

INVESTIGATIONS INTO THE EARLY PREHISTORY OF THE EAST JORDAN VALLEY: RESULTS OF THE 1993/1994 LA TROBE UNIVERSITY SURVEY AND EXCAVATION SEASON

by

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Introduction

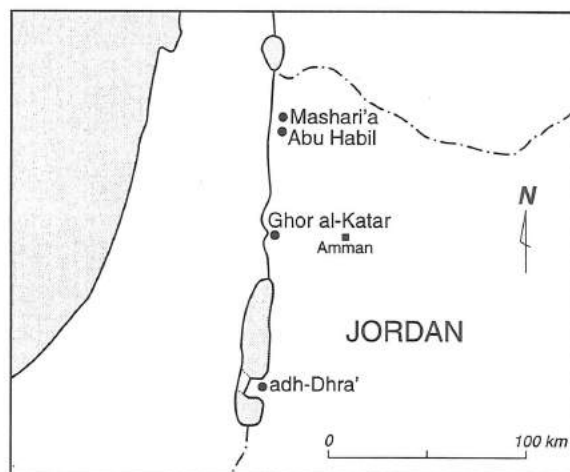
A project directed at the investigation of open-air Pleistocene archaeological sites in the East Jordan Valley was undertaken by La Trobe University between December 1993 and January 1994. The fieldwork was directed at the survey, excavation and dating of newly discovered sites, and the re-examination of other previously described but still little-known deposits attributed to both the Early and Middle Pleistocene. The work aimed to provide the basis for a comparative stratigraphy of the known East Jordan Valley Lower Palaeolithic sites and localities.

The main focus of the project and of this report is the excavation of the Acheulian site of al-Mashāri'1, located near Ṭabaqat Faḥl (ancient Pella), and stratified in the Ṭabaqat Faḥl Formation (Macumber 1992). Essential to the initial recognition of al-Mashāri'1 was the key discovery by Macumber (1992) that the 100 m thick Ṭabaqat Faḥl massif was Middle Pleistocene (from ca. 730,000 years ago) in age. The Mashari'1 site was one of five containing Acheulian bifaces occurring in the 120 m thick Ṭabaqat Faḥl formation which outcrops over an area of about 5 Km². Three of those sites (al-Mashāri'2, 4 and 5) occur in the conglomeratic member of the Ṭabaqat Faḥl Formation and the other two (al-Mashāri'1 and 3) in the limestone member. It is uncertain as to whether the sites in the conglomeratic member are *in situ*, however with the possible exception of Abū Hābil (discussed below) the two sites in the limestone member of the Ṭabaqat Faḥl Forma-

tion are the only clearly *in situ* Lower Palaeolithic archaeological sites known from the East Jordan Valley.¹

The project also targetted other Middle and Early Pleistocene open sites and geological formations at several localities along the East Jordan Valley, for example, at the Abū Hābil' and Ghawr al-Katar Formations in the central Jordan Valley, and the Dānā Conglomerate Formation located further south on the al-Lisān Peninsula, east of the Dead Sea (Fig.1).

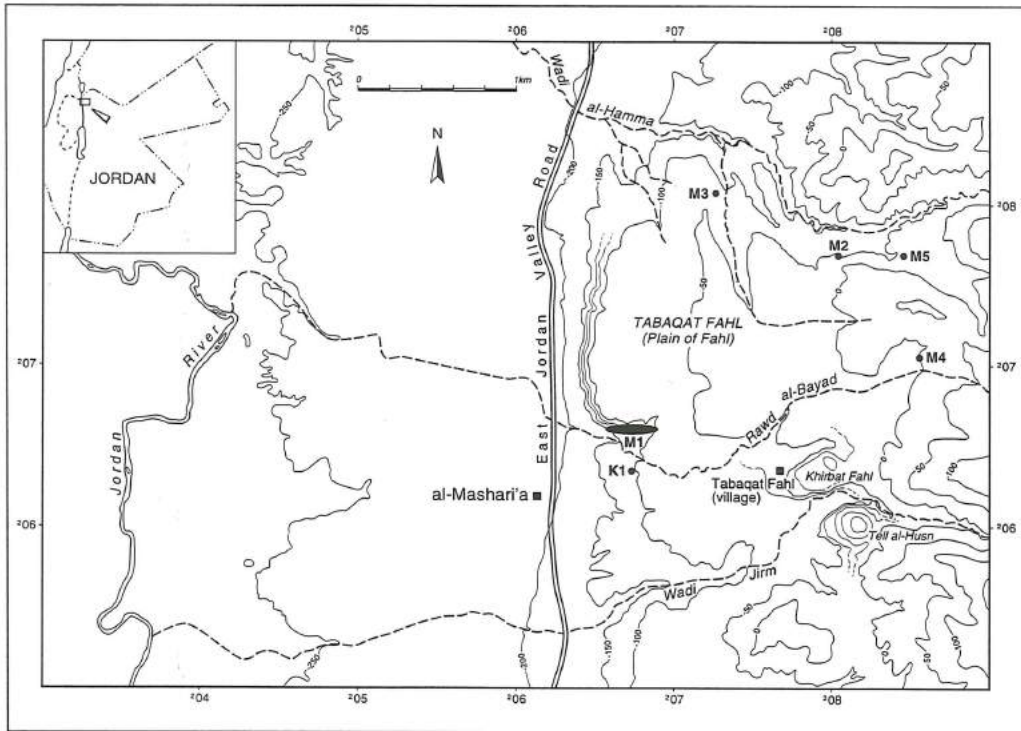
While the main focus of this season concentrated on earlier periods, a well-preserved Natufian site was investigated in Wādī al-Khawwan, a minor erosion gully lying directly opposite the towering massif of the Ṭabaqat Faḥl Formation (Fig.2). This site is named Wādī al-Khawwan 1, and consisted of a discrete band of artefacts stratified in a massive spring-deposited tufa bed. One further later period site is briefly described here: in the course of survey work



1. Sites and localities investigated in the present study.

1. Unfortunately, large-scale excavation for agricultural terracing carried out during 1990-1991

along the steep slopes of Wādī al-Himar destroyed the al-Mashāri'2 and al-Mashāri'5 sites.



2. The Tabaqat Faḥl / Wādī al-Ḥimmah region, indicating the al-Mashārī' (M) series of Lower Palaeolithic sites, and the Natufian site Wādī al-Khawwan 1 (K1).

on the Ḍānā Formation in the Plain of adh-Dhrā' a large architectural site called Zahrat adh-Dhrā' was discovered,² probably dating to the Middle Bronze II period according to the evidence of surface pottery.

Before proceeding to describe the excavations and preliminary results at al-Mashārī'1, its context and stratigraphy is better understood by a brief summary of the geology and geomorphology of the Tabaqat Faḥl Formation which contains the site.

Geology and Geomorphology of the Tabaqat Faḥl Formation

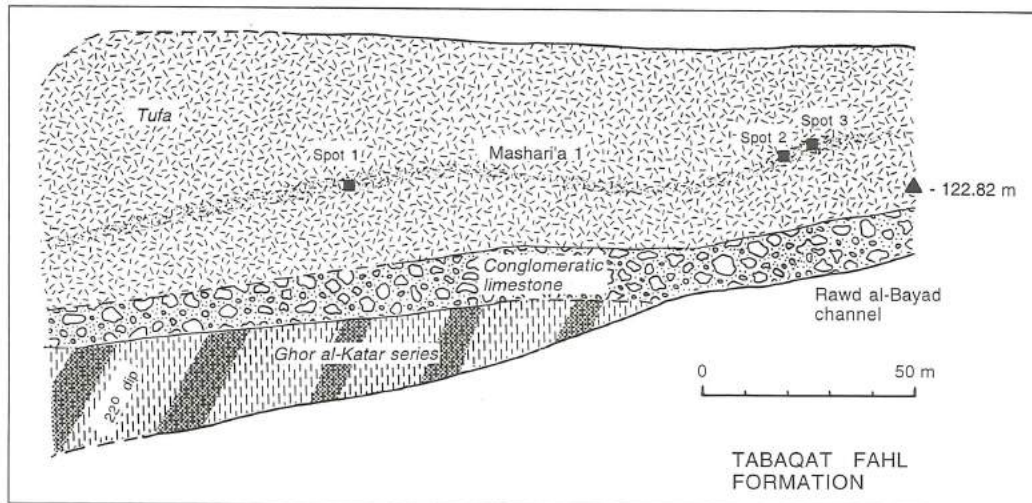
The Tabaqat Faḥl Formation rises to an altitude of 125 m above the Jordan Valley floor, which in this region lies at about 180 m bmsl (below median sea level). The town of al-Mashārī' lies at the foot of the Tabaqat Faḥl, along its western edge with the Jordan Valley (Fig. 2). In elevation, the Tabaqat Faḥl Formation surface lies between the 75 m bmsl contour at its western edge adjacent to the rift valley, and the -25 m bmsl contour where it adjoins the hills at Abū al-

Khass to the east. It is bounded to the north by Wādī al-Ḥimmah, and to the south by the stream channel of Rawḍ al-Bayad.

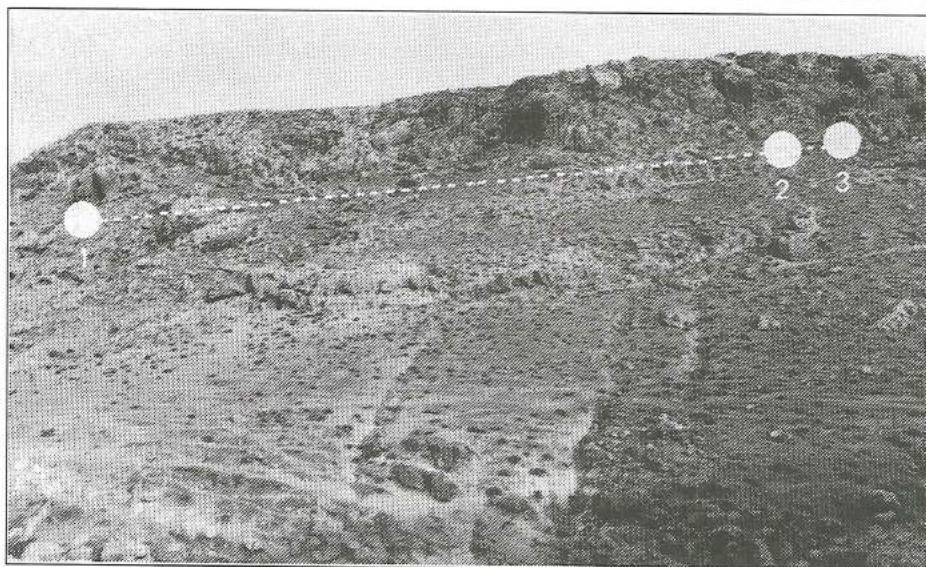
The Tabaqat Faḥl gives its name (Macumber 1992) to the sediments comprising the Tabaqat Faḥl Formation (Figs. 3 and 4). These consist of dense conglomerates, hard white and sometimes nodular limestones, and thick tufas. At the valley edge, the formation is about 120 m thick. In its more easterly outcrops under the Tabaqat Faḥl plateau, the Tabaqat Faḥl Formation unconformably overlies dipping sequences of Cretaceous/ Lower Tertiary sediments. Nearer the rift valley it overlies steeply dipping conglomerates, sandstones and pinkish limestones lithologically similar to the Ghawr al-Katar Series. The Ghawr al-Katar series is thought to be Early Pleistocene in age (Bender 1968, 1974), however, as yet it lacks absolute dating, and its age is therefore largely conjectural. The Tabaqat Faḥl sequences are tilted and gently folded in places, but elsewhere are horizontally bedded. Considering the position of the

2. All of the sites reported here, including al-Mashārī'1, Wādī al-Khawwan 1 and 2, and Zahrat

adh-Dhrā' were discovered by Phillip Macumber during survey work in the Jordan Valley.



3. Geological section of the Ṭabaqat Faḥl Formation (south elevation), also indicating the al-Mashāri' 1 site and its Excavation Spots 1 to 3.



4. The southerly face of the Ṭabaqat Faḥl Formation, indicating the Late Acheulian site of al-Mashāri' 1 and Excavation Spots 1 to 3.

Ṭabaqat Faḥl perched high in the landscape (ca. 120 m above the Jordan Valley floor), and also that its limestones (which represent a paludal, lakeside palaeoenvironment) have no lateral equivalent surviving in the Jordan Valley itself, it follows that the formation has undergone a remarkable degree of tectonic uplift since its deposition.

The basal unit in the Ṭabaqat Faḥl Formation sequence is commonly a conglomerate (Fig. 3), largely composed of chert and limestone pebbles in a calcareous and siliceous matrix. This conglomerate caps the hills to the east of Ṭabaqat Faḥl and passes beneath the Ṭabaqat, where it is overlain and partly replaced by an 80 - m thick tufa member, which comprises large numbers of fossil reeds cemented in a calcareous ma-

trix, and significant numbers of the freshwater gastropod *Melanopsis praemorsa*. The al-Mashāri' 1 site is contained within this member. The Ṭabaqat Faḥl Formation thickens on approaching the rift valley edge. Here the basal conglomerate is replaced by a uniformly dense, white limestone, with occasional bands of hard nodular concretions, varyingly flattened and distorted (not shown in Figure 3, as this occurs further west than the illustrated section). The dense limestone outcrops as an apron at the base of the Ṭabaqat, and is seen in outcrop along the highway at al-Mashāri', between the Rawḍ al-Bayad and Wādi al-Ḥimmah. Here, the conglomerate is missing and the tufa rests directly on dense nodular limestone. The latter is interpreted as representing a

paludal to lacustrine rift valley unit.

The overall pattern of facies variation within the Ṭabaqat Faḥl Formation, passing from conglomerate on the hills to predominantly tufa on nearing the rift valley is similar to that observed in the Late Pleistocene valley-fill sequence in Wādī al-Ḥimmah (Macumber and Head 1991); that is, a change from ephemeral fluvial sedimentation (represented by the conglomerates) to a zone of massive spring deposition (represented by the tufas), in a zone of groundwater outflow adjacent to a large lake (hard uniform limestone) within the Jordan Valley. The sequence represents an earlier depositional cycle to that occurring during the periods of existence of Lake al-Lisān. It also represents a very much larger and more persistent version of the occupational environment present during Middle, Upper and Epipalaeolithic times in Wādī al-Ḥimmah. The tufa member of the Ṭabaqat Faḥl Formation represents a massive version of the modern adjacent Wādī aj-Jirm spring system - now cultivated, but only recently a riparian jungle including dense stands of *Phragmites* reeds. Groundwater carbonate presently accretes around the stems of the plants as they grow in place, illustrating the processes which lead to the

deposition of the adjacent Ṭabaqat Faḥl. Clusters of *Melanopsis praemorsa* gastropods are also frequently encountered in the spring waters of Wādī aj-Jirm.

Excavations at the Acheulian Site of al-Mashāri' 1

Al-Mashāri' 1 is an open-air, *in situ* Acheulian site which extends in cliff section for several hundred metres along the southern edge of the Ṭabaqat Faḥl plateau (Figs.3 and 4). Overlooking Rawḍ al-Bayad, the archaeological horizon is stratified in the tufa member some two-thirds of the way up the 100 m high limestone cliff. At this level, and over the face below, numerous bifaces and flakes erode from the deposit, over a distance of several hundred metres. There are also artefacts embedded in solid rock, including discrete clusters of flakes (Fig. 5).

Excavations encompassed an 115 m long stretch of the site. Two excavation pits, (Spots 1 and Spot 3) spanned this distance (Figs. 3 and 4), and another one, Spot 2, was placed between them near Spot 3. The cultural stratum occurs in a cemented layer of calcareous silts. This sediment may represent a period of soil formation during a hiatus in sedimentation when artifacts were



5. Al-Mashāri' 1. Cluster of small flakes embedded in tufa deposits.

discarded at the site. This possibility is indicated by the occurrence, in the excavations, of tufa blocks with embedded artefacts found within the cemented silts.

Our optimism about the good conditions of site preservation prompted by surface exposures of *in situ* artefact clusters was borne out by the results of the excavations. The flaked chert assemblages recovered yielded a highly consistent series of flaked stone products which included a few bifaces, but numerous biface-thinning flakes, notched flakes (many of which were formed through use), invasively retouched flakes, some invasively retouched scrapers, marginally retouched flakes, and a few flake cores. The good conditions of preservation were confirmed by numerous finds of fine shatter chips and small flakes (Fig. 6a: 1), but particularly by a refitting flake core, where a single 5-cm deep spit (Spot 2, Loculus 1.9) yielded six conjoinable flakes struck from a chert core (Fig. 6b).

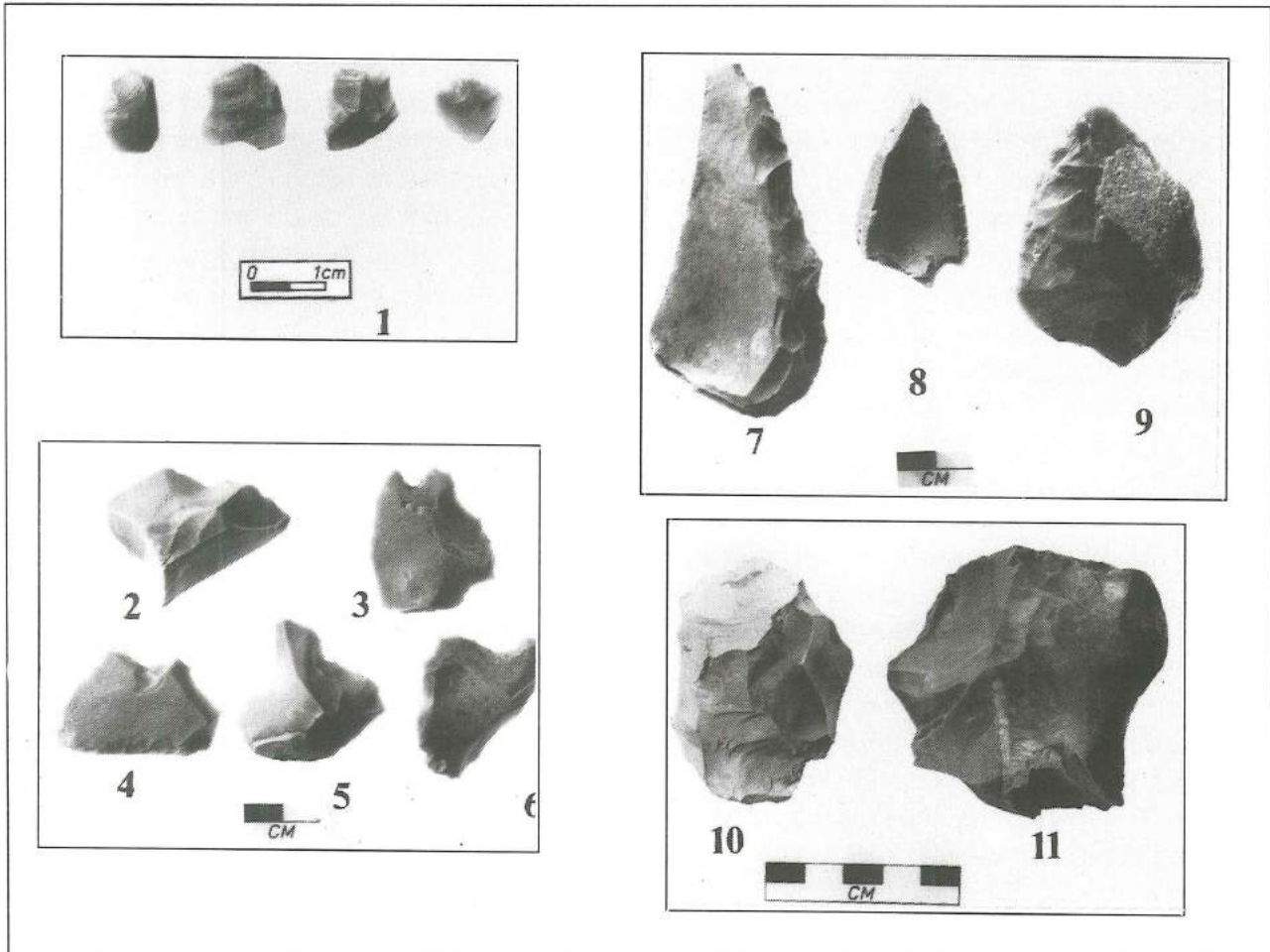
The core was embedded in a rich layer of additional knapping debris, yielding an equivalent density of 15,125 pieces / m³. According to the fragments so far conjoined, the core is a small, semi-ovoid flake core (65 mm long x 51 mm wide), with the cortex at one end of its long axis having been faceted before five small flakes were detached from this same platform. A single flake had also been struck from a cortical platform at the opposite end. The raw material is a brown chert with lighter pigmented veins, and on unflaked surfaces the cobble has developed a thick white patina. The distinctive colouring of the piece has aided in the recognition of its constituent fragments among the thousands of fragments of additional chert debitage. Several other fragments of this cobble occur in the underlying 10 cm unit, but have not yet successfully been refitted. Given the large number of flakes bearing acute platform angles and multiple dorsal scars indicative of biface reduction, the existence of this small core, and

other opposed platform and multiple platform cores from the site, (Fig. 6a: 10-11) demonstrates alternative pathways to flake production than through biface reduction.

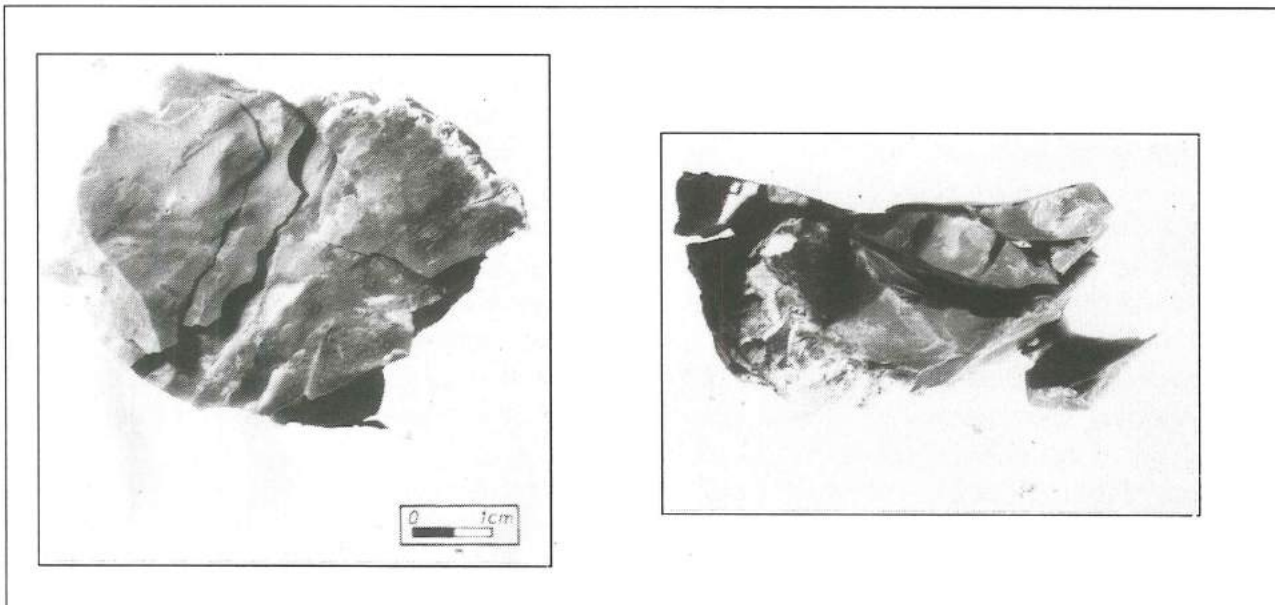
Quantitative results are given here for only the first ten of sixteen excavation units in Spot 2 (Fig. 7), as processing of material from all excavation units remains incomplete. Units 1 to 9 are all 5 cm deep, while Unit 10 is 10 cm deep. (Note that larger excavated volumes in the lower units would correspond to amplified equivalent densities per cubic metre for these units). Artefacts and *Melanopsis* gastropods consistently increase in amounts going from Unit 1 to Unit 10.

This gradual increase in finds towards Unit 10 and the coherence of this pattern overall suggests continuous sedimentation in an area repeatedly visited by tool-making hominids. Whether the vertical artefact distribution resolves itself as a sharp maximum centred on unit 10 and the adjacent ones or not must await further analysis. Our impression at this stage, in roughly judging the amounts of finds in the bags hailing from units 11 to 16, is that densities peak at unit 11 and dwindle rapidly thereafter down to Unit 16. Several possibilities may account for the vertical artefact distribution. The first is that the overlying material represents post-depositional disturbance from an originally sharply defined occupational land surface. However several lines of evidence weigh against this conclusion: the sharp, unabraded condition of the artefacts; the presence of small chips and microflakes retained in each unit; the small conjoined fragments which all derive from a single 5-cm deep unit; and finally the conditions of deposition in a zone of low-energy groundwater outflow.

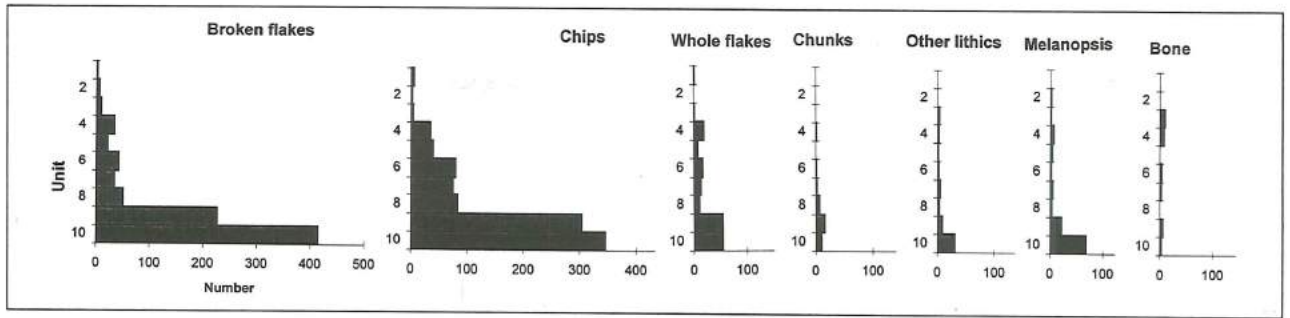
Alternatively, the higher numbers of objects of various types clustered around Unit 10 may correspond with a hiatus in sedimentation at that time, or its abatement, leaving longer periods for surface debris ac-



6a. Al-Mashāri' 1. (1) Small flakes, Spot 2, Locus 1.9. Notched flakes. (2) Spot 2, Locus 1.8, (3-4) Spot 2, Locus 1.9, (5) Spot 2, Locus 1.10, (6) Spot 3, Locus 1.6. Retouched flakes (7) Spot 2, Locus 1.10, (8) Spot 3, Locus 1.4. Invasively-retouched flake (9) Spot 3, Locus 1.5, Multiple platform cores (10) surface, (11) Spot 2, Locus 1.3. Note different scales).



6b. Al-Mashāri' 1. Spot 2, Locus 1.9. Flake core with conjoined flakes (top and side views).



7. Frequencies of artefacts and other finds in the Late Acheulian site al-Mashāri' 1, Spot 2, Locus 1.1 - 1.10.

cumulation. This would explain the larger numbers of *Melanopsis* gastropods, considered to be naturally occurring, in Unit 10.

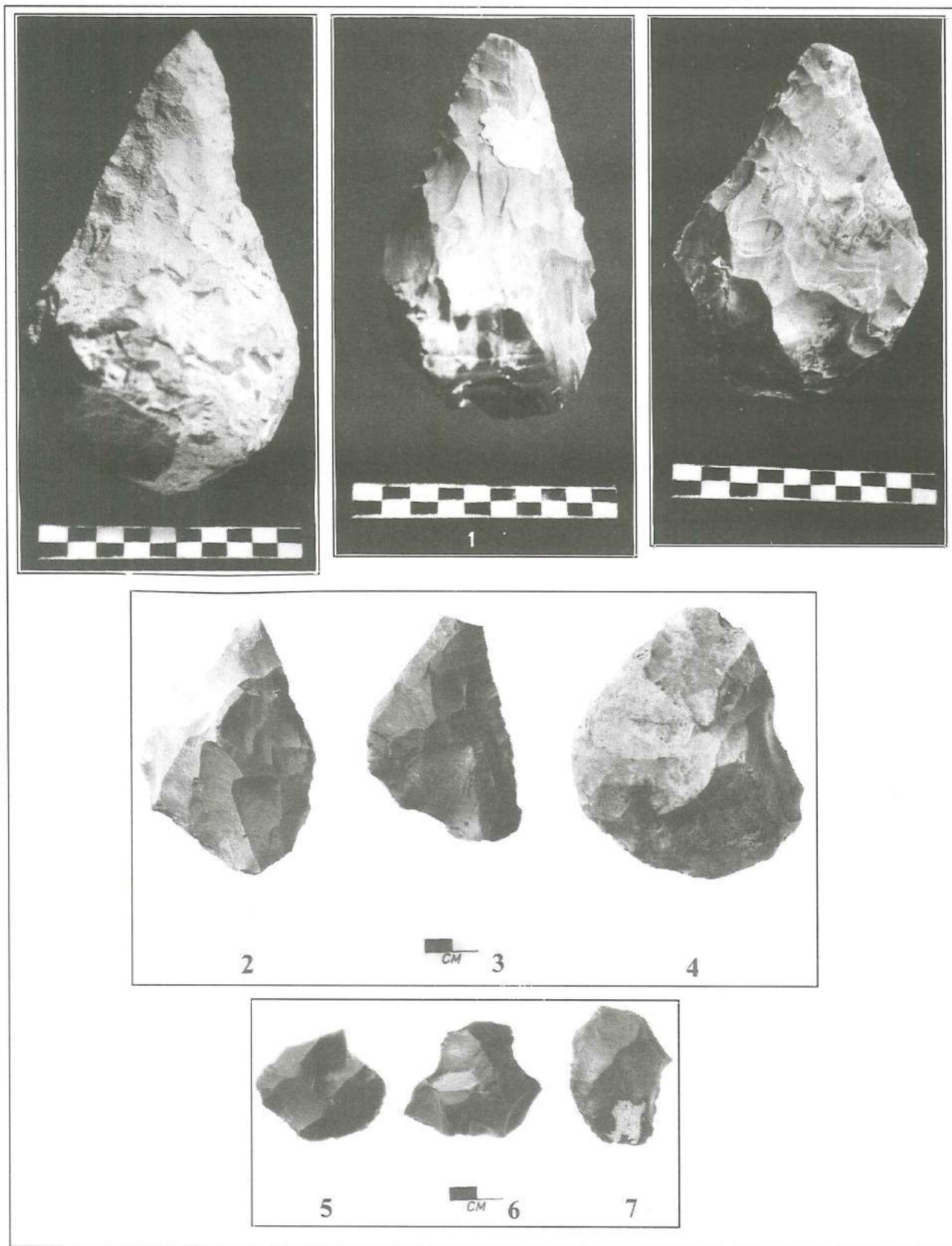
The flaked chert assemblage is numerically dominated by flakes, both broken and whole, and small pieces of chert shatter products. A few blades occur, together with a small number of retouched tools, which include notches, retouched flakes, scrapers, and a few multiple tools such as notch/scrapers, Table 1). While no bifaces were found in this particular part of the site, their presence is well attested by several biface fragments. The shallow platform angles on many of these pieces, and also on many of the small flakes in the assemblage carrying multiple dorsal flake scars, indicates their

origin as by-products of biface reduction.

Elsewhere in the site a single gracile and asymmetrically-shaped biface was found (from Spot 3, Locus 1.9, Fig. 8:3), very similar in form to a al-Mashāri' 1 surface find (Fig. 8: 2), and another found at a similar altitude in surficial sediments on the western face of the Ṭabaqat Faḥl Formation (Fig. 8:4). The excavations also yielded some diminutive bifaces (Fig. 8:5-7). A number of other bifaces were all found on the slopes just below the al-Mashāri' 1 site (but none above it), these having eroded from the sediments. They include pointed bifaces of Micoquian type and cordiform to ovate types (Fig. 8:1), and the aforementioned asymmetric 'D-shaped' bifaces.

Table 1. Al-Mashāri' 1, spot 2, Locus 1.1-1.10. Numbers of 'Other Lithics' presented in Fig. 7.

	Cores	Core trim	Broken blades	Whole blades	Biface frags	Scrapers	Multiple	Notches	Retouched flakes
Unit 1	0	0	0	0	0	0	0	0	0
Unit 2	0	0	0	0	0	0	0	0	0
Unit 3	0	0	0	3	0	0	0	0	0
Unit 4	0	0	0	1	0	1	0	0	0
Unit 5	0	0	0	1	0	0	0	0	0
Unit 6	0	0	0	0	2	0	0	0	0
Unit 7	0	0	0	2	2	0	0	1	0
Unit 8	0	0	0	0	1	0	0	2	0
Unit 9	1	2	1	0	1	0	0	1	2
Unit 10	2	1	1	0	0	5	3	11	7



8. Al-Mashāri' 1 bifaces. (1) Pointed bifaces, surface. Asymmetric bifaces from (2) Mashari' 1 surface, (3) Spot 3, Locus 1.9. (4) Ṭabaqat Faḥl Formation surface. Small bifaces from (5) Spot 2, Locus 1.11. (6) Spot 3, Locus 1.8, (7) Spot 3, Locus 1.6. (Note different scales).

They consistently bear numerous shallow, hinge-terminated flake scars, and are themselves relatively small and gracile, indicating manufacture by the soft hammer technique.

The range of retouched forms include a flake trimmed by deep, flat, invasive retouch (Fig.6a: 9), marginally retouched flakes (Fig.6a:7-8), and several notches formed on thick flakes (Fig. 6b: 2-6). Many of the notches have been formed by edge damage through use, rather than by formal patterning, and are characterised by multiple tiny, stacked step fractures.

Relationships between the Ṭabaqat Faḥl and Abū Hābil Formations

The presence of late Acheulian artefacts in the Ṭabaqat Faḥl Formation raises questions as to its relationship to the nearby Lower Palaeolithic site at Abū Hābil, located 15 km to the south of al-Mashāri‘ (see Fig. 1).

At Abū Hābil, immediately north of the village of Wādī al-Yābis, hard conglomerates and conglomeratic pebbly limestone - the Abū Hābil Formation - outcrop as low hills bordering the main road (Bender 1974). They contain pebble tools described by Huckriede (1966) as ‘Oldowan and Munzenberger’, and considered by him to be Middle Pleistocene in age. However, there is only Huckriede’s very brief description of the Oldowan occurrence at Abū Hābil, and these earlier finds have not since been reproduced. On this rather flimsy basis the Abū Hābil Formation has been equated tentatively with the Early Pleistocene Al-‘Ubaydiyya Formation, now thought from the evidence of molluscan fauna to date as early as 1.4 million years old (Tchernov 1987).

Huckriede’s claims have been repeated in the subsequent literature (e.g. Abed 1985, Horowitz 1979, Vita-Finzi 1982), so that the Abū Hābil Formation has now become correlated with the al-‘Ubaydiyya and ‘Erq

al-Aḥmar Formations, and entrenched as Early Pleistocene in age in chronostratigraphic syntheses.

Bender (1974) notes that along the eastern side of the rift valley, the hard, conglomeratic, partly pisolitic limestone of the Abū Hābil Formation overlie steeply dipping conglomerates, sandstones, clays and limestones of the Ghawr al-Katar Series. Similar sequences outcrop periodically between Abū Hābil and al-Mashāri‘, often as discrete outcrops lying westwards of the main rift valley fault. These locations include Wādī al-Ḥimmah, the Ṭabaqat Faḥl Formation, and Wādī aj-Jirm. At the Ṭabaqat Faḥl Formation and in the mouth of Wādī aj-Jirm, as at Abū Hābil, the Ghawr al-Katar series underlie near horizontally-bedded limestones of the Ṭabaqat Faḥl series.

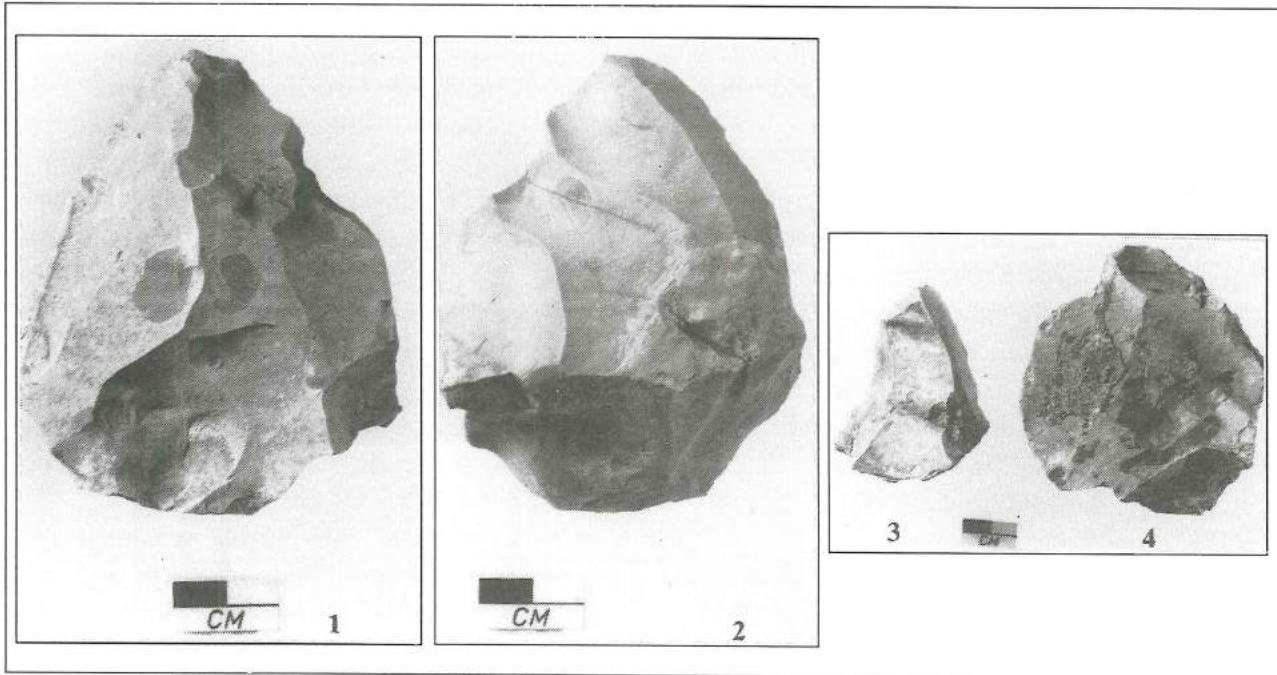
Muheisen (1988) revisited the Abū Hābil area during the 1985 archaeological survey of the Jordan Valley. He noted a Lower Palaeolithic site (Site 44), extending over a 16 m vertical interval. Two assemblages were obtained - a lower one came from the conglomerates, and the upper from a disturbed zone near the surface. The upper assemblage had a light grey to white patina, and included Levallois cores and a Levallois point. Muheisen tentatively dates the upper assemblage as Late Acheulian. In the lower zone an assemblage yellow brown in colour, included bifaces, picks and a spheroid. An age of between 0.6 and 1.8 million is given. The basis for this age is ultimately typological, however it is presumably based on earlier correlations with al-‘Ubaydiyya. Whatever the age, the assemblage seems better assigned as Acheulian rather than Oldowan in character.

During the 1993 / 1994 season we revisited the Abū Hābil Formation to inspect surface artefact exposures. Most of those encountered had the same white to light grey patina as reported by Muheisen, and observed by ourselves on surface finds from

the Ṭabaqat Faḥl Formation (though this white patina rarely occurs on excavated artefacts). Our brief survey on the slopes and across the top of the Abū Hābil Formation yielded numerous artefacts of Middle Palaeolithic character, in that flakes often exhibited thick, protuberant bulbs of percussion and bore faceted platforms. Discoidal cores (Fig. 9:4) and Levallois point cores (Fig. 9:3) were also observed. An unusual artefact, with one face formed as a Levallois point core (Fig. 9:2) but with the reverse face invasively flaked as a biface (Fig. 9:1) was embedded in limestone conglomerate on the top of Abū Hābil. The artefact singly combines characteristics found between the Late Acheulian and Middle Palaeolithic in the Levant. Our brief observations at Abū Hābil indicate the widespread distribution of artefacts of Middle Palaeolithic character. These finds and the additional existence of bifaces suggest, in our opinion, an age of ca. 250,000 BP or later for the stone artefacts issuing from the limestone conglomerates exposed on the surface of the Abū Hābil Formation, rather than an Oldowan affiliation.

In order to obtain radiometric dates for Abū Hābil, we took samples of hard, pisolitic limestones from an outcrop protruding from the lower slopes of the Abū Hābil Formation. Lithologically and sedimentologically, the hard conglomerates and pisolitic limestones at Abū Hābil are similar to the dense calcareous conglomerates and nodular limestone which form the basal sequences to the Ṭabaqat Faḥl Formation. Both the Abū Hābil and Ṭabaqat Faḥl Formations are underlain by Ghawr al-Katar sequences and protrude into the main rift valley from the steeper rises further east. Furthermore, neither formation compares readily with the steeply dipping conglomerates and lacustrine clays of the Al-'Ubaydiyya Formation, with which the Abū Hābil Formation has been commonly correlated. Lithologically and sedimentologically, the Abū Hābil Formation is better assigned to the latter part of the Middle Pleistocene than to the Early Pleistocene.

Artefactually also, its upper strata at least, seem better correlated with the late Acheulian / Middle Palaeolithic than with the Oldowan or Lower Acheulian.



9. Abū Hābil. (1) Biface with (2) Levallois point core on reverse. (3) Levallois-like point core (4) Discoidal core. (Note different scales).

The Natufian Site of Wādī al-Khawwan 1

The site of Wādī Khawwan 1 lies a kilometre due west of Ṭabaqat Faḥl village, in a small cutting known locally as Wādī al-Khawwan. It is situated on the edge of the agricultural fields, overlooking the town of al-Mashāri', where the flat, tilled plain descends to the rift valley edge (see Fig. 2). The site of al-Mashāri' 1 which is embedded in the Ṭabaqat Faḥl Formation towers over it to the north, separated by the deeply incised Rawḍ al-Bayad.

The site of Wādī al-Khawwan 1 lies exposed in section two metres from the top of the cutting. The plain comprising these deposits filled with alluvial sediments during the Late Pleistocene against the higher terrace formed by the Ṭabaqat Faḥl Formation, just as Wādī al-Ḥimmah filled with late Pleistocene sediments against its northern face.

The sediments consist of loosely cemented, pisolitic limestones, containing many *Melanopsis praemorsa*, representing deposition through fresh groundwater discharge.

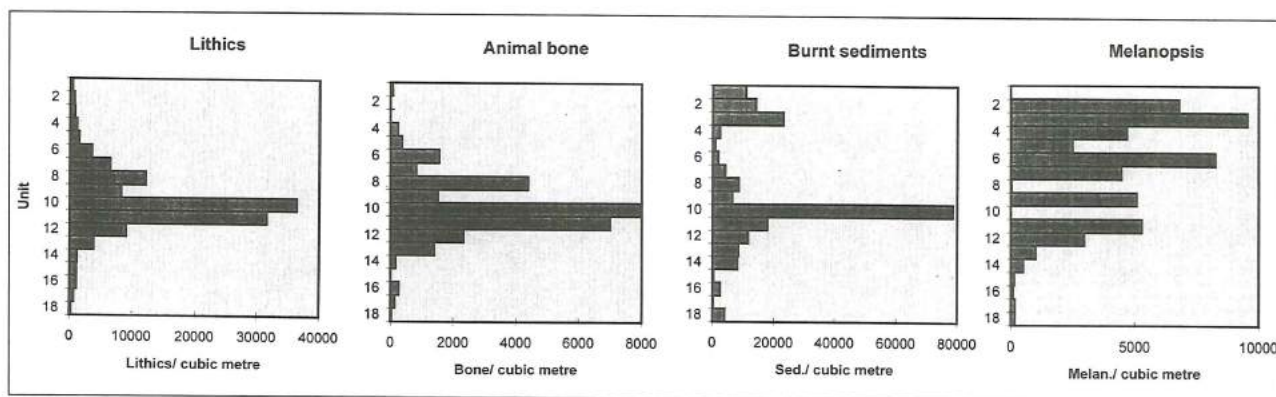
Carbon dates have not yet been obtained from Wādī al-Khawwan 1, though a collection of *Melanopsis praemorsa* shells sampled by P.G. Macumber from near the top of the same sediment body in the northern bank of the small cutting at a locality designated Wādī al-Khawwan 2 yielded a radiocarbon date of 11,620 ± 240 BP (ANU - 8470).

Besides yielding samples of many (natural) *Melanopsis* shells, Wādī al-Khawwan 2 yielded only scanty traces of human occupation, and is not further reported upon here.

Wādī al-Khawwan 1, on the other hand, is a sharply-defined, dense and horizontally-bedded band of artefacts outcropping at waist level in the shallow cutting. A one metre wide excavation was made through the exposed section, consisting of eighteen successive arbitrary units, over a depth of 1.1 m, and emplaced to intercept the rich artefact band. The nature of vertical artefact distribution is given in Figure 10, displaying the densities of lithics, animal bone fragments, burnt sediments, and *Melanopsis* shells.

The former three categories shows the same correspondent densities distributed strongly throughout a depth of thirty centimetres between units 8 and 12, and peaking in units 10 and 11. The naturally incorporated *Melanopsis* shells, however, show an independent distribution. This is unlike the situation in al-Mashāri' 1 reported above, and does not suggest, in this case, that the dense artefactual band represented a slowed or lagged phase of sedimentation. However the sediments of units 8 to 12 in which peak densities occur do consist of noticeably finer sediment particles than from above and below. This issue is far from being resolved.

The flaked chert debitage is dominated



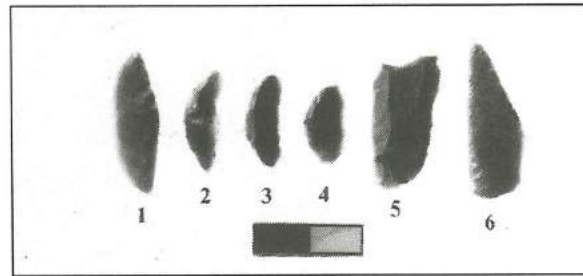
10. Densities of artefacts and other finds in the Natufian site Wādī al-Khawwan 1.

by small flakes (Mean length = 14.4 mm, SD = 9.4 mm, N = 171), but there are many more broken examples than complete. As a whole the assemblage is numerically dominated by debris, or angular chert fragments and small shattered chips (Table 2). Cores are few and consist mainly of fragments, but are distributed vertically throughout the site. Together with the abundant debris and debitage they indicate that core reduction occurred persistently.

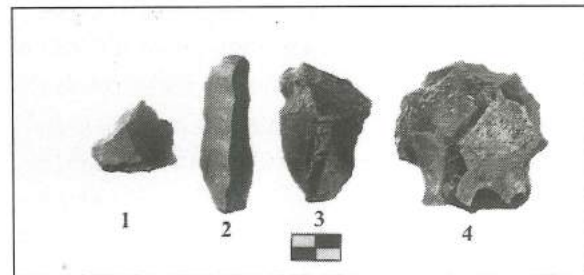
The retouched component is small but varied and typically Natufian, consisting of lunates, three of which are backed (e.g. Fig.11a:1,3) and four Helwan-retouched (e.g. Fig.11a: 2, 4); a couple of Helwan bladelets and allied forms (Fig.11a:1,6); truncated bladelets (Fig.11a:1,5), truncated flakes (Fig.11b:1) rounded scrapers (Fig. 11b: 4) and endscrapers (Fig.11b:2), and notches (Fig.11b:3). Again, these forms occur throughout the vertical extent of the site.

Few of the many small bone fragments are identifiable, but diagnostic elements include *Gazella* sp. (gazelle) phalanges, scutes of *Testudo* cf. *graeca* (Greek tortoise), and phalanges of *Potamon potamon* (Freshwater crab). Two fragments of marine *Dentalium* sp. shell had been imported, probably from the Mediterranean.

A few examples of several other artefact



11a. Retouched chert artefacts from the Natufian site Wādī al-Khawwan 1. (1) Unit 7, Helwan bladelet. (2) Unit 5, Helwan lunate. (3) Unit 11, Abrupt lunate. (4) Unit 12, Helwan lunate. (5) Unit 13, Concave-truncated blade. (6) Unit 15, Helwan retouched point.

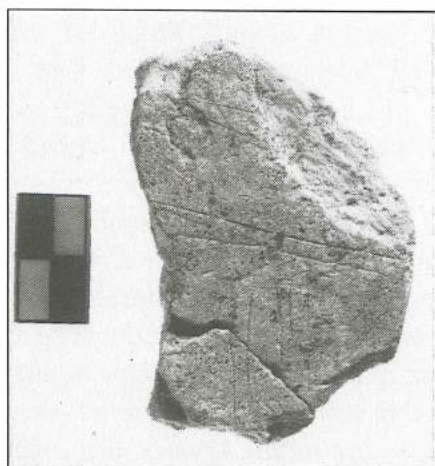


11b. Retouched chert artefacts from the Natufian site of Wādī al-Khawwan 1. (1) Unit 16, Truncated flake. (2) Unit 4, Endscraper on blade. (3) Unit 13, Flake with large notch. (4) Unit 7, Rounded scraper on flake.

types occur in or near the rich artefact band. These include four ochre fragments, two fragments of worked basalt and a small limestone fragment (Fig.12a), incised faintly but clearly with paired horizontal strokes from which are appended similar vertical strokes. The pair of horizontal strokes are

Table 2. Flaked chert artefact assemblage counts for Natufian site Wādī Khawwan 1.

		RETOUCHED	
DEBRIS (large and small angular shatter)		Scrapers	3
Chunks	40	Burins	1
Chips	2,190	Truncations	3
Sub-total	2,230	Retouched Blade	1
DEBITAGE		Retouched flake	7
Flakes	910	Awl	1
Blades	149	Notched flakes	3
Spalls	4	Microliths	3
Core-trimming	1	Geometric microliths	
Cores	12	<i>Helwan Lunates</i>	4
Sub-total	1,076	<i>Abrupt lunates</i>	3
		Sub-total	29
		TOTAL	3,335



12a. Incised limestone fragment from the Natufian site of Wādī al-Khawwan 1.

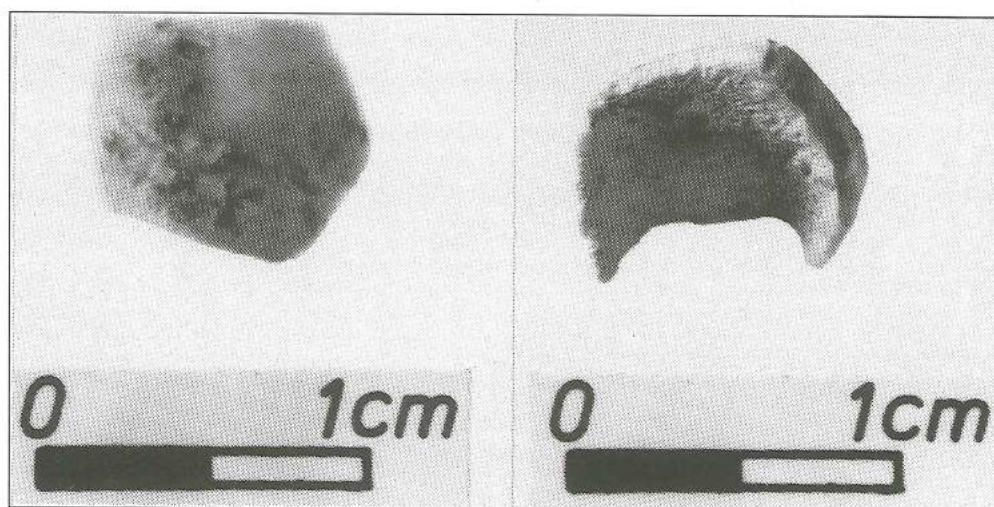
continued on to the reverse of the piece. It was found in section just to the west of the excavation area, but firmly embedded in the rich artefact band. This style of mobiliary art also recalls the varied inventory of small incised limestone plaques and fragments recovered from Wādī al-Ḥimmah 27 (Edwards 1991: Fig.8).

There was also a fragmentary human tooth modified by polishing (Fig.12b) found in the peak density region of the site (Unit 12). The fragment preserves enamel and underlying dentine representing 50 per cent of the labial surface of a single crown belonging to either a canine or first premolar (Fig.12b). The crown is not sufficiently well preserved to identify the tooth as being from the maxillary or mandibular dentition.

One of the fragment margins is oriented horizontal to the line of the crown and is likely to represent a fracture at or near the cervical margin (bottom of right picture, Fig.12b). Portions of both interproximal surfaces adjacent to the cervical margin are also preserved. None of the fracture margins indicate whether or not they were intentionally shaped. However the lack of perikymatic undulations and the high degree of gloss on the labial surface indicate deliberate polishing of the tooth. (Note that the dark area on the labial surface in [Figure 12b] is post-depositional staining and not the result of mineral encrustation).

The tooth recalls the varied Natufian repertoire of bead forms fashioned from skeletal and dental elements. In cross-section, it is worth drawing a parallel to the tubular bone-bead type found in the nearby Early Natufian site of Wādī al-Ḥimmah 27 (Edwards 1991, Fig.11:13-14).

Wādī al-Khawwan 1 presents many interesting points of comparison and contrast with the earlier Wādī al-Ḥimmah 27 (dated in its latest phase to 12,000 B.P, Edwards 1991). The latter site is one of the largest and richest of Early Natufian sites, containing several large architectural complexes rebuilt over several phases and embedded in 2 - 3 m of dark humic clay. Underneath the constructions were interred human burials. The site possesses a varied



12b. Modified human tooth from the Natufian site of Wādī al-Khawwan 1. View of the labial surface (left) and view from the occlusal plane (right).

and abundant incised limestone art assemblage, pecked and ground basalt equipment, and a rich bone tool assemblage including many sickle hafts.

On the other hand, Wādī al-Khawwan 1 is a small and thin artefact band, lacking architecture or human burials. And yet it is not similar to the many pre-Natufian Epipalaeolithic open sites found in Wādī al-Himmah (Edwards *et al.* 1996), which are invariably limited to flaked stone and animal bone assemblages, together with a few hearth stones. Wādī al-Khawwan 1 has additionally a small but surprisingly varied repertoire including specimens of incised limestone art and a modified human tooth, imported marine shells, ochre, and ground basalt artefacts. It remains to be seen whether the difference between the two sites result from their temporal distance, whereby al-Khawwan 1 represents the smaller, less complex site type known from the Late Natufian period (Bar-Yosef and Belfer-Cohen 1992, Stordeur 1992), or whether the two sites are broadly contemporaneous, but different in function.

Ghawr al-Katar

Ghawr al-Katar, the type site for the steeply dipping sequences of conglomerates, sandstones and limestones which underlie the limestones of Ṭabaqat Faḥl and Abū Hābīl, occurs as a long and narrow outcropping ridge near the Jordan River (see Fig. 1), north-west of the town of al-Karāmah (Bender 1968: 92-93, 1974: 93-94). Some 350 m of dipping rocks are exposed, consisting of 'alternating conglomerates, conglomeratic sandstones, and sandstones, marls and marly clays' (Bender 1974: 93). The contrasting colouration of the alternating beds endows the sequence with its distinctive red, white and black-striped appearance. At present the construction of the al-Karāmah Dam has resulted in the excavation of a clear section of the dip-

ping sediments, against which the onlap of the later, horizontally-bedded Late Pleistocene al-Lisān marls is clearly visible. While we found occasional rolled chert artefacts of Middle Palaeolithic character in the al-Lisān deposits here, none have so far been observed in the Ghawr al-Katar series, despite the ubiquitous natural chert constituents of the conglomerates. The Ghawr al-Katar is intruded by a major basalt dyke. Given that the cooling of the basalts could provide a minimum age for the formation, we collected basalt samples, which are currently being processed.³

Investigations in the Ḍānā Conglomerate Formation on the adh-Dhrā' Plain

The third part of the field season centred on the adh-Dhrā' Plain, between the villages of Ghawr al-Mazra'a and adh-Dhrā', on the east shore of the Dead Sea adjacent to the al-Lisān Peninsula (Figs. 1 and 13). Our interest here was aroused by the Ḍānā Conglomerate (DC) Formation, which is lithologically and structurally similar to the Ghawr al-Katar Formation, but which, unlike the Ghawr al-Katar, is littered with abundant chert artefacts including simple flaked cobbles (see below Fig.1b). While the DC Formation was named for a type sequence located further south between Ḍānā and ash-Shawbak, it outcrops most extensively in this region (Khalil 1992:40-41). Here, the formation is manifest in two major exposures extending over approximately 20 square kilometres, situated north of the village of adh-Dhrā' and east of the larger town of Ghawr al-Mazra'a (Fig. 13). The outcrops extend to the east of the al-Karak road at the rift edge, and smaller outcrops occur south of Potash City.

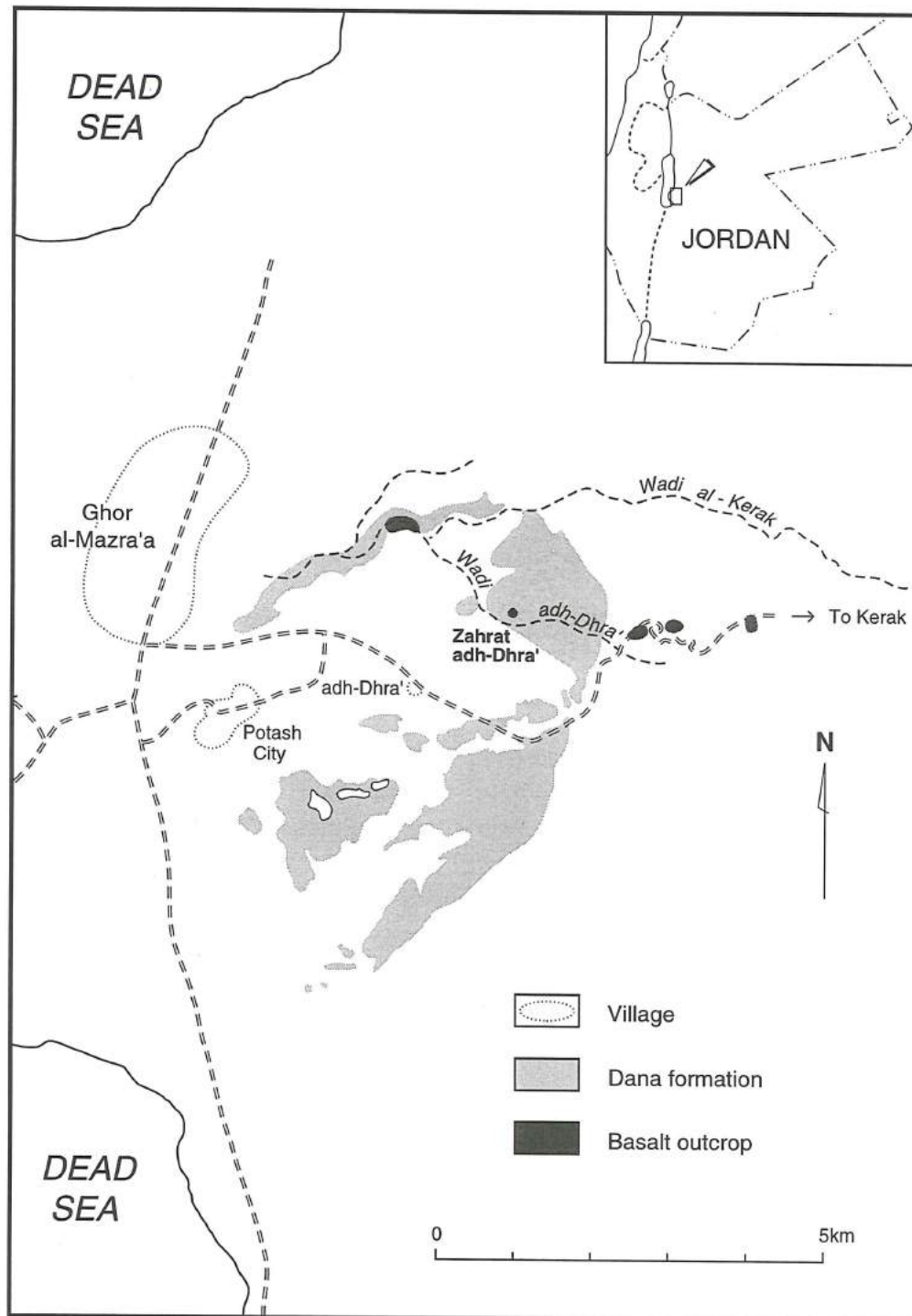
The interbedded bands of conglomerate and lacustrine limestone indicate that the sequence represents an alternation of lacustrine and fluvial/terrestrial conditions within the subsiding Rift Valley setting.

3. By David Foster of the La Trobe University School of Earth Sciences.

This sedimentary pattern is similar to that occurring further to the north in the Rift Valley, both within the Ghawr al-Katar Formation and at al-'Ubaydiyya (Bar-Yosef and Goren-Inbar 1993) where the earliest archaeological sites in southwest Asia have been found. Nearer to the edge of the rift and the adh-Dhrā' monocline, the Dānā For-

mation is composed of steeply-dipping, vertical and overturned fault blocks (Powell 1988: 93). Further west the dip is shallower, and tectonic activity has resulted in back-tilted blocks still further west in the adh-Dhrā' plain (Fig.14).

The age of the Dānā Formation is still unclear. The formation is divided in to an



13. The adh-Dhrā' / Ghawr al-Mashāri' region.



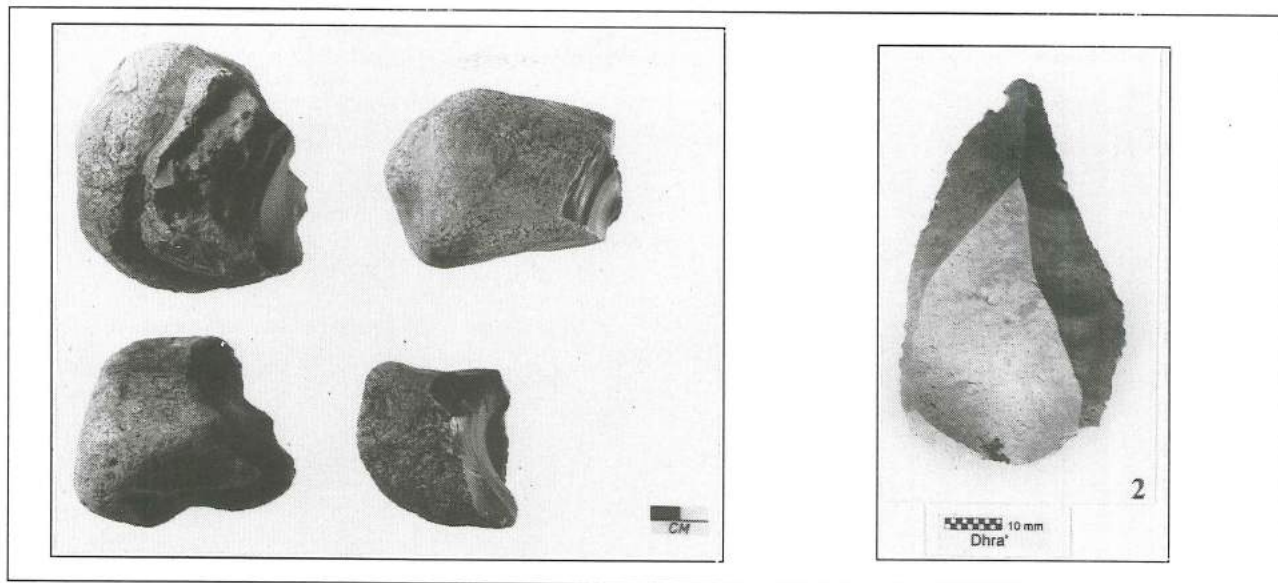
14. Back-tilted sediments of the Ḍānā Formation on Wādī adh-Dhra', capped by horizontally-bedded Late Pleistocene gravel. View to east.

earlier, lower member (DCL), and a later upper member (DCU). Doleritic basalts intrude the DC along the lower course of the Wādī al-Karak (Fig. 13). These have not been radiometrically dated, but are considered to be petrologically similar to samples from several kilometres north dated at 18 ± 3 million years (Barberi *et al.* 1980). Fossils have not been discovered in the DC in this area, though the calcarenites contain burrows considered similar to *Thalassinoides*. Fossil collections from the adh-Dhrā' area have also produced *Globigerina officinalis subbotina*, *G. senilis* and *G. tripartita*, thought to be Oligocene in age. By analogy then, the DCL is considered to be Oligocene to Miocene in age. On the other hand, the latest age for DCU is given by Bender (1974) as Middle Pleistocene, because in the Ḍānā area it is overlain by gravels containing flint implements diagnosed by him as Middle Pleistocene (Bender 1974, Powell 1988). In this connection it is worth noting that we have found several, white-patinated Levallois points (i.e., Middle Palaeolithic or Late Pleistocene) in the adh-Dhrā' plain (Fig.15), associated with the Pleistocene gravels which unconformably overlie the DC (Fig.14).

The barren plain of adh-Dhrā' has a sur-

prisingly rich archaeology, which has been the subject of numerous archaeological surveys. R. Raikes (1984) has observed that, in the past as now, the apparent barrenness of the area is somewhat misleading. While rainfall is extremely low, the area is well-watered by numerous springs, including 'Ayn as-Sikkīn, 'Ayn al-Mughra, and 'Ayn al-Ḥammām al-Ḥamra. Indeed the name of the largest town in the plain - al-Mazra'a - translates as 'the Farm'. At present the groundwaters are locally utilised to irrigate extensive vegetable gardens in the area. While illegal excavations in the region are rife, so that most encountered sites have been substantially damaged, fewer sites have undergone systematic excavations. Perhaps the best known of these is the Early Bronze Age town of Bāb adh-Dhrā', with its associated necropolis (Rast and Schaub 1981, Schaub and Rast 1989). Others also exist, for example the adh-Dhrā' Neolithic site excavated by Bennett (1980), and more recently by Kuijt and Mahasneh (n.d.). Nearby to this the 'Monumental Pillar' site has been excavated by Körber (1992).

Like ourselves, many researchers have found numerous artefacts typologically datable to the Middle Palaeolithic and Acheulian (Rollefson 1985). Numerous flaked



15. (1) Flaked cobbles, adh-Dhrā' quarry (Spot 7); (2) Levallois point, Pleistocene gravel cap, adh-Dhrā'.

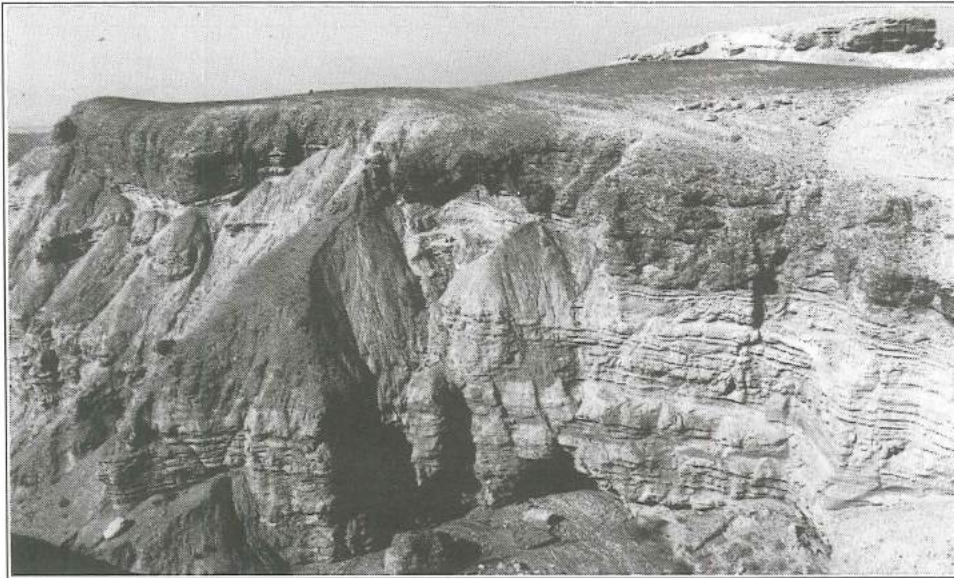
cobbles or 'choppers' (Fig.15) also present pose more of a problem. Not only could they be diagnostic of every period from the Oldowan onwards, but as we shall see, they are particularly common on flint quarry sites, where they may represent the initial stages of core reduction, or merely the testing of chert cobbles by itinerant knappers. Also, despite the likely attribution of points and handaxes to the Middle Palaeolithic and Acheulian, these artefacts like the choppers point to the pressing need for a stratigraphic framework for the Lower Palaeolithic of the adh-Dhrā' Plain.

Nevertheless, many simple flaked cobbles were strongly associated with the outcropping chert conglomerates of the DC, and there still remained the possibility that these artefacts were issuing from the Upper DC. If so, on archaeological grounds the rock beds could only date from the Early Pleistocene. This would be in line with the clear lithological similarities with the Ghawr al-Katar and perhaps the al-'Ubaydiyya sequences.

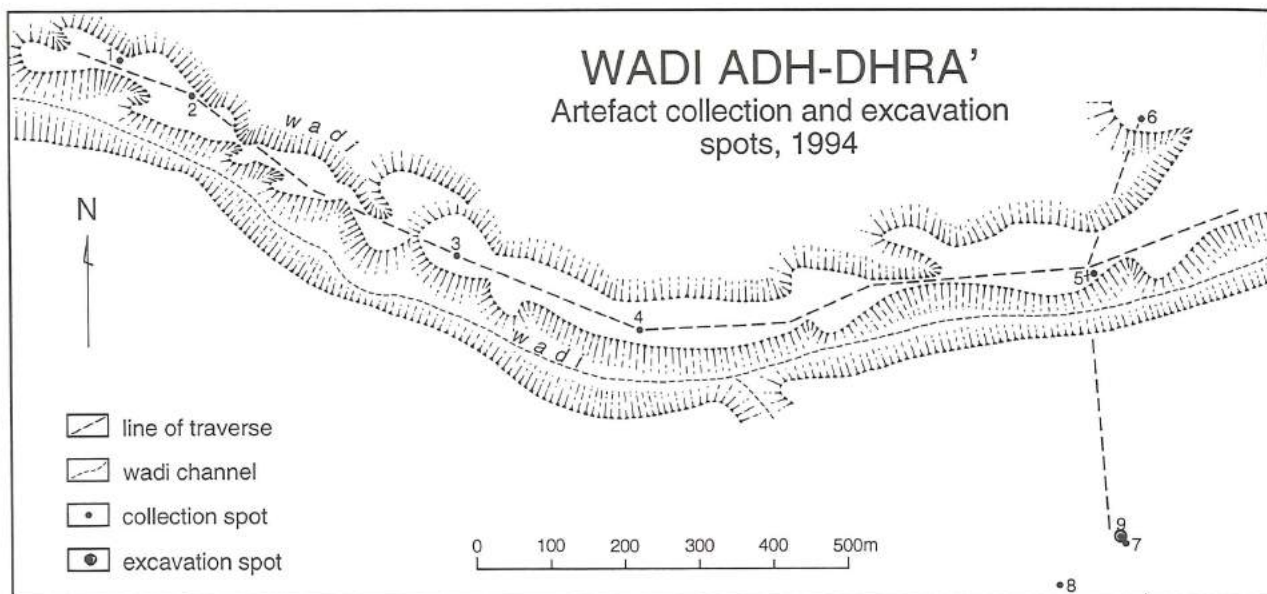
Given the possibility that the Upper DC might date to the Early to Middle Pleistocene, interest centred on the large number of flaked chert artefacts, including the flaked cobbles, which are distributed over

its thick chert beds (Fig.16). On flat surfaces, the naturally-rounded chert cobbles weather loose from the conglomerate and lie intermingled with prodigious numbers of flaked chert artefacts. The crucial question which needed to be resolved here was whether the artefacts were eroding *from* the conglomerate, and so dated from the Early/ Middle Pleistocene or earlier, or whether they were merely surficial, resulting from surface quarrying for chert well after the deposition of the DC.

Excavations at 'Spot 9' (Fig. 17), located on a broad, shallow slope of the chert-rich conglomerate, proved conclusive. Artefacts were distributed on top of the deposit, and filtered down some 30 cm though the upper five units of a 90 cm deep excavation pit (Fig. 18), but were not embedded within the conglomerate. The verdict must be that these are not among the earliest sites in Southwest Asia. Had artefacts been found in the Dānā Formation's alluvial chert-rich beds, they would have been rolled by water transport. In a few cases, yellow sandstone deposits exist which provide possible find-spots. Although we clambered up and down considerable areas of these rugged outcrops, both in this area and south of Potash City, no luck was had in finding *in situ* artefacts



16. Dānā Conglomerate Formation outcrop in Wādī adh-Dhrā', showing thick chert conglomerate (dark capping layer). Note human scale.

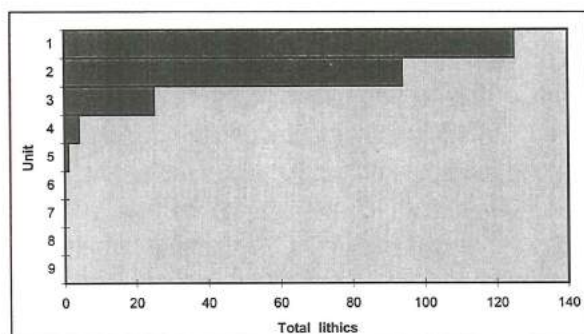


17. Artefact collection and excavation areas on the adh-Dhrā' Plain.

despite the numerous bands of thermally shattered flint present. We hope that the basalt samples from the Wādī al-Karak will settle whether the DC in this area antecedes the Plio-Pleistocene, and is thus earlier than the hominid lineage.

The Flint Quarries of the adh-Dhrā' Plain

Nevertheless, the millions of artefacts distributed across the chert conglomerates include handaxes and Levallois point cores, indicating the use of this barren place as a quarry over hundreds of thousands of years. While previous surveys in the adh-Dhrā' re-



18. Excavation of adh-Dhrā', Spot 9. Numbers of flaked chert artefacts according to depth.

gion have emphasized the many discrete sites present, it is also important to stress that these sites are overprinted (and often,

in chronological terms, 'underprinted') by the more or less continuous scatters of flaked stone artefacts that carpet much of the plain.

The chert beds produce countless rolled cortical cobbles, a form that serves as an immediately useful flake core (e.g. Fig.15). While flakes, cores and retouched tools are most abundant on the quarry, these items were also widely distributed in the surrounding region. Rather than accent discrete findspots, our sampling strategy was designed to capture any pattern in the lateral distribution of stone artefacts in relation to the major chert bands and on a variety of geological substrates across the plain. In order to sample this distribution, we made total artefact collections at points successively further away from the sources of the flat-topped Ḍānā chert conglomerates concentrated near the al-Karak road.

The scope of the survey was limited by time and local topographic features. To the east the al-Karak road immediately borders the vertical slopes of the rift valley edge. To the south, extensive vegetable gardens obscure and have silted over the ground surface. Immediately north of the gardens, the flat-topped ridges of Ḍānā Conglomerate and their overlying sediments are dissected by the deeply incised, westward-trending gorges of Wādī adh-Dhrā', Wādī al-Karak,

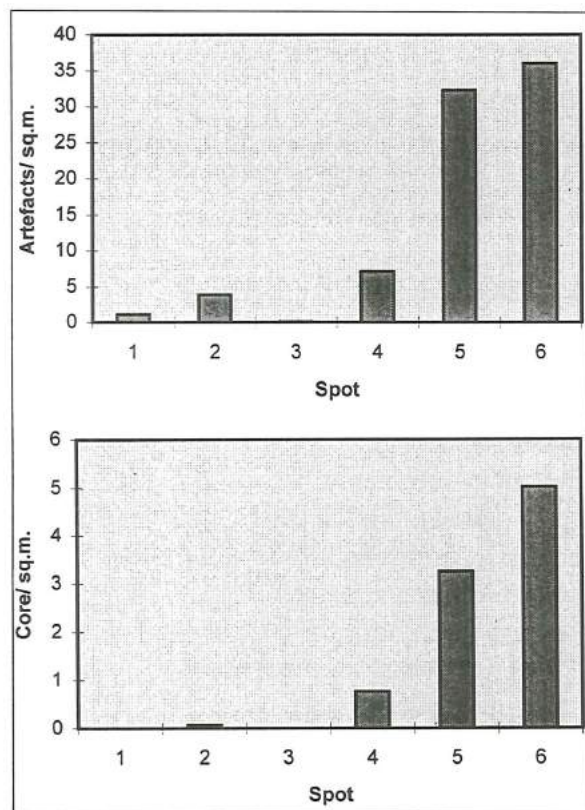
and their tributaries.

Therefore, four collection circles (of 3 m diameters) were effected at successive distances to the west of the conglomerates along a ridge overlooking the Wādī adh-Dhrā' (Fig. 17). Three collections (half this size) were also made on the conglomerates which served as the quarries (Fig. 19), of which Spot 5 and Spot 6 are reported here. The results reveal 'fall-off' curves in terms of artefact numbers and numbers of cores with distance (Fig. 20), as well as degree of reduction of the cobbles as indicated by cortex coverage, and also decreases in the average size of artefacts with distance. The pattern of transported artefacts indicate that the great majority of them emanate from the chert quarries, an additive process exacerbated over hundreds of thousands of years.

These patterns of distribution are usually associated with the transport of stone materials considerable distances (hundreds of kilometres) from the source (eg. Torrence 1986). Here we stress that we do not intend to explain the similar patterns encountered here, given the short distances involved, as resulting from exchange patterns, but as the casual, serial use of a raw material carried away over long periods from its source. Analogous to Renfrew's 'law of monotonic decrement', many scenarios of raw materi-



19. Artefact sampling at adh-Dhrā' chert quarry (Spot 6).



20. Flaked stone artefact distribution across adh-Dhrā' collection points. Artefacts / square metre (top) and cores/ square metres (bottom), according to sampling spot.

al procurement can ensure that “effective distance from a localised source will be a monotonic decreasing one” (Renfrew 1977: 72).

In the adh-Dhrā' Plain, the coherent fall-off patterns are not so much to be explained as a ‘distance-decay’ phenomenon, but rather, the massive amounts of flaked cobbles and chert cores on the conglomerate bands simply dwarf those numbers adjacent to it. Furthermore, the major practice of initial core reduction in this vicinity results in much higher cortex frequencies than away from it. There is some indication that re-touched artefacts are more common as distance from the quarry increases. While the dark brown chert cobbles of the Dānā conglomerate are distinctive, the geology of the region further complicates the distribution pattern. For example, one of the sampled areas consisted of barren lacustrine silts (Spot 3). Another (Spot 4) was located on a

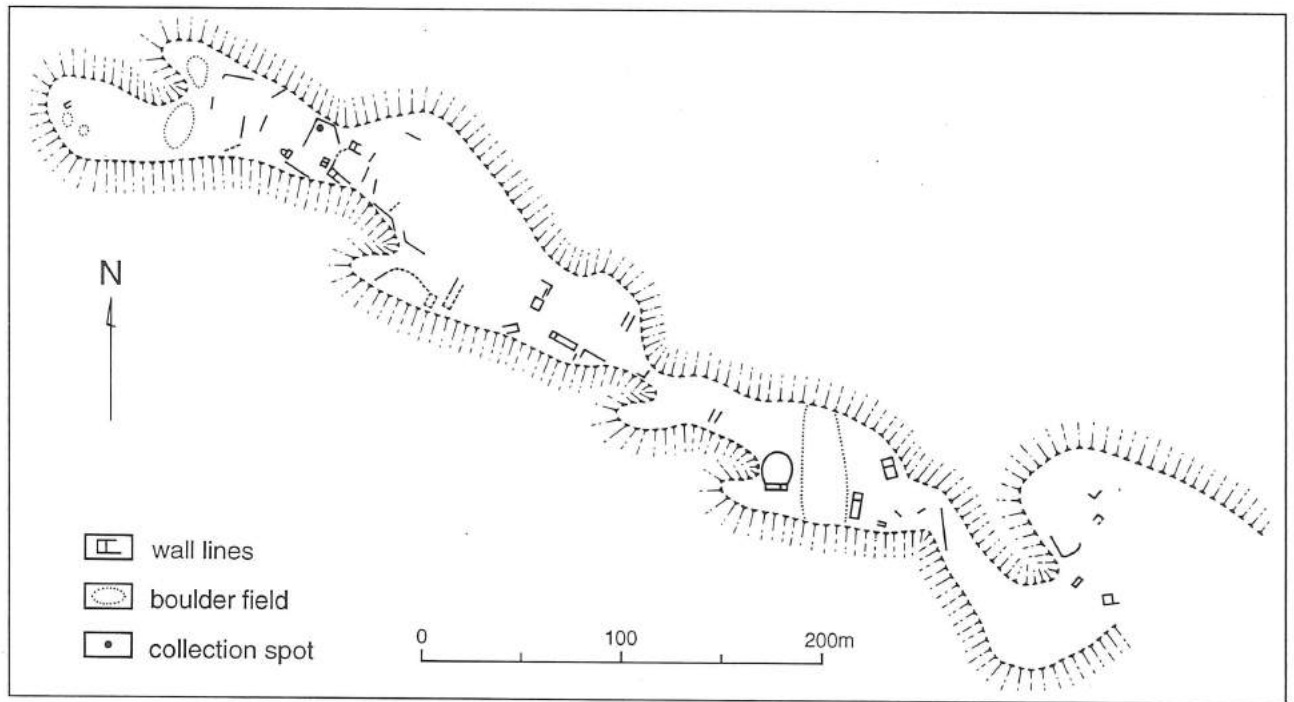
Late Pleistocene gravel cap (see Fig.14), with its secondary source of alluvial chert and rolled chert artefacts, and still another collection point (Spot 1) coincided with a major Middle Bronze Age town site (see below). While raw material origins cannot be vouchsafed for any single artefact in the adh-Dhrā' Plain, overall the coherent pattern of distribution indicates long-term use of the Dānā Conglomerate as a quarry for tool making.

The Middle Bronze Age Site of Zahrat adh-Dhrā'

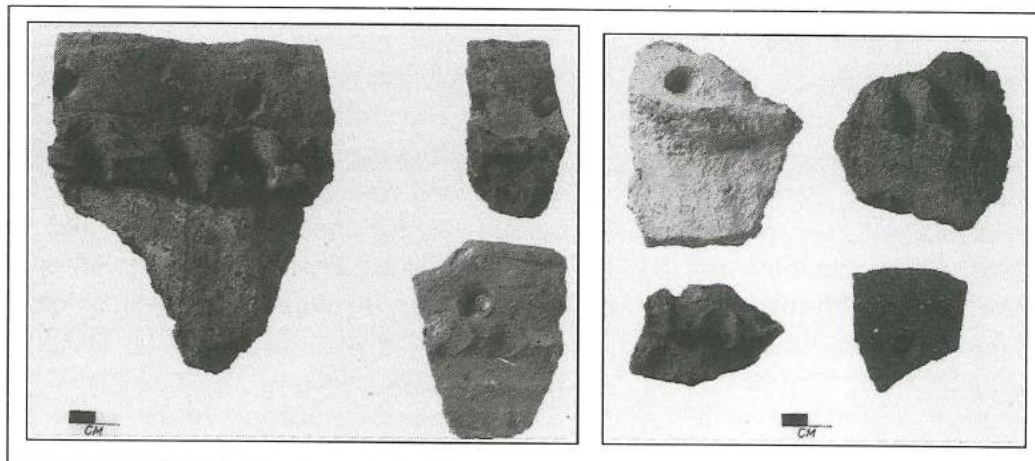
Our investigations of the Wādī adh-Dhra' flint quarry sites, described above, involved the sampling of surface artefacts at several collection points placed successively farther away from the quarries along the interfluvial ridge that runs between Wādī adh-Dhrā' to the south and a feeder gully to the north (see Fig. 17).

‘Spot 1’ and ‘Spot 2’ were placed in the middle of a large archaeological site located at the extreme western end of the ridge, which had been discovered by Phillip Macumber during earlier survey work in the area. This area is known as Zahrat adh-Dhrā' and this name we give to the site discovered here which has apparently not been described before. Many other surveys have been carried out in the region but appear to have been located outside of this specific area. To the north of Wādī al-Karak, Worschch (1985) discovered numerous sites of many periods. To the west, McConaughy (1981) located prehistoric sites in the fan of the Wādī al-Karak. However, survey reports do not appear to have reviewed the ridge under discussion.

In the context of our Pleistocene investigations at Dhrā', we did not have time to extensively investigate this large site, though plans of the major exposed buildings (Fig. 21) and collections of the distinctive surface ceramics were made (Fig. 22).



21. Surface architectural remains at Zahrat adh-Dhrā'.



22. Middle Bronze II pottery sherds from Zahrat adh-Dhrā'.

The site is characterised mainly by the remains of rectilinear buildings as well as a few curvilinear ones, built of stone boulders and cobbles. Many of the larger stones are composed of 'beach rock', which is a compressed and lithified sedimentary rock that is derived from a former Lake al-Lisān beach. Deposits of this soft and comparatively light stone lie only a short distance away from the eastern end of the site, over the gully to the north. The rock erodes out of section in large, squarish blocks extremely convenient for extensive building programs. Some of the eroded blocks here

exceed several metres in length but many come in smaller sizes.

Similar outcrops of rock occur on the steep rift edge slopes, three kilometres to the east, that rise up sharply at the edge of the Jordan Valley near the place where the adh-Dhrā' spring emerges. The stone was also utilised here as a building material in extensive and ambitious building programs from Chalcolithic times onwards, exemplified by Körber's (1992) 'Monumental Pillar' site and associated cross-country wall.

The most common building plan at Zahrat adh-Dhrā' is a one or two-roomed struc-

ture, located along the minor axis of a rectangular circuit wall (presumably enclosing a courtyard). Building units are free-standing, scattered widely over the ridge and extend back eastwards to its termination for some 600 m. At the eastern end of the site, huge blocks of beach rock have been dragged up on to the ridge top from the nearby quarry source. It is notable that the largest stones, well over two metres in length are distributed in a rough line at the eastern end of the site, some still standing upright, but with one large flat stone embedded in the ground, giving the impression of the remains of an entry gate within a fortified town wall.

On the southern face, several buildings have clearly been truncated by the deep incision of Wādī adh-Dhrā', and several similar buildings are to be found across the chasm to the south. This is an extraordinary occurrence, since it implies that the ca. 60 m deep channel of Wādī adh-Dhrā' has cut into the surrounding sediments only after the settlement was built, and every evidence suggests that this happened in the Middle Bronze Age II period. An explanation may lie in the model developed by Frumkin and colleagues (1994) of a 60 m rise in the level of the Dead Sea during the Early Bronze Age period and the subsequent drop in level at the end of this period, after which massive incision by the adjacent wadis such as Wādī al-Karak and Wādī adh-Dhrā' occurred in Holocene terraces (Donahue 1985). This proposition remains to be tested in the case of Zahrat adh-Dhrā'.

As described in the previous section, Zahrat adh-Dhrā' is covered with flaked chert artefacts - undiagnostic flakes for the most part. But the most relevant finds concerning the age of the site occur in the form of the many coarse ware pottery sherds which litter the site.

The most distinctive type is a cooking-pot rim shed characterised by a design of thumb-impressions applied to a raised clay

band, surmounted by a pattern of circular indentations. A second type bears a band of indented decoration, and a third has a band-combed decorative scheme (Fig. 22). These types are familiar Middle Bronze II ceramic types from northern Palestinian and Jordanian sites with examples found, *inter alia*, at Megiddo XV (Loud 1948: Pl. 22:6), Tall Beit Mirsim D (Albright 1933: Pl. 5:1) and Pella (Smith and Potts 1992, Pls 36-37).

Ceramic traditions and site types of the Middle Bronze Age have hitherto been unknown in the Plain of adh-Dhrā'. Thus far, similar pottery has been reported regionally from the Middle Bronze cairn tombs at Dayr 'Ayn 'Abātā, some thirty kilometres to the south (Politis 1993). In its setting in the Plain of adh-Dhrā', Zahrat adh-Dhrā' emerges as a unique and important settlement site.

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