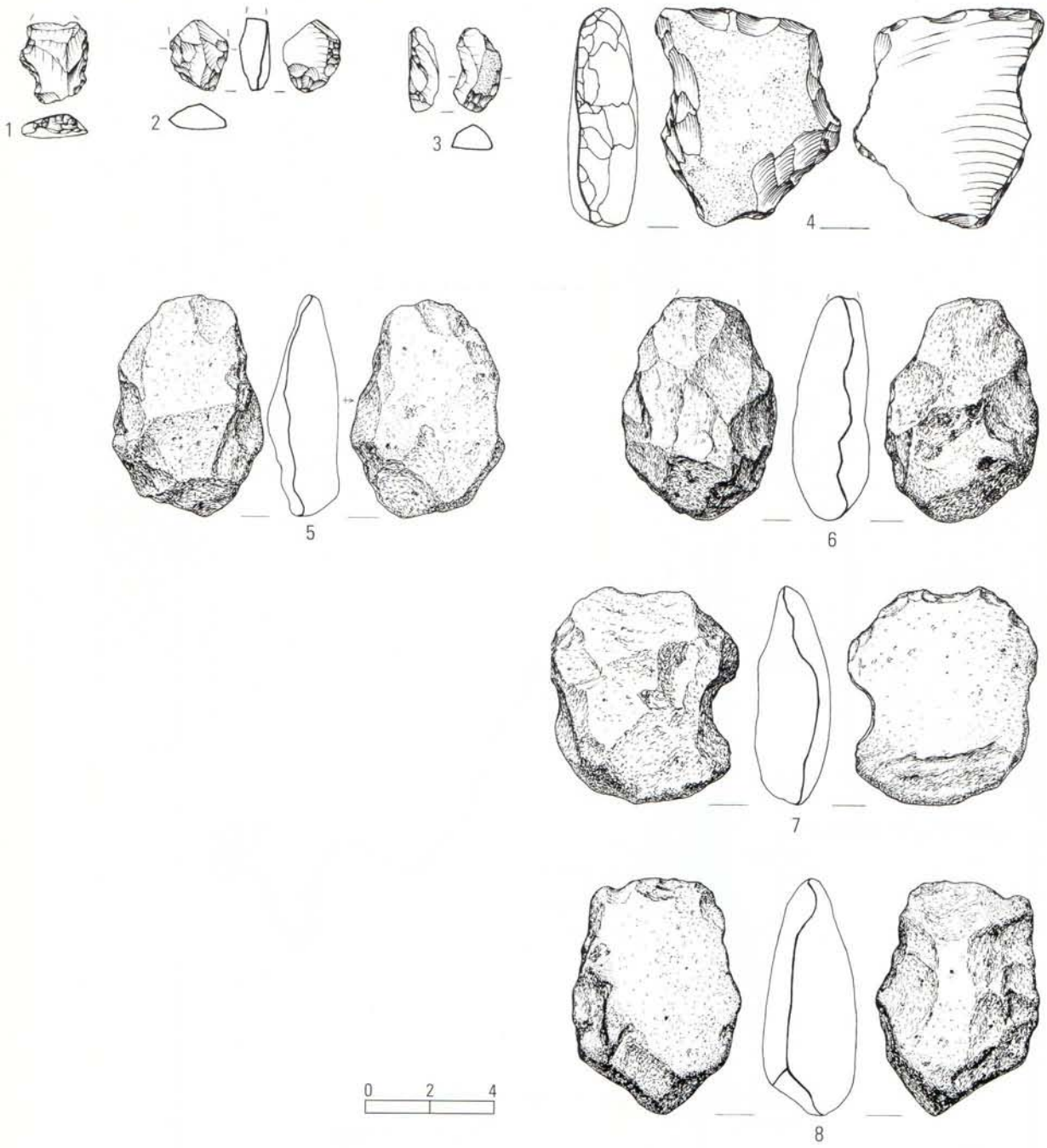

Fig. 9: Lithic artifacts from conglomerate in top layer of Section I.

Fig. 10: Tilted layers of Benot Ya'aqov Formation in the northern sector.

Fig. 11: Northernmost exposure of Benot Ya'aqov Formation at GBY.

Preliminary Report on the Fauna from the Drainage Destruction at GBY

Numerous bones from all the prehistoric sites of GBY were found among the spoils from the drainage project. The state of preservation, color and texture of the bones are similar to those excavated in 1989-1997 by Goren-Inbar. Their dark, smooth surfaces are typical of weathering by water. Pitted outer surfaces are also frequent due to the same reason.

The bones were identified when possible and the number of bones, according to species, is presented in Table 1. Many of the bones found are unidentifiable splinters. It is interesting to note that the distribution of species collected from piles ascribed to the Acheulian, Mousterian or Epipaleolithic sites correlates with the animal spectrum typical to these archaeological periods. Proboscideans and other large species are found in all Acheulian assemblages (north and south of the Benot Ya'aqov Bridge). Cervids and bovids are frequent in the Mousterian assemblage and small species (gazelles, wild goat, birds, hare and tortoise) are found in the Epipaleolithic assemblage. Human activity is clearly evident on a few bones that were broken in order to extract marrow.

New Archaeological Data from GBY

The Acheulian of GBY

Two main Acheulian exposures were damaged during the 1999 drainage work, the area around Goren-Inbar's excavation south of the Benot Ya'aqov Bridge and north of the bridge in the area studied by Garrod, Stekelis (1960) and Gilead (1970) (Fig. 3; see Goren-Inbar et al. 1992a for location of these excavations).

Table 1: Fauna from the Gesher Benot Ya'aqov Destruction.

	Proboscidean	VLM	LM	SM	Bovid	Gazelle	Goat	Fallow Deer	Red Deer	Wild Boar	Turtle	Bird	Hare
Acheulin	5	13	2	1	-	-	-	-	-	-	-	-	-
Mousterian	-	2	13	3	8	7	-	7	8	1	-	-	-
Epi-Paleolithic	-	-	-	-	1	2	1	7	-	-	4	3	1

Key: Proboscidan – straight – tusked elephant (Palaeoloxodon antiquus); VLM – body size group (BSG) elephant size; LM – BSG auroch size; SM – BSG gazelle size; Bovid – large bovids, Bos cf. primigenius; Gazelle – *Gazella gazella*; Goat – *Capra aegagrus*; Fallow deer – *Dama dama mesopotamica*; Red deer – *Cervus elaphus*; Wild boar – *Sus crofa*; Turtle – *Testudo* sp.; Bird – unidentifiable elements; Hare – *Lepus* sp.

North of the bridge massive lava flows that dictate the river's narrowing at this spot are visible on both banks of the river up to 300 m to the north (Fig. 8). North of these basalt flows, the tilted layers of the BY Formation are exposed (map ref. 268.99/209.13; Fig. 11). The geological relation between the BY Formation layers and the basalt flows is unknown. Field observation and data obtained from drilling on both banks of the Jordan (for the building of the new Benot Ya'aqov Bridge), suggest that the BY Formation here is embedded below and above the lava flows. These BY Formation horizons are very rich in lithic artifacts, primarily basalt bifaces and flakes. As mentioned above, the excavations of Garrod, Stekelis and Gilead took place in this area. Subsequently this section was heavily damaged by later drainage work in the 1970's. At this time, large numbers of basalt bifaces were collected here by D. Ben Ami (Goren-Inbar et al. 1991).

Finds from the northern Acheulian were collected from the piles and from the Jordan River banks in the course of visits to the site since the 1999 destruction. Of 246 bifaces collected, 213 are of basalt and 33 are of flint. In addition, some 40 basalt flakes and many flint flakes and flake tools were collected. Some of the basalt bifaces are heavily weathered while others are extremely fresh (Figs. 12, 13). This can probably be explained by their origin from different layers. Elephant bones and teeth were collected from the riverbanks in this location. All these finds are currently under study.

Six spheroids of limestone and one of basalt were also collected from the eastern bank in this area (Fig. 14). Although these tools are well known from other early Acheulian sites in the Levant (Clark 1966; Bar-Yosef and Goren-Inbar 1993), this is the first time that this tool type is reported from GBY.[3]

The sediments dug from the BY Formation in the northern sector were dumped some 100 m east of the Jordan River west of the old caravansary (map ref. for piles 269.17/209.11; Fig. 3). The piles west of the caravansary are extremely rich in lithic artifacts and many of the earlier-mentioned bifaces were collected from them, while many more are probably still buried. The sediments obtained from this part of the Jordan are rich in large boulders of basalt, some of which were later used by the Kinneret Drainage Authority as pavement material in the far northern sector (Fig. 3). As a result, contamination of the paved area with Acheulian artifacts should be expected.

Between Goren-Inbar's excavation Areas C and B of GBY, a large pile of sediments was dumped (Fig. 3), originating from the deepening of the river between the two excavation areas. The sediments are typical to the Benot Ya'aqov Formation, comprising coquinas, sands and clay. They are rich in lithic and faunal materials. A large elephant tusk was retrieved from this pile during a visit to the site in summer 2000.

The Mousterian of GBY

A previously unknown Mousterian site was discovered by I. Shaked while inspecting the drainage work near the confluence of the Nahal Mahanaim and the Jordan River (map ref. 270.39/209.28; Figs 3, 5). The sediments dug from the riverbed in this area are comprised mainly of different colored clays and are rich in fresh flint artifacts and fossilized animal bones in an excellent state of preservation. The sediments containing the Mousterian artifacts (as well as Epipaleolithic artifacts - see below) belong to the Ashmura Formation defined by Horowitz (1979:137). The exact stratigraphic location of the archaeological layers in the geological section of the area is as yet unknown. The lithic artifacts were recognized as Middle Paleolithic Levantine Mousterian and are currently under study (Goren-Inbar et al., in prep.).

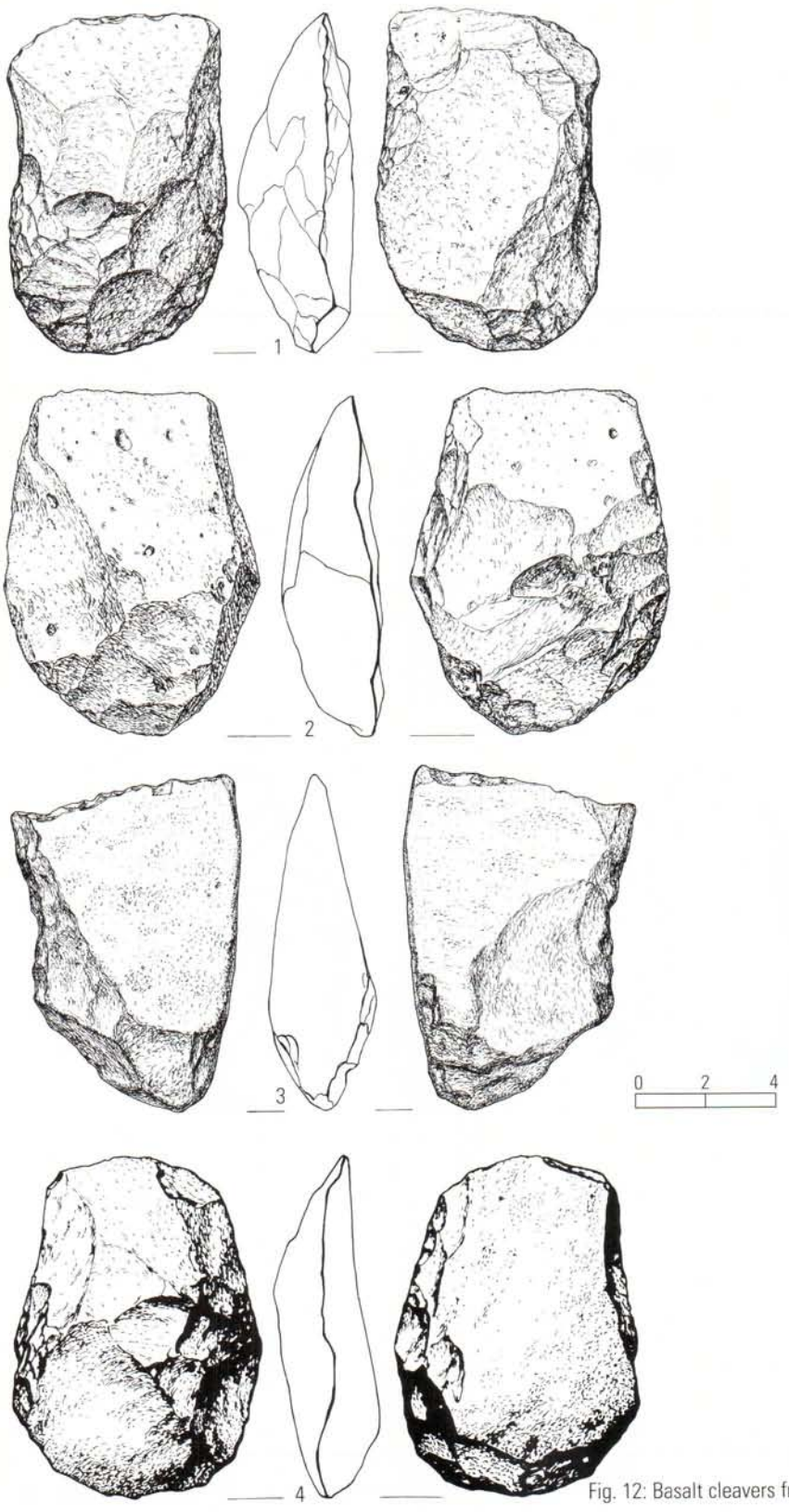

Fig. 12: Basalt cleavers from the northern Acheulian site.

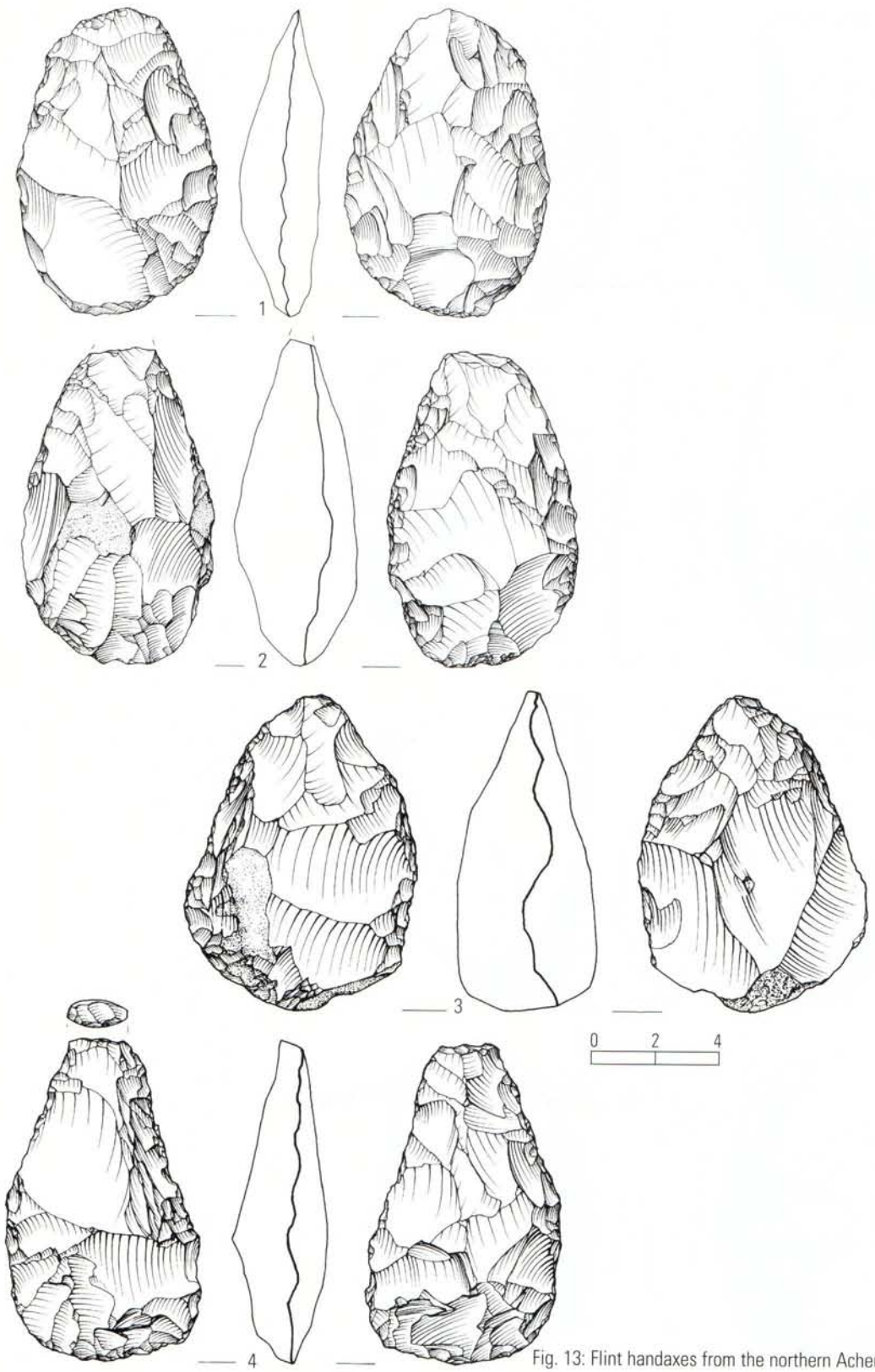

Fig. 13: Flint handaxes from the northern Acheulian site.

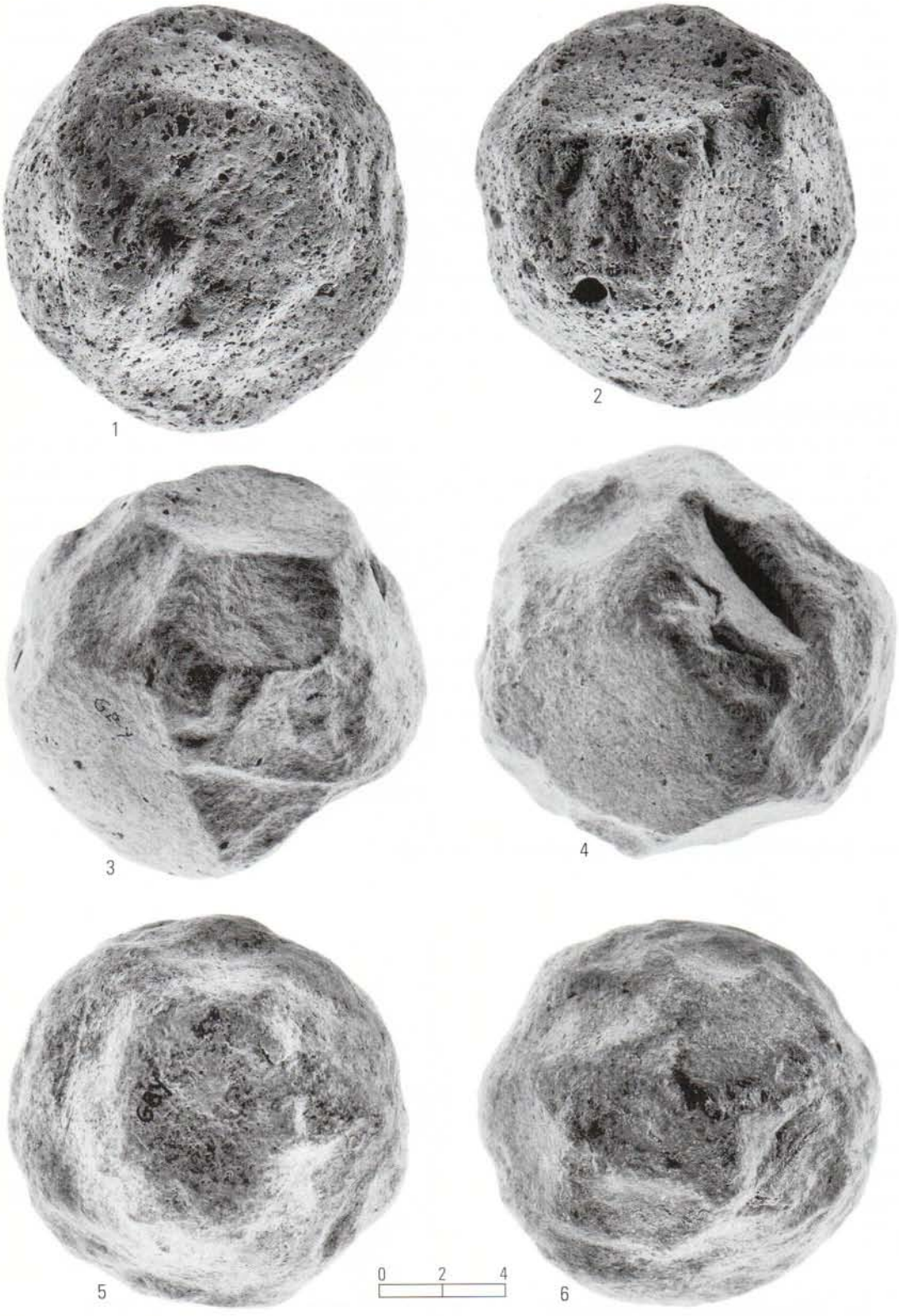

Fig. 14: Spheroids from the northern Acheulian site.

Preliminary analysis of this lithic assemblage also suggests the presence of an Upper Paleolithic site of Levantine Aurignacian affinities (Goren-Inbar et al., in prep.). This is in accordance with Stekelis' early observation of Upper Paleolithic techniques in the lithic assemblage he excavated at GBY (Stekelis 1960:65).

This part of the Jordan River is outside the declared archaeological site of GBY. As a result, the IAA faced difficulties preventing the drainage work and massive earth moving which took place during the year 2000. As the exact stratigraphic location of the archaeological layers in this part of the river bank is still unknown, the ongoing damage to the site cannot be estimated. It should be noted that the boulders used to pave the banks of the river and the spring channels were taken from the piles containing sediments of the Benot Ya'aqov Formation in the northern sector, and apparently from other unknown localities, as they also include Neolithic artifacts such as basalt grinding stones.

The sediments containing the Mousterian artifacts and bones were largely dumped in an area some 500 m to the northeast of their original location (map ref. 271.08/209.42; Fig. 3). However, sediments from other damaged sectors of the river were probably dumped in this locality as well, and the archaeological material in the spoil is a mixture of many periods. The piles were flattened by heavy machinery and are now being used as agriculture land.

The Epipaleolithic of GBY

A previously unknown Epipaleolithic occurrence was discovered during the pre-destruction survey north of the Benot Ya'aqov Bridge (map ref. 269.77/209.06; Fig. 3). An archaeological horizon rich in flint artifacts and animal bones was observed in a mollusk layer on the east bank of the Jordan River. During the drainage operation sections of the archaeological layers were dug from the riverbank and the sediments were piled on the east bank. The southernmost pile is the richest archaeologically. The exact size of the site is unknown but the work undoubtedly caused heavy damage. No clear stratigraphic section is known from this part of the Jordan River. However, it can be suggested that the archaeological material was embedded within a sequence of lake margin deposits, containing clays, coquinas, sands and organic rich layers, all of which were observed in the river bank and the piles. These deposits contain very well-preserved botanical remains including wood, seeds and even acorn, some in close association with flint artifacts. The flint and bones collected from the river bank and piles range in size from small chips to large flakes and cores. The flint artifacts demonstrate differential levels of abrasion, few of which are fresh. It seems that the lithic artifacts were redeposited by water a short distance from their original position.

Since the Epipaleolithic lithic assemblage was obtained from a surface collection of uncertain context, it was analyzed as one unit and will be only briefly discussed here (Tables 2–5).

Table 2: Composition of the GBY Epipaleolithic Assemblage.

Type	N	%
Debitage	327	50.5
Debris	172	26.6
Cores (Table 3)	27	4.2
Tools	121	18.7
Total	674	100.0

Table 3: GBY Epipaleolithic Core Frequencies*.

Type	Cores for Blades/bladelets	Cores for Flakes
Single striking platform	10	3
Double striking platforms	2	2
Broken core		3
Amorphous		5
Discoidal		2
Total	12	15

*Due to small numbers, no percentages were calculated.

Table 4: Frequencies of Unretouched Artifacts from the GBY Epipaleolithic Site.

	Type	N	%
Debitage	Primary flakes	56	17.1
	Primary blades	9	2.8
	Flakes	174	53.2
	Blades and bladelets	57	17.4
	CTE others	15	4.6
	Core tablets	5	1.5
	Ridge blades	5	1.5
	Burin spalls	6	1.8
Total		327	100.0
Debris	Chunks	73	42.4
	Chips	99	57.6
Total		172	100.0

Table 5: GBY Epipaleolithic Lithic Tool Type Frequencies.

Type	N	%
End-scrapers	16	13.2
Side-scrapers	8	6.6
Burins	8	6.6
Borers	3	2.5
Awls	4	3.3
Notches and denticulates	19	15.7
Retouched flakes	22	18.2
Retouched blades	18	14.9
Truncations	1	0.8
Massive tools	4	3.3
Microliths	14	11.6
Varia	4	3.3
Total	121	100.0

Cores: The most dominant core type is a single-platform pyramidal or semi-pyramidal core (Table 3) for blade/bladelet manufacture. These are occasionally made on thick flakes.
Tools: Microliths and scrapers are the most distinctive tool types (Table 5).
Microliths: The microliths include curved, pointed, backed bladelets, obliquely truncated bladelets and backed and asymmetrical trapezes. The asymmetrical trapeze resembles, on the one hand, the proto-triangle found at Ohalo II (Nadel 1999: Fig. 1), and on the other hand, the asymmetrical trapeze B of the Kebaran Geometric assemblages found along the coastal plain (Bar-Yosef 1970: Fig. 37, Nos. 14–16; Goring-Morris 1987: Fig. V-2, Nos. 9–17).
Scrapers: All the scrapers, except for two, were made on flakes and frequently display a rounded working edge.
Based on this data, it is somewhat problematic to offer a more detailed chronological placement of this assemblage. Nevertheless, the presence of scrapers on flakes with rounded working edges, certain microliths and the pyramidal cores for the production of blades/bladelets, suggests an Early Epipaleolithic affinity, probably Kebaran. However, it cannot be ruled out that some Middle Epipaleolithic artifacts, namely Geometric Kebaran tools, are also present in the assemblage. Other tools found in the same locality are Mousterian, and some are possibly Neolithic (e.g. a burin made on a sickle blade and a few grinding stones). All demonstrate the problematic nature of this surface assemblage.

Closing Remarks

The presence of sites from the Lower, Middle and Upper Paleolithic to the Epipaleolithic and Neolithic periods, and their rich faunal and botanical assemblages, are evidence that the southern margins of the Paleo-Huleh Lake have always been a favorable environment for human activity. On its course south of the Ḥuleh Valley the Jordan River exposes unique geological formations. The geology of this area is a composition of lake and lake margin deposition with basalt flows, all of which underwent massive tectonic disruption. These margins of the Paleo-Huleh Lake are the only exposed evidence of the Pliocene and Pleistocene history of this area. We are still very far from gaining a sufficient understanding of the geology of this area. The geological exposures of this section of the river also hold a unique potential for the understanding of the human activity in this area beginning some 780,000 years before the present. Specifically, the evidence presented in this paper shows that the extent of the Benot Ya'aqov Formation is much larger than was previously known, and offers, for the first time, the possibility of correlating between the geological sequence that holds the Acheulian layers north and south of the Benot Ya'aqov Bridge.

The new occurrences discovered in the unfortunate circumstances of the destruction described here have great potential for future study. The Mousterian site is possibly the source for the long known Middle and Upper Paleolithic artifacts from GBY (Stekelis 1960). The excellent preservation of bones and botanical material together with the wealth of lithic artifacts is unique among the rare open-air sites of this period in the Levant.

Epipaleolithic artifacts have never before been reported from GBY. The data from the newly discovered site are still very limited and more research is needed before any conclusions can be offered. Nevertheless, this is the only site of this period known from the southern Ḥuleh Valley. It fills a gap in the distribution of Epipaleolithic sites in this region between Early Epipaleolithic (Kebaran) sites known from the northern Ḥuleh Valley such as 'En Hashomer and Tel Ḥai in the north (Shaked and Marder 1996) and 'En Gev (Bar-Yosef 1970) east of the Kinneret in the south.

The archaeology of GBY is unique not only in the richness of its sites but also in the fact that all the archaeological layers were deposited in an anaerobic environment. The waterlogged sites enabled the excellent preservation of organic materials such as wood, seeds and fruits from as early as the Lower Pleistocene (Melamed 1997). Observations from the newly discovered Middle and Epipaleolithic sites show that both localities are rich in botanical remains and hold great potential for radiometric dating as well as for understanding of their paleoenvironment. The 1999 destruction lowered the water level in the whole area and the loss of organic and especially botanical data is one of its worst consequences.

The surveys carried out before and after the destruction have brought to light much new archaeological and geological data. Ongoing studies of the material will result in a new understanding of the site and its vicinity. However, the scientific quality of this data has been irreversibly impaired. Unique geological and archaeological layers have been removed and unknown segments of the region's history lost. The stratigraphic sequence of the southern Ḥuleh Valley as recorded at GBY is today missing some 10 m that were present in the beginning of the last century, and correlation between its different exposures has become impossible.

The unique archaeological sites and geological exposures of the GBY area have suffered enormous damage from drainage work in the last century and the data they held is lost forever. Furthermore, the sites are still unprotected and susceptible to additional damage from future drainage operations planned for this area.[4]

Resources should be allocated to study the different archaeological sites and assemblages of Gesher Benot Ya'aqov. The unique archaeology, geology, flora and fauna of this area should be protected by law in order to prevent future destruction and to preserve Gesher Benot Ya'aqov's status as a world heritage site.

Notes

1. The study presented in this paper was supported by the Israel Antiquities Authoriy, the Israel Sciences Foundation, founded by the Israel Academy of Sciences and Humanities, and the Hebrew University, Jerusalem. G. Laron took the photographs of the spheroids. The aerial photos were taken by A. Baltinester. The lithic artifacts were drawn by L. Zeiger. E. Hovers offered important comments on an earlier version of this paper. Many people helped to bring this data to light. We thank S. Gorodetzki for translation. B. Madsen found the first spheroid from GBY. The IAA Marine Archaeology Branch and the "Jordan River Rafting" supplied the kayaks for the survey. R. Bankirer and I. Hadar from the IAA helped with the survey and GPS mapping. Z. Gal, I. Shaked, N. Gezov and H. Smithline from the IAA inspected, collected and generally helped.

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2. S. Belitzky, C. Feibel, N. Goren-Inbar, H. Khalaily, O. Marder and G. Sharon participated in the survey.
3. A spheroid was found previously at GBY by A. Asaf and is currently on exhibit at the Kibbutz Ma'ayan Baruch Museum.
4. As we write these lines (November 2000), the IAA is in litigation against the Kinneret Drainage Authority and its director, Mr. Eitan Sat. The IAA is requesting that the court order the Kinneret Drainage Authority to take all necessary actions to reconstruct and preserve what is left of the GBY archaeological sites in accordance with Israeli antiquity law. It is also requested to execute the scientific work necessary to preserve the archaeological and geological findings of the destroyed site.

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Erratum

1. Author names – for “Hamudi M. Khalaily” read “Hamudi Khalaily”.
2. Introduction Summary line 5 – for “an previously” read “a previously”.
3. Figure 6 – title should be “Piles of discarded sediments at the Epi-Paleolithic site at GBY”.
4. Figure 9 – Scale is incorrect.
5. Figure 7 – for “Loess conglomerate” read “Loose conglomerate”
6. Table 1 – for “Acheulin” read “Acheulian”.
7. Figure 12 – Scale is correct only for # 3 and 4.
8. Figure 14 – a. The pairs of numbers 1&2, 3&4 and 5&6 are two faces of the same tools.

   b. Scale is incorrect.
9. Note 1 line 1 – for “Antiquity Authoriy” read “ Antiquity Authority”.