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A new type of anvil in the Acheulian of Gesher Benot Ya'aqov, Israel

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We report here on the identification and characterization of thin basalt anvils, a newly discovered component of the Acheulian lithic inventory of Gesher Benot Ya'aqov (GBY). These tools are an addition to the array of percussive tools (percussors, pitted stones and anvils) made of basalt, flint and limestone. The thin anvils were selected from particularly compact, horizontally fissured zones of basalt flows. This type of fissuring produces a natural geometry of thick and thin slabs. Hominins at GBY had multiple acquisition strategies, including the selection of thick slabs for the production of giant cores and cobbles for percussors. The selection of thin slabs was carried out according to yet another independent and targeted plan. The thinness of the anvils dictated a particular range of functions. The use of the anvils is well documented on their surfaces and edges. Two main types of damage are identified: those resulting from activities carried out on the surfaces of the anvils and those resulting from unintentional forceful blows (*accidents de travaille*). Percussive activities that may have been associated with the thin anvils include nut cracking and the processing of meat and bones, as well as plants.

1. Introduction

This paper presents a newly identified type of anvil, an addition to the assemblage of percussive tools from the Acheulian site of Gesher Benot Ya'aqov (GBY). The extensive role of percussive tools in hominin evolution is recorded in a variety of disciplines. These include the material cultures of non-human primates, contemporary hunter–gatherer societies, and Early Stone Age and Lower Palaeolithic sites [1].

Chimpanzees [2,3] and bearded Capuchin monkeys [4] use both anvils and percussors to smash fruits and crabs, to open bivalves and primarily to crack open several types of nuts [5,6]. Various raw materials, including stone, wood, branches and roots, are used as anvils (e.g. [3,7]).

Ethnographic studies record the application of anvils in a wide variety of tasks [8,9]; this is supported by experimental work [10], which contributes additional observations on the role of percussive tools. These artefacts, made from a variety of raw materials, are considered indicative of planning, different procurement modes and mobilization to and from sites (e.g. [11]).

The earliest occurrences of anvils are documented in Oldowan and Acheulian African sites (e.g. Olduvai Gorge, Melka Kunture, West Turkana and others: [12–14]), as well as Levantine Acheulian sites ('Ubeidiya and Latamne: [15,16]). These items, which can undoubtedly be identified as large anvils, are sometimes pitted and frequently bear different signatures of their past use (for Oldowan through Acheulian finds, [17]). The rarity of these large anvils in early sites could be a result of the methodologies used during the early days of prehistoric research. But the few examples that do exist demonstrate a large array of markings that are informative of different functions.

The meagre information that is available in the Levant originates mainly (at the time of writing this study) from the site of 'Ubeidiya. There, 22 anvils were reported from three layers: from old to young, I-15 ($N = 18$), K-29 V.B. ($N = 2$), I-26d ($N = 1$) and I-26c ($N = 1$) [15]. Layer I-15, the most extensively excavated archaeological horizon, provided 18 anvils [18]. Gilead described these artefacts as follows:

> ... all large chunks, half made of flint and half of basalt. In comparison with many of the tools and most of the natural chunks found on the living surface, these pieces feature a square cross-section created by two parallel, naturally smooth surfaces which are always covered by cortex. The definition of anvils is also based on the observation that the edges of the flat surfaces were battered. [18, p. 110].

Anvils made of limestone and flint were also introduced by hominins to the site of Latamne. These artefacts, 20–40 cm in size (long axis), are much larger and heavier than the other components of the archaeological horizon [16,19,20]. At Latamne anvils were found in association with manuports (Clark's 'rubble') and were identified among other features by '... at least one flat face, the edges of which show fairly extensive battering ...' ([16, p. 32], description given for two artefacts). Clark further characterized the flint anvils:

> '... all have sharp, angular edges and might have been carried to the site as raw material for toolmaking' [16, p. 11].

He generalized about the function of the tools:

> '... bashing stones for vegetable food or for breaking bones, or as material for constructing some sort of shelter or hide ...' [16, p. 14].

The published reports of Latamne include eight additional anvils of limestone and, as the weathering of the limestone blocks was sometimes very intensive, there may have been more anvils at the site. Clark further suggested that there may have been smaller anvils at the site, whose poor preservation rendered their identification impossible.

Interestingly, none of the long stratigraphic sequences of the Levantine cave sites assigned to the Lower and Middle Palaeolithic (Amud, Hayonim, Kebara and Tabun) has furnished any anvils. By contrast, open-air Mousterian sites provide some indication for the important role of anvils in the lithic assemblages. At the open-air Mousterian site of Quneitra, six basalt anvils (flat-surfaced artefacts in contrast to the abundant basalt percussors, which are typically rounded) were found in Area B [21, p. 108, table 22]. These were found closely associated with fossil bones. One of the anvils was associated with horse skull bones and teeth, all deriving from the same jaw, which were distributed in the immediate periphery of the anvil [21, p. 46, photo 16; 22]. Recently, in an attempt to search for the spatial patterning of artefacts and bones, the anvils were plotted against other components and were found to be clearly associated with equid jaw remains [23, fig. 10].

The two most common functions of anvils, as recorded by ethnographic and archaeological studies, involve the knapping of stone (e.g. [24–26]) and breakage of hard materials (e.g. [27,28]).

The identification and classification of percussive tools are demanding tasks, as the acquired shape of the artefact is frequently a result of the intensity with which the tool was used. Thus, limited use of artefacts may not have left a clear signature and they can easily be classified as natural or minimally used objects; examples of such cases are manuports and modified artefacts (following the terminology of [12,29]). Percussive tools (e.g. percussors, pitted stones, anvils) are generally divided into mobile (active) and dormant (passive) artefacts [30], which are frequently indistinguishable. Anvils form a different and distinct category, as their morphology is considered to have played a role in their function as a dormant percussive tool. Generally, anvils are characterized by having at least one flat working surface on which the activity takes place and on which it leaves its markings (e.g. [12]).

Anvils are usually divided into two main categories: the first involves blocks of large dimensions, frequently of a pyramidal shape with a flat base, and the second are nodules of smaller size and different forms [27,30]. Clearly, this division is based on archaeological finds that are related to the availability of different types of raw materials in a given area and cannot serve as a yardstick for the entire Old World. The definition given by Leakey & Roe [29, p. 7] for anvils fits many of the Early and Middle Pleistocene sites (as well as much younger ones): '...These consist of cuboid blocks or broken cobblestones with edges of approximately 90° on which there is battered utilization, usually including plunging scars...'

The issue of percussive tools has recently attracted much attention. The focus has been on aspects of nomenclature (e.g. [27]), methodology (e.g. [25,31]), great ape studies (e.g. [32]), Early and Middle Pleistocene sites (e.g. [17,28,33]) and much younger periods (e.g. [25]).

We present here a study focused on a particular tool type—a thin, flat basalt anvil, a component of the percussive tool assemblage that has not been described at any other Lower Palaeolithic site. This tool has been recently identified at the Acheulian site of GBY in the Upper Jordan Valley, Israel. The characteristics, frequency, possible interpretation and implied behavioural patterns of these anvils are described below. We aim to describe these tools and to discuss their contribution to the overall Acheulian tool kit known from the site.

(a) Gesher Benot Ya'aqov

GBY is an open-air, waterlogged Acheulian site in northern Israel. The site is located in a lake margin environment of palaeo-Lake Hula, assigned to the Lower and Middle Pleistocene (MIS 20–18) [34–36]. Acheulian artefacts are bedded throughout the entire stratigraphic sequence in the study area, portraying a continuous hominin occupation of some 100 ka duration along the lake margin. The cultural record is established by the presence of conservative lithic assemblages [37] in 15 rich archaeological horizons, located above the Bruhnes–Matuyama Chron boundary [34]. The lithic tradition of the site was assigned to the large flake phase of the Acheulian technocomplex [38], with typical handaxes and cleavers produced on large basalt flakes [39]. Rich palaeontological assemblages display a great diversity of species, some in abundance [40–42], as well as an extremely rich palaeobotanical assemblage [43–45]. GBY furnishes the earliest evidence in Eurasia for continual fire-making [46,47]. In addition, multidisciplinary information on the environmental conditions, ecology, habitat and palaeoclimate, derived from an array of other studies [48–50], provides background for the use of anvils at the site.

The Acheulian hominins at GBY selected three different types of raw materials (flint, limestone and basalt) for the production of the lithic assemblages. Within each raw material we have recognized additional specific patterns of selection. For example, limestone pebbles of particular size were selected for use as two different types of percussors [28].

Within the basalt inventory, we have recognized the selection of two distinctly different morphotypes. The first are large, thick basalt slabs of boulder size, which were selected for their dimensions and geometry as well as for their particular flaking properties. These were knapped into giant cores used for the long and complex reduction process aimed at the production of bifaces [39,51–53]. The second morphotype consists of spherical nodules that were introduced to the site to be manipulated as percussors of different sizes [54].

The lithic assemblages of GBY include both mobile and dormant percussive tools of different sizes and weights, and most probably of different functions [54,55]. For example, a single pitted surface occurs on a massive, fragmented basalt slab [52,53]; owing to its great weight and its morphology (two flat surfaces), it was clearly used as a passive anvil.

In this study we report the identification of an additional, third strategy of basalt selection. The initial recognition and identification of the new anvil type described below were based not on pitting or other damage markings but on other, primary morphological characteristics, and hence provide an additional artefact category that expands our understanding of Acheulian percussion technology. This newly identified tool involved a procurement mode of small, thin basalt slabs, which are found all along the cultural sequence at the site. We consider this newly identified type to be an anvil that was manipulated and used for a multitude of percussive functions, as will be demonstrated below.

(b) The thin basalt anvils

The thin anvils of GBY are thin, non-vesicular basalt slabs, at times slightly weathered. The artefacts are characterized by two flat, parallel unflaked surfaces (figures 1–3). All the thin slabs are fragments of larger objects (figures 4 and 5), which sometimes bear signs of heavy percussive force (impact) that caused their fragmentation. The basalt slabs have a particular geometry (differing from that of pitted stones), similar to that of the massive basalt slabs from which giant cores were flaked. As with the massive slabs, the original cross-section morphology of the thin ones sometimes has a general trapezoid geometric form, with part of the upper surface occasionally sloping to form an acute angle with the lower surface (for further details on the geometry of the thick slabs, see [52,53]).

The thin basalt anvils are recorded at GBY in several rich archaeological horizons that provide an appropriate sample size for a detailed lithic analysis. They occur in two excavation areas and in all of the eight levels of Layer II-6 (table 1). These levels exhibit conservative technological and typological characteristics but differ from one another in the activities that they reflect, as expressed by the frequencies and traits of their lithic, palaeontological and palaeobotanical assemblages. For example, while Layer II-6 levels 4 and 4b are extremely rich in bifaces [39], other layers do not reach the same frequencies (e.g. [37]). Similarly, while level 1 is rich in faunal remains, the others are very poor [40,56]. The presence of the thin basalt anvils in each of the levels is therefore highly informative and shows that they played a very important role within the diversified activities that took place on these archaeological horizons.

2. Material and methods

The frequency of the anvils in each of the layers is too low to allow any significant analysis and does not enable in-depth morphological study of their original planform (table 1). Considering the conservative nature of the GBY cultural sequence [37], we have grouped the items from all levels to form a single assemblage that is large enough to allow suitable analysis.

Figure 1. Thin basalt anvil (#16123; Layer II-6 level 2); (*a*) plane A with view of the pitted surface; (*b*) fracture in plane C and (*c*) another view of planes A and C. (Online version in colour.)

(a) Positioning

As the thin anvils are not intentionally shaped objects, a method of positioning was necessary in order to achieve a systematic analysis. Three planes (surfaces) were defined for each artefact following the methodology of de la Torre [31,57]. First, the two large opposite planes were termed A and B, plane B being the flatter one. Thus, plane B is considered as the one that was placed on the ground (facing down). The third plane, the slab's profile, is termed plane C. In the cases where the artefact was identified as a flake (19%), its ventral face was considered as plane B. For the purpose of systematic recording and analysis, the artefact was rotated so that its maximal length was parallel to a fixed Y axis and its widest end was placed proximally (figure 2). This systematic positioning is not related to the rock damage observed on the anvils, but simply aims to generate an objective common denominator for the geometric documentation and analysis of these artefacts.

(b) Analysis

The systematic positioning of the anvils allowed efficient recording of their breakage patterns. A breakage is defined as a fracture that extends through the entire thickness of the artefact. The breakage damage type is caused either by intentional fragmentation or by a massive accidental blow that caused the thin slab to break (longitudinally or transversally). The morphology of the anvils was recorded in accordance with their systematic positioning, using four metrical measurements (length, width, thickness and weight).

The analysis focused on the signs of use and other rock damage types identified on the three different planes of the anvils. We have defined a number of damage categories that

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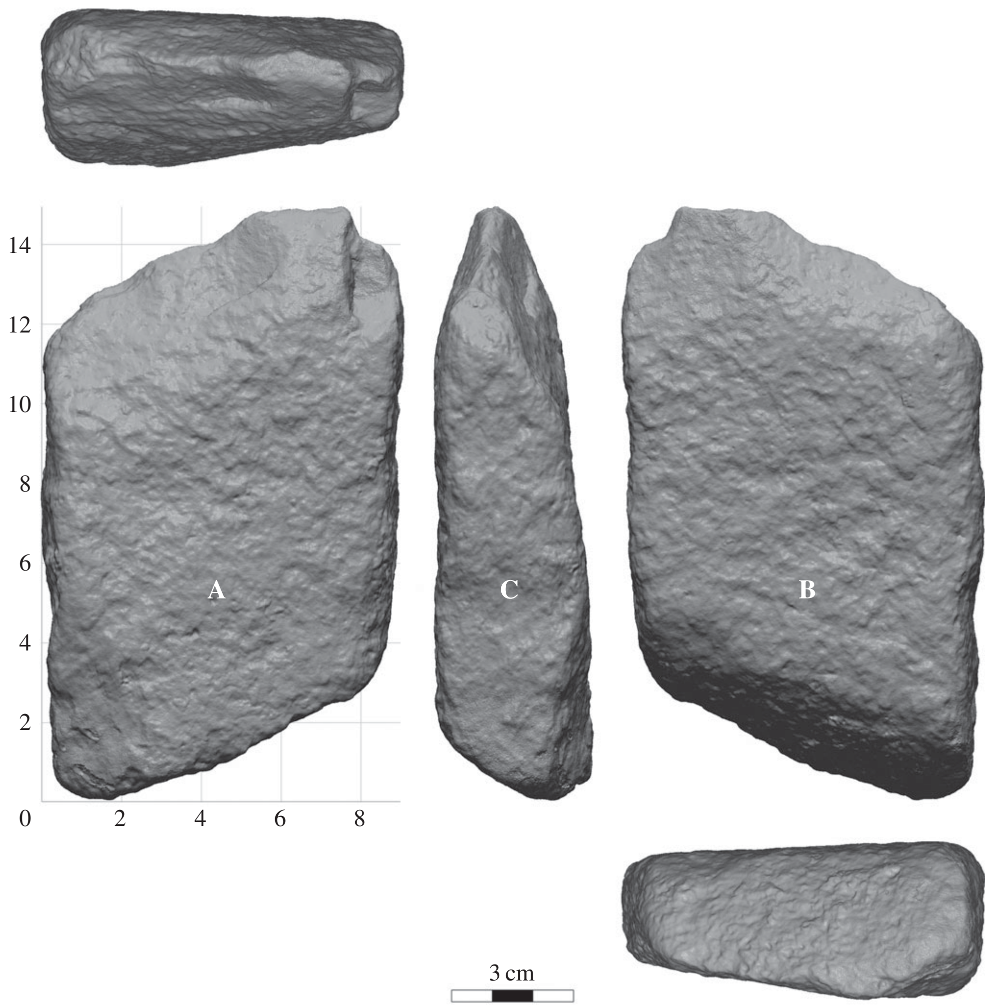

Figure 2. Positioning method of thin basalt anvils (three-dimensional model) and their A, B and C planes (#5571; Layer II-6 level 1).

include: (i) pitting damage, (ii) flake scars, and (iii) damage caused by the use of the artefact as a percussor.

Pitting damage is defined as depressions on any of the surfaces of the artefact, caused by energy transferred to the artefact during its use as a passive (dormant) percussion artefact. A pit was determined when a small area, of distinct limits, was observed to be deeper than its surrounding natural surface [55]. Pits appear on different locations of the artefacts and differ in depth, diameter and concentration, all of which result from distinct types of functions and intensity (figure 1*a*).

Intensity of damage was recorded for pitting on the horizontal planes A and B, which is the most common. Given the scarcity of this damage type on plane C, we registered only its presence or absence. These observations of signs of damage, and specifically those of pitting, were subjective and did not involve any microscopic tools. The intensity of pitting was determined according to the number of pits, their depth and their concentration on a specific plane.

Damage caused by flaking is determined by scars on the surfaces of the artefacts (figure 6). Six types of flaking damage were defined and documented, considering the direction of the scar removal and the plane from which it originates (figure 7):

(1) A–C flaking direction, documented by a scar on plane C originating from plane A.
(2) B–C flaking direction, documented by a scar on plane C originating from plane B.
(3,4) Directions C–A and C–B: in both cases plane C serves as the striking platform and the scar is located on either plane A or plane B.
(5) Plane-to-plane flaking. This is in practice a sub-type of the first two categories, but differs from them because it resulted from a powerful blow that was inflicted on one or other of the horizontal planes and removed a flake from the entire thickness of the slab, either from plane A or from plane B, somewhat similar to an overshot flake.
(6) The last type of flaking damage is a longitudinal scar. This type appears only on plane C and consists of a flake removal from one edge of plane C to another.

In cases where a restricted area on one or more of the surfaces exhibited the shattering damage distinctive of use as a percussor, this type of damage was recorded as percussor damage.

3. Results

The size of the thin anvils presents minimal variability, expressed in all three dimensions of length, width and thickness (table 2). The fact that the large majority of anvils (95.2%) are broken on at least one edge and 11.9% are fragments broken on all sides makes their uniformity of size even more notable. The thickness presents an even greater homogeneity, as it is not influenced by breakage. As we have no knowledge of the original length and width of these slabs, we consider their observed thickness to represent the original feature selected by the GBY hominins.

Pitting damage is very common and occurs on 81% of plane A, whereas on plane B it occurs only on 57.1% of the items (table 3). In both cases, the most common pattern is

Figure 3. 3D model of thin basalt anvil (#7695; Layer II-6 level 6).

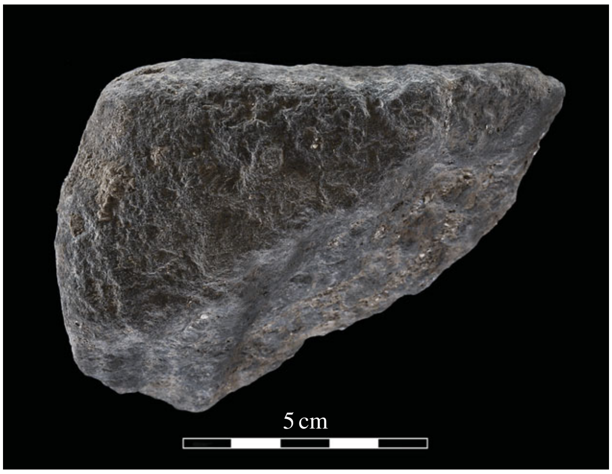

Figure 4. Broken thin basalt anvil (#5889; Layer II-6 level 2). (Online version in colour.)

that of low intensity, although frequencies vary between planes (50% for plane A and 35.7% for plane B; table 4). This variability supports the identification of plane A as the upper surface on which damage is recorded more frequently and more intensively. Pitting damage on plane C is rare, occurring on 19% of the artefacts.

Similar to pitting, damage resulting from flaking is very common and 81% of the artefacts bear flake scars (table 3). This type of damage appears mostly on one of the lateral edges of plane C (66.7%) and is less abundant on its proximal and distal edges (23.8% and 21.4%, respectively). The flake scars on plane C usually appear on a single edge (52.4%), although items with two (26.2%) and three (2.4%) flaked edges are also recorded. In over 64% of the anvils, the scars on plane C originate in plane B, and 38.1% originate in plane A (table 5). Longitudinal scars, which occur only on plane C and are dictated by the thinness of the slab that guides the percussive energy, occur on 11.9% of the anvils.

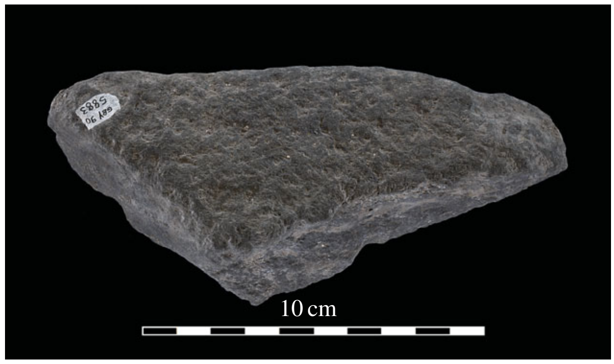

Figure 5. Broken thin basalt anvil (#5883 Layer II-6 level 2). (Online version in colour.)

Table 1. Occurrence and frequencies of thin basalt anvils at GBY presented along the time trajectory (top = youngest). Trench II refers to material that was quarried and not excavated.

layer	*N*	%
JB	2	4.8
II-6/L1	8	19.0
II-6/L2	7	16.7
II-6/L3	5	11.9
II-6/L4	6	14.3
II-6/L4b	2	4.7
II-6/L6	6	14.3
II-6/L7	5	11.9
Trench II	1	2.4
total	42	100.00

On 40.5% of the anvils we have identified flake scars with multiple directions. Flaking damage on planes A and B is less common, as only 11.9% of the items display it on plane A and 2.4% (a single item) on plane B. Plane-to-plane flaking damage, which extends through the entire thickness of the artefact and likely results from a massive blow, occurs on 38.1% of the anvils.

It appears that some of the items were also used as active percussors, as 26.2% of them bear the typical battering damage that is indicative of percussive action (table 3).

4. Discussion and conclusion

The analyses of the anvils highlight two main issues. The first is the selection and transport of thin basalt slabs into the site for their use as anvils, and the second involves their different damage traces, suggestive of a variety of functions.

(a) Selection

The dimensions of the thin anvils are too large to pertain to the clast sizes of the lake margin and thus are foreign to the depositional characteristics of palaeo-Lake Hula [35,36]. They should therefore be added to the assemblage of purposefully unshaped basalt manuports, which also includes cobbles, thick slabs and thick slab fragments that were transported into the site by hominins. These objects were collected, transported, used and discarded by hominins in the lake margin occupations.

Figure 6. Damage in the form of flake scars on thin basalt anvil (#7498; Layer II-6 level 1). (Online version in colour.)

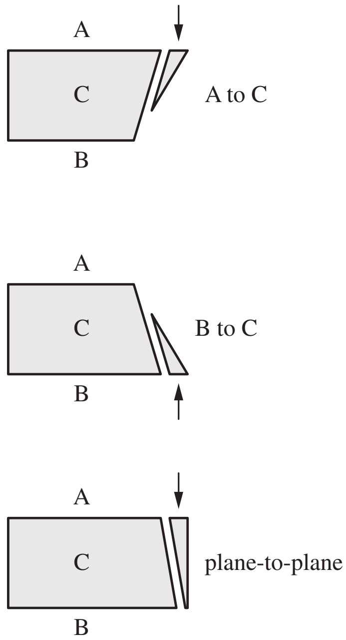

Figure 7. Location and direction of types of flaking damage on thin basalt anvils at GBY.

The size of anvils (table 2) exhibits minimal variability, although we can relate only to their thickness because the original size of the slabs is unknown. The values of thickness display homogeneity and are indicative of intentional selection. It reflects their natural properties, preferred and chosen by the hominins of GBY throughout a long time trajectory. The homogeneous aspect of the thin anvils is the outcome of a particular procurement selection mode. This mode reflects the hominins' accumulated and transferred knowledge of their environment and its geology, including the particular properties of the basalt/basanite flows [58],

Table 2. Size (in millimetres) and weight (in grams) of thin basalt anvils ($N = 42$) at GBY.

	size				
	max. length	length	width	thickness	weight
min.	78	70	45	28	163
mean	135.1	124.4	96.9	44.7	827.1
max.	209	196	165	81	2350
s.d.	31.3	30.5	28.4	12	553.2

Table 3. Damage types and location on thin basalt anvils at GBY. *, % calculated from the total number of anvils.

damage types	*N*	%*
plane A pitting	34	81
plane B pitting	24	57.1
plane C pitting	8	19
flaking	34	81
plane-to-plane	16	38.1
percussor	11	26.2

expressed by rare transversal fissuring structure that has resulted in the formation of slabs [53].

As similar thin basalt slabs in their primary location within the flows have as yet not been identified, their original size is unknown. Such thin components have been observed in secondary deposition in the wadis that drain the Golan Heights into the Jordan Valley [38, fig. 14a]. The thin slabs are even rarer than the thick basalt slabs used for the giant cores, which can be observed in only a few exposures (Golan Heights and Western Galilee), mainly in the Kramim Basalt, Upper Flow [59] and from Rosh Pinnah River [38, fig. 14c]. Clearly, at present one cannot expect to find the full array of volcanic phenomena that were visible to the hominins during Early–Middle Pleistocene times. The repetitive diachronic pattern of these artefacts at GBY indicates that they were purposefully sought for their properties, collected and transported to the lake margin, procedures that necessitated an investment of time and energy. This reflects the important role of these objects within the Acheulian tool kit.

The selection of particular types of raw materials for the production of specific tool types is known in the Levantine Corridor since its occurrence at 1.6 Ma in the site of 'Ubeidiya [15]. At GBY, these procurement modes have previously been identified in various tool types, e.g. basalt bifaces [37,39], basalt and limestone percussors [28] and small flint tools [54]. This study demonstrates that even within a particular class of percussive tools, different size categories were purposefully selected. All but two of the thin anvils exhibit pitting on one or more of their surfaces. Comparison between these and the category of pitted stones ($N = 165$) shows that the anvils are significantly wider and longer than the pitted stones (length: t ratio: 6.98 $p < 0.0001$; width: t ratio: 3.95

Table 4. Location and intensity of pitting damage on thin basalt anvils at GBY.

	no pitting		low		medium		high		total	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%
plane A	8	19.1	21	50	4	9.5	9	21.4	42	100.00
plane B	18	42.9	15	35.7	8	19	1	2.4	42	100.00

Table 5. Type and direction of flaking damage on thin anvils at GBY. *, % calculated from the total number of anvils.

type and direction of flaking	*N*	%*
A to C	16	38.1
B to C	27	64.3
C to A	5	11.9
C to B	1	2.4
longitudinal	5	11.9
plane-to-plane	16	38.1

$p < 0.0002$). This further emphasizes the intentional selection of these tools (figure 8).

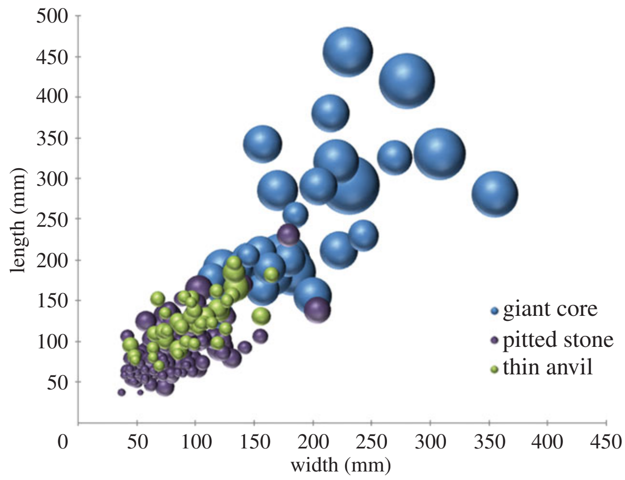

Figure 8. Size (in millimetres) of thin basalt anvils, giant cores and pitted stones; bubble size corresponds to the artefacts' thickness. (Online version in colour.)

(b) Function

The basalt slabs, despite their thinness, are viewed here as anvils, serving primarily as passive percussion tools based on their morphological characteristics. The anvils were placed with their flatter surfaces (plane B) on the ground and the main surface of activity (plane A) facing upwards. All artefacts were exposed with their horizontal planes parallel to the archaeological horizon surface during the excavation. All planes show evidence of activity in the form of different types of rock damage. The blows that were inflicted on the surfaces resulted most frequently in pitting, as described above, and in flake scars when excessive force was applied.

These damage markings vary extensively from clear signs in the form of pits and flaking to minimal damage that at present cannot be characterized and classified. Some anvils display surface damage on a single surface, while on others the damage occurs on both surfaces (figures 2 and 3). In most cases, plane A is more intensely damaged than plane B by pitting. Damage signatures also appear on the thin surfaces (plane C) of the anvils (figures 1*b*, 2 and 6).

The main activity that involved the use of anvils was carried out on their horizontal surfaces. Pitting of different depths, varying surface coverage and surface weathering resulting from pounding and other as yet undefined activities all inflicted different degrees of damage on the working surfaces. The intensity, the materials used on the surfaces of the anvils and their function remain unknown at present.

The second most common type of damage is that which resulted in the removal of flakes. Like the pitting damage, this damage type is associated with percussive activity and the transmission of force to the anvils. This type of damage is evident mostly on the thin surface of the artefacts (plane C) and much more rarely on the horizontal surfaces. This observed pattern of flaking damage is interpreted here as resulting from accidental blows of excessive force, possibly combined with inaccuracy, inflicted during the manipulation of an unknown material on the surface of the anvils. The only exceptions are the longitudinal flakes on plane C, as well as the few flakes removed from the horizontal surfaces (table 5); these are considered to be intentional and are possibly related to an attempt to manipulate the natural morphology of the anvil. In general, our results show that there was very little intentional flaking and that the anvils retained their natural surface morphology.

The observed damage patterns are not a result of the bipolar knapping technique, as is sometimes suggested for percussive tools (e.g. in the Olduvai sites: [26,60–63]), as no evidence for this type of technique was observed within the lithic assemblages of GBY. It should also be stressed that, while the removal of flakes from anvils has been shown to be spontaneous in the African record, where any evidence of conchoidal fracturing is lacking [57,60,62], at GBY all the flake scars on the anvils display clear features of direct percussion.

The multiple patterns of rock damage that occur on the different surfaces of the anvils, the dynamic manipulation of their different planes and the shifts between their passive and more rarely active use, all indicate that the GBY anvils had long life-histories. They were involved in a variety of tasks, making them an important component of the GBY Acheulian tool kit. At present, we cannot associate any particular use to the damage markings on the anvils, but they may have included nut cracking [55], possibly nut popping [64], bone fragmentation for the extraction of marrow, which is very common at the site [40,42], cracking open the shells of crabs and bivalves [6], fruit smashing (as practised by chimpanzees [65]) and possibly the preparation of other plant foodstuffs such as underground storage organs. The presence of Gorgon nuts (*Euryale ferox*; Fox nuts) in all the archaeological horizons and the interpretation of their mode of processing (popping; for details see [64]) provide further support for the use of the thin basalt anvils in the preparation of plant foods. The controlled use of fire at GBY clearly widens the scope of the possible functions suggested above, particularly in the association between nuts, hearths, percussors, pitted stones and thin anvils.

A wealth of percussive activities was undoubtedly common during the occupations of early sites, covering an extensive array of materials such as stone, bone, meat, vegetal material, various foodstuffs, etc. At GBY different tool types (core tools and flake tools) were employed in these activities and bear pitting signs and other rock damage signatures. These occur primarily on limestone [28] and basalt [54], and on both passive and active artefacts of diverse morphologies. Their definition, unlike that of the thin basalt anvils, relies mainly on the identification of their damaged surfaces. Their unknown functions resulted in, among others, recurrent pitting of various sizes, accidental flaking, striations, percussor damage and other types of rock damage.

The thin basalt anvils are a distinct phenomenon within the Acheulian record of GBY. Their procurement involved a repetitive behavioural pattern that prevailed throughout a very long period, an estimated duration of 50 ka [37]. These anvils provide an additional indication of the hominins' knowledge and understanding of the structure, traits and variability of basalt flows. The fact that these items were identified, quarried and transported to the sites shows that the power of observation and thought processing went beyond a simple understanding of the properties of rocks. The thin anvils were brought to the lake margin for particular tasks, differing from those that motivated the quarrying of large slabs and the collection of percussors—all of basalt, but dissimilar in qualities and properties, size and morphology. The knowledge involved in identifying the location of these slabs and their acquisition, as well as their association with an array of different tasks, points to the importance and uniqueness of these items within the Acheulian of the Upper Jordan Valley and the Levantine Corridor. Such repetitive procurement of similar objects through time is indicative of a conservatism of sorts, or in other words a continuous tradition. It clearly necessitated communication in the form of language, as well as long-term memory, spatial memory and memory of other types [66]. All of these are indicative of the transmission of complex sets of information from generation to generation.

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