EXCAVATIONS AT WZ 121, A CHALCOLITHIC SITE AT TUBNA, IN WĀDĪ ZIQLĀB

by

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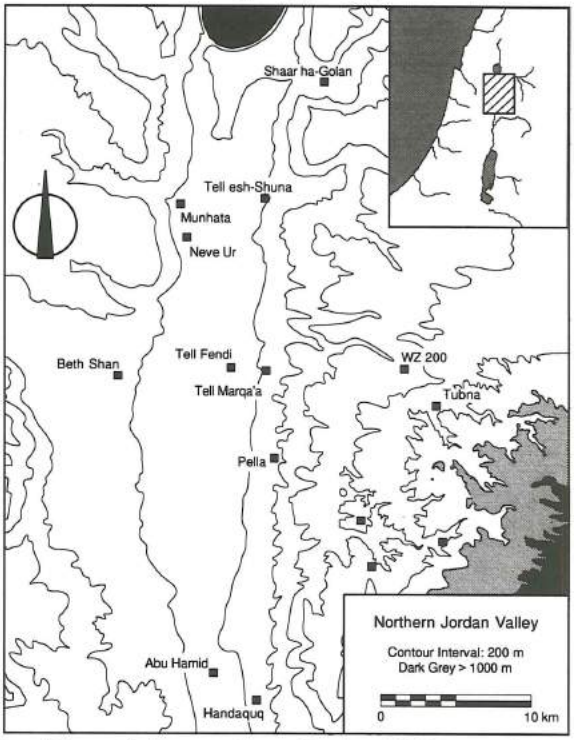
Introduction

During June and July of 1995, the Wādī Ziqlāb Project carried out excavation of a Chalcolithic settlement on the western slopes of Tubna, in the al-Kūra district, northern Jordan. The site had been discovered during the course of a short season of test trenching in 1993.

The site lies at an elevation of about 550 m asl in a small olive grove on a terrace built over limestone and overlooking Wady Summayl (Wādī 'Ayn Zubiya), one of Wādī Ziqlāb's main tributaries (Fig. 1). The nearest water source in antiquity, so far as we have been able to determine, would have been the stream some 100 m below the site. There is also a spring, 'Ayn Sirīn, about 1200 m to the northeast. Only about 1 km to the south of the site, oak-pistachio forest, mainly regenerated in recent times, gives some impression of what the environment of the region may have been like before widespread deforestation. The site itself has been disturbed by agricultural activities, including plowing, tree-planting, removal of stones for terrace construction, and probably the movement of fill during terrace construction. Most of the cultural remains we encountered occurred on a single terrace, with architecture concentrated near its southern end, but probe trenches also encountered fairly abundant Chalcolithic and some Byzantine artifacts upslope, along with a single stone-lined pit of Chalcolithic age, indicating that the site may originally have extended up to where the lowest modern houses now lie. Surface lithics on the lower terrace, meanwhile, extend from just south of the excavated areas more than 200 m to the northwest, although not all of these appear to be Chalcolithic. Many of the lithics to the far north appear to be of Middle Palaeolithic or Upper Palaeolithic age.



1. Map of the northern Jordan Valley and surroundings, showing the location of Tubna and selected Late Neolithic and Chalcolithic sites (E. Banning).

A test trench measuring 2 m x 1 m on this site during the summer of 1993 intersected a buried stone wall and was associated with undisturbed deposits, with abundant lithics and pottery sherds and fairly good preservation of bone, at a depth of approximately 50 cm. The general character of the material appeared to be either Late Neolithic or Chalcolithic. The purpose of broader excavations at this site was to determine its size, to estimate the number of structures, to uncover the plan of at least one structure, and to extract data on the character and distribution of pottery, lithics, fau-

nal and floral remains using the same methodologies we used at WZ 200, a Late Neolithic site we had excavated in 1990 and 1992 at the confluence of Wādī Summayl and Wādī Ziqlāb, about 3 km away. These include excavating by natural stratigraphic units, dry-screening excavated soils, gridding floors and surfaces into quadrats no greater than 50 cm on a side, and bagging the soil for floatation and micro-refuse analysis. In addition we hoped that the site might have Late Neolithic and Chalcolithic stratigraphic deposits, with evidence for the transition between them.

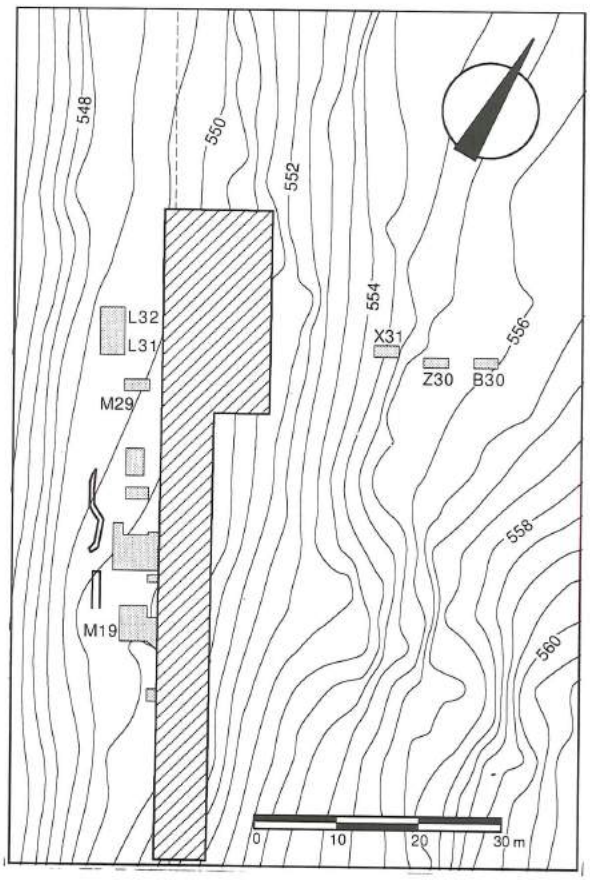
Remote Sensing

In May, before excavation commenced, a small team carried out survey of the main terrace on which site WZ 121 occurs. In addition to topographic surveying, this included a survey by differential proton magnetometer.[1]

The magnetic survey involves measuring differences in magnetic intensity simultaneously at a base station and at a series of points across the surface of the site, so that diurnal variations — changes in the earth's magnetic field over time — are discounted. Variations in magnetic intensity across the site can, therefore, be attributed to variations in the magnetic properties of materials on and beneath the surface of the earth, principally in the amount of iron present. Since the targets of greatest interest in this surface were buried walls, which we would expect to have been constructed of limestone, at least in their lower courses, we were looking mainly for linear "negative" anomalies — long, narrow areas showing the distinctive signature of materials with low magnetic resistivity — because limestone has extremely little iron content compared with the soil that surrounds and overlies it on the site. This is not so simple as looking for areas of low magnetic intensity, however, because at mid-latitudes the anomalies show both a negative and a positive peak. For materials of low magnetic resistivity surrounded by soil with higher resistivity, the low values should occur south of the high values. At latitudes where the magnetic "dip" or inclination is about 45°, as at Tubna, we would expect the negative peak to be slightly larger than the positive peak and the buried wall to be offset north of the negative peak by approximately the distance from the instrument to the centre of the limestone wall. Here the instruments were 1.0 m above the modern surface, and most of the limestone walls that excavations later detected were not buried very deeply, so we would expect this shift to be only in the order of 1.2 to 1.4 m.

Maps of magnetic variation across the site appear in Figures 2 and 3. The "hot spots" with very high "spikes"of magnetic intensity combined with somewhat smaller "lows" to the north mark locations where there is probably iron metal, such as nails or steel cans, close to the surface. The areas of interest are principally the "troughs" of low magnetic intensity, which we might expect to be associated with buried limestone walls that run north-south, and "troughs" with somewhat smaller "ridges" just north of them that could mark buried eastwest walls. Unfortunately, few of the negative anomalies are extremely linear, and there is not

1. L. A. Pavlish, C. d'Andrea and S. Ierullo did the magnetic survey, while E. Banning, M. Blackham and P. Racher carried out the topographic survey. Note that the grid used for the remote sensing, because the topographic survey was not complete, deviates from grid north by about 1°. Measurement spacing along each northsouth transect was 0.25 m, with 0.5 m between transects. The instrumentation consisted of two GSM-19T proton magnetormeters, with one-gamma precision, from the Physics Department at University of Toronto, one of which was used as a base station to correct for diurnal variations in the earth's magnetic field (differential magnetometry). The largest shifts in this field occurred in late morning and were as much as 20 gammas. Typical field intensity was in the order of 43000 gammas.



2. Topographic map of WZ 121, Tubna al-Gharbiyyah, showing location of magnetic survey (hatched). The 1995 magnetic survey at site WZ 121 (D. Lasby and E. Banning).

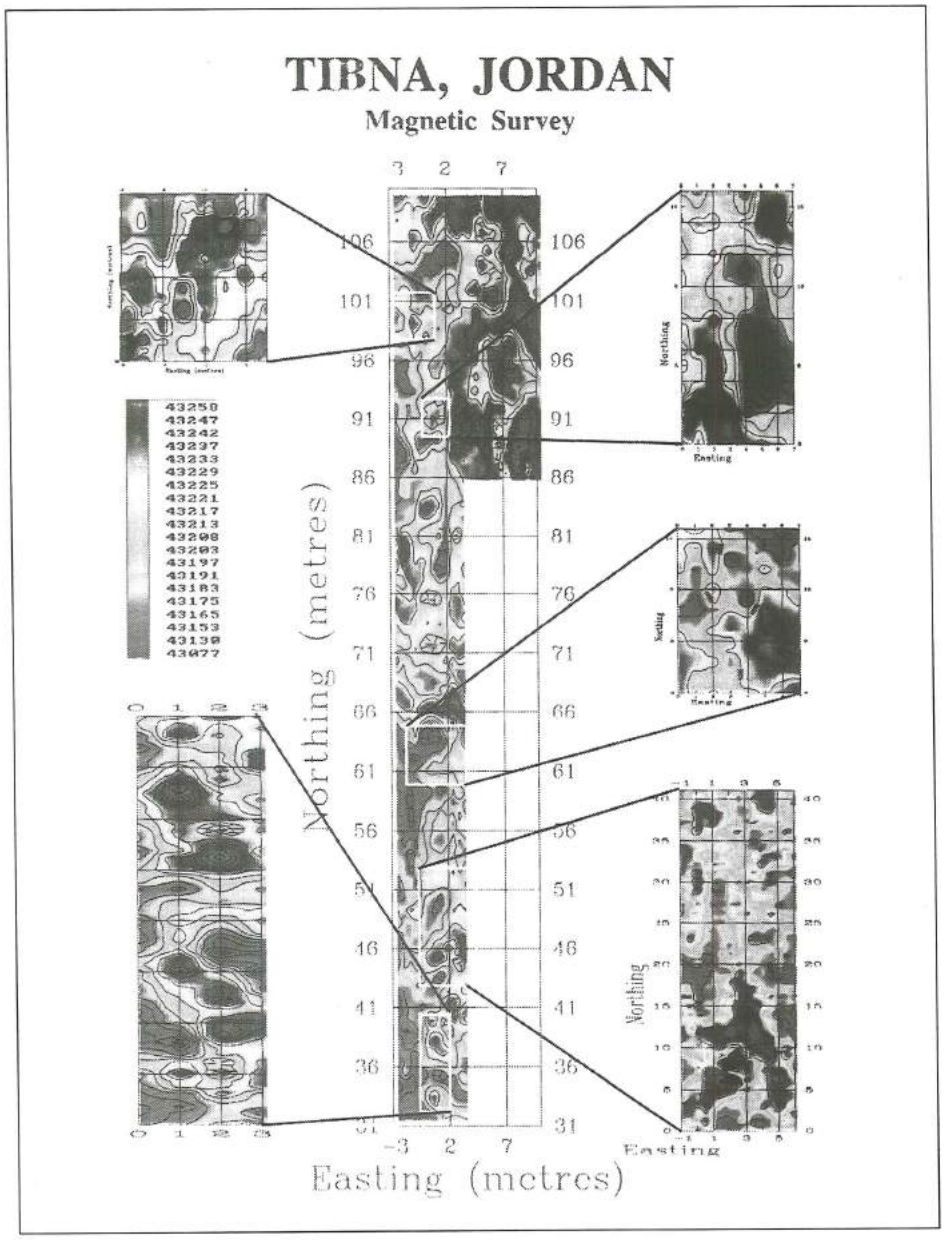
any really convincing evidence for buried structures. As later excavations showed, however, there was indeed quite a large limestone wall that seems to correspond with an anomaly that runs northsouth in the region of N19 to N22, and a positive anomaly, with a low just north of it, in P22, where excavations uncovered a stone-lined pit (see below). The most substantial negative anomalies, however, seem to mark places where bedrock is shallow; indeed bedrock outcrops just east and west of the site and comes close to the modern surface in many of our excavations. Deep pits in Area P21 may be responsible for the magnetic variation apparent there, but oddly it is a large negative anomaly similar to those that are due to bedrock near the surface, when pits into limestone would normally result in positive anomalies.

Excavation Areas

We imposed a 3 m x 3 m grid over the site, which we originally assumed was restricted to a single terrace on the hillside, using letters from west to east and integers from south to north, oriented to a grid north that was in fact roughly northwest (Fig. 4). The baseline, designated "P,"extends from a benchmark A on a limestone outcrop at the southern extremity of the site to the corner of a modern house visible on the hillside to the northwest. The test trench excavated in 1993, simply designated Area A, fell within the grid square now designated as N19. We began by excavating half-squares, each 3 m x 1.5 m in extent, in Areas P19, P22, P24, P27, P33, P35, N34, Q32 and Q34 to prospect for subsurface cultural deposits and architecture. Later we closed some of these Areas, especially in the more northerly part of the site, and opened additional excavation Areas in N16, M19, N19, N20, M20, M21, P21, L22, M22, N22, L23, M23, N23, M25, M26, M29, L32, L33, and M37. Many of these were placed so as to expose a reasonably large contiguous area with architecture, although the need to avoid damage to olive trees made this difficult. We also prospected for cultural remains upslope, requiring us to extend our grid farther east than we originally anticipated, with probes of either 1 m x 3 m or 1.5 m x 3 m in Areas E26, B31, X31, Z31, and A34. The excavations revealed a near-contiguous area of some 90 m^2 in the southern part of the site, about 30 m^2 in the northern part, with smaller exposures between and to the east.

Stratigraphy and Architecture of the Site

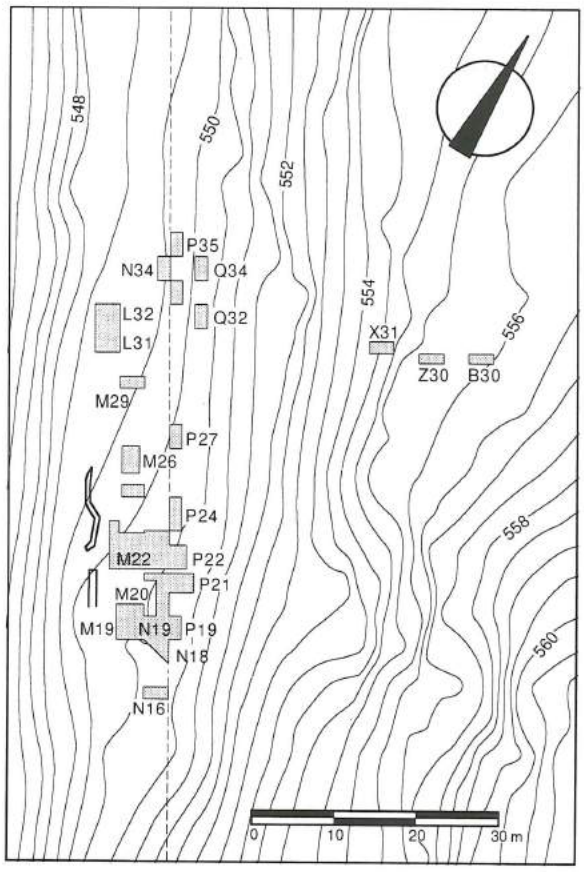
The gross stratification of the site consists of irregular bedrock, overlain by Chalcolithic deposits from 0.2 to more than 1 m thick, in turn covered by Chalcolithic walls and other Chalcolithic deposits from which pits were dug and later filled. All of this is capped by shallow deposits of Byzantine and modern age that appear to be related to



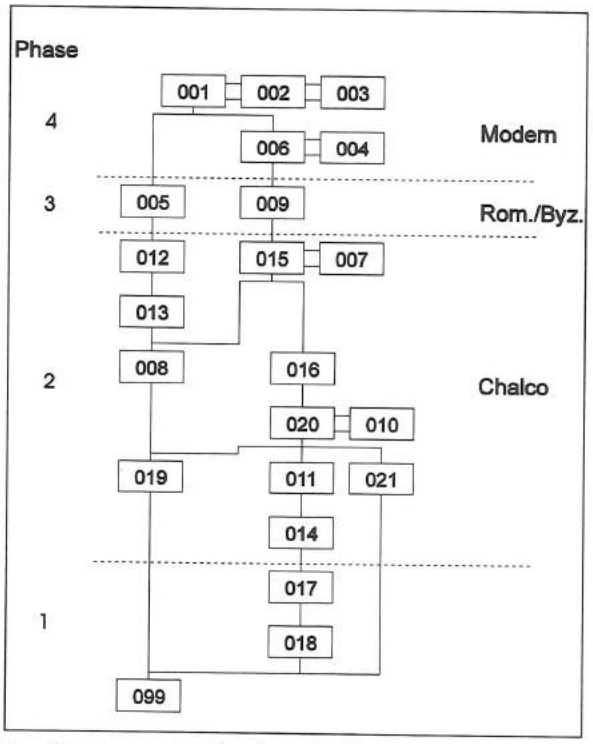
3. Map of magnetic intensity over the geophysical survey area at site WZ 121 (L. A. Pavlish).

agricultural activity on the site (Table 1). In at least one case (Area L32), Byzantine farmers appear to have used the remnants of prehistoric walls to pile stones during field clearance. Another Byzantine wall appears along the grid line between Areas M22 and N22. Architecture appears to be infrequent, perhaps as a result of the dispersion of households on the site, and usually not very well preserved, owing both to its proximity to the modern surface and to recent farmers' stone removal and planting of trees and vines.

The earliest human activity we have detected on the site (Phase 1) appears on bedrock, and Area N19 provides the best glimpse of it (Fig. 5). Here a hollow in the bedrock appears to have been modified by the addition of a crude wall that closes a gap on its western side and the hollow was later filled by rich deposits, including some living surfaces. We had hoped that deposits from this earliest phase would include some Late Neolithic material but, in spite of some ceramic attributes that hinted at possible Neolithic connections, we now see nothing in our sample that is really diagnostic of the Neolithic and there are no sherds that close-



4. Topographic map of WZ 121, Tubna al-Gharbiyyah. Location of excavation Areas at site WZ 121 in 1995 (E. Banning and D. Lasby).



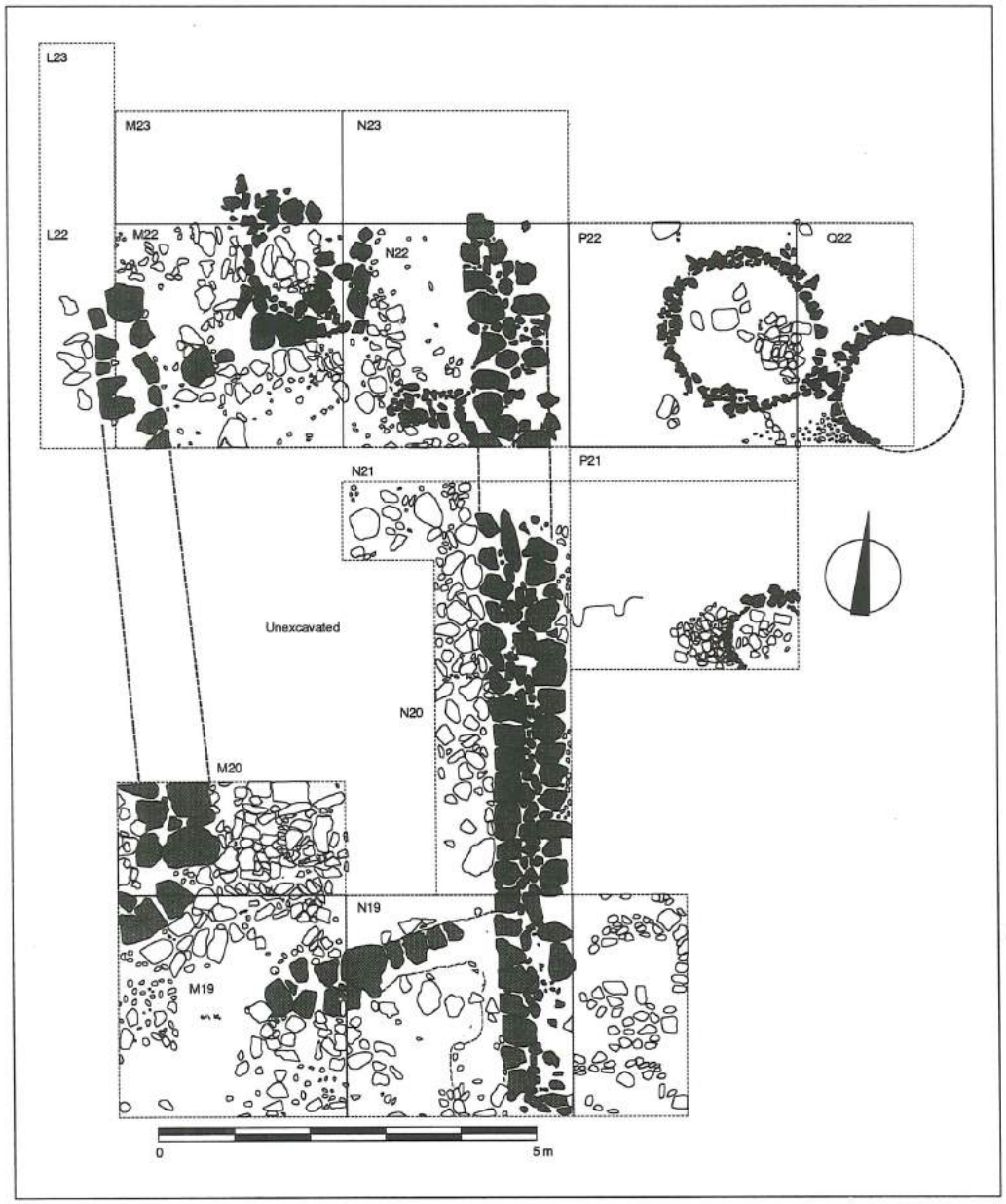
5. Harris matrix for deposits in the deep sounding in Area N19 at site WZ 126 (D. Lasby).

Table 1. Stratigraphic Phases at Tubna (WZ 121).

Phase	*Description*
4	Plowzone, modern site surface. Heavy disturbance.
3	Roman / Byzantine layer. Moderate disturbance.
2	Chalcolithic layer.
1	Early Chalcolithic layer, founded directly on bedrock.

ly parallel pottery from the nearby Late Neolithic site of Ṭabaqat al-Būma (WZ 200; Banning *et al.* 1992; 1994; 1996). It is possible that this hollow in the bedrock was roofed with some perishable material to provide a simple shelter. Similar bedrock pits, which seem to be dwelling pits of Chalcolithic Age, occur at other sites, such as Beth Shan (Fitzgerald 1934: 124). In other areas of the site, especially in the more northerly excavation Areas, we find abundant Chalcolithic material on bedrock, but without any features or architecture and it appears to represent either redeposited material or dispersed activity on the site, probably during Phase 2.

The principal architectural features of Phase 2, also of Chalcolithic Age, are what seem to be two very large buildings, one partially exposed in Areas L31 and L32 (Fig. 6) and the other extending into areas M19, N19, M20, N20, M21, N21, L22, M22, N22 and, possibly, N23. In the former, we have the building's northwestern corner and much of its western side. The corner was later cut by a Chalcolithic stone-lined pit (see below). In the latter, we have two parallel walls about 5 m apart and apparently marking the eastern and western sides of the building, but poor preservation near the surface at the north end and later pitting at the south end seem to have truncated the building's extremities and made it impossible to determine its full extent. Of crosswalls only wall M22.020 and wall A.002 (from the 1993 probe trench) are very convincing, and the former, at least, seems to be a later addition, perhaps associated with another pit like the one in L32. Neither crosswall is bonded with the large walls.



6. Architectural plan of structures in the southern part of the 1995 excavations at site WZ 121 in 1995 (E. Rachman and E. Banning). Grey shading on stones indicates walls.

In both buildings construction is very similar and generally quite massive, and there appears to have been at least one episode of rebuilding prior to Byzantine use of the walls as stone repositories in Phase 3. One to three courses of stones are preserved, and these are generally large, squarish boulders that give the walls something of a megalithic appearance. Most of the walls, at least in their last building phase, are double-leaf walls. We could detect no signs of foundation trenches but rather the walls appear to have been constructed on top of Chalcolithic surfaces, which in some cases may have been laid down intentionally to make the ground a little more level prior to construction. In spite of this, the wall on the east side of the more southerly building is founded at a generally higher level than that on the west (M20.015, M22.009), and the surface between slopes down to the west. The eastern wall, in its earliest phase, appears to have extended only about 5 m from north to south, but the double-leaf wall built on top of it (N19.008=N20.008=N22.003) was at least 12 m long.

We found no hearths or other domestic

features within the buildings, and their exact function has yet to be determined, although it seems likely that they are portions of habitations with walled courtyards. Detailed analysis of the finds within the structures, including micro-refuse from some of the surfaces in M20, N22 and N23, may help us identify activities there.

Outside the southern structure, just east of its eastern wall, we found two well constructed, stone-lined pits and a number of other less formal pits. The stone-lined pits, P22.003 and Q22.005, had been cut from a surface at least as high as the bottom of the modern plough zone. In fact their associated use-surfaces may well have been higher than the modern surface and have been eroded or plowed away. Both pits are approximately circular in plan, with diameters a little under 2 m, and have nearly vertical sides lined with angular and sub-angular stones 10 to 15 cm across. The largest of the two (P22.003) was cut some 20 cm into the underlying limestone bedrock (locus 099). There may have been a third such pit in Area N18, just south of one of the large walls, where a circular floor has been chipped into the bedrock. Later pitting and rodent disturbance has obliterated traces of the upper part of this pit, if it in fact existed.

Pits P22.003 and Q22.005 were filled with fine, somewhat ashy soil containing relatively large Chalcolithic sherds and animal bones, but relatively few lithics (pit fills P22.004 and Q22.007), and the P22 pit was then covered with a flagstone pavement (locus P22.009) that was only partially preserved below the plough zone. In Q22.007 there is a substantial disturbance, particularly in the southeast corner from either animal burrowing or former tree roots, while P22.004 is disturbed by the roots of a recent grape vine. The function of these pits, and the pavement that covered at least one of them, has yet to be determined, but their contents seem to represent repeated deposits of domestic rubbish, probably from hearths or ovens, over a relatively brief period of time. The sherds in the deposits are frequently flat-lying or gently sloping, giving the appearance of a large number of small, interleaved surfaces, as you might expect from the dumping of basket-loads of soil, and the fills' compaction varies substantially, but there is no evidence of less ashy soil intervening between the surfaces. It is noteworthy that similar pits with ash and pavements occurred, for example, at Tall al-Farah North (de Vaux 1957: 561) and Megiddo (Loud 1948: 59). They also appear similar to cist-graves at more southerly sites, such as Shiqmim (Levy 1987), but the ones at Tubna show no evidence of use as graves.

Phase 3 is represented on the main terrace by dark deposits containing fairly frequent Byzantine sherds in addition to Chalcolithic material, while Phase 4 represents modern pits, mainly associated with tree-planting, and plough zone.

On the upper terrace, although some trenches detected substantial deposits containing Chalcolithic artifacts, only Area B31 intersected any Chalcolithic architecture. This (B30.003) is another stone-lined pit, similar to those in P22 and Q22. Its fill (B30.004) is very rocky, however, unlike those on the lower terrace.

Ceramics

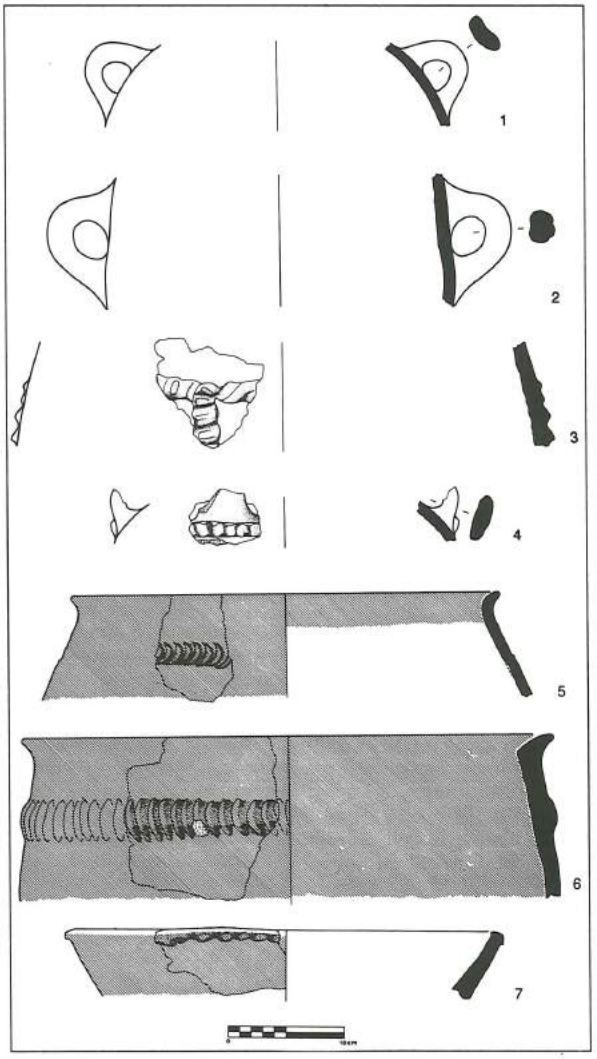
The pottery from WZ 121, except for occasional sherds of Byzantine date in upper loci, consists mainly of coarsely grit-tempered pottery with numerous parallels in such Chalcolithic sites as Pella (Smith and Hanbury-Tenison 1992), Abū Hābīl (de Contenson 1960; Leonard 1992), Abū Ḥāmid (Dollfus and Kafafi 1986; 1993; Dollfus *et al.* 1988), Neve Ur (Perrot 1967), and Tall Fendi (Kareem 1989; Blackham *et al.* 1998). Preliminary observations in the field indicate that inclusions, often up to 3 mm in size, consist of chert, limestone or grog, and several distict fabrics are recog-

nizable. Most common are thin to medium sherds of red, yellow or orange paste with angular chert inclusions and no slip. A less common fabric is usually yellow or light brown, of medium thickness, and with a brown or buff grog temper. Grey and black fabrics, again usually with angular chert inclusions, are also fairly common. A rarer fabric tends to be finer, with a thick white or buff slip and occasionally with red or brown paint. All are handmade, and determination of the exact methods of pot-building and final classification of fabrics is underway in Toronto.

The excavations yielded a wide repertoire of forms, with jars of various types apparently dominant. Many of these are somewhat inverted, without necks, making forms similar to "holemouth" jars except for the slight out-flaring at the lip (e.g., Figs. 7 and 8). There are also large numbers with short everted necks, often with scalloped decoration just below (Fig. 7: 5) and some with short to medium vertical necks that make an angle close to 90° with the shoulder. The distinction between "holemouth"jars with out-flaring lips and jars with short, everted necks is subtle, but the latter tend to show considerable thickening at the inflexion and are generally heavier. A few of the smaller jars have fairly vertical, only slightly inverted bodies with slightly out-turning rims (Fig. 8: 1), and appear to be from "beaker" forms. So far only two sherds, one a rim and shoulder and the other a handle and base, appear to come from churns and there are no clear examples of cornets.

Bowls include hemispherical, very slightly S-profile (Fig. 8: 19), and probably V-shaped forms. There is one example of a shallow bowl with a pedestal base (Fig. 8: 21).

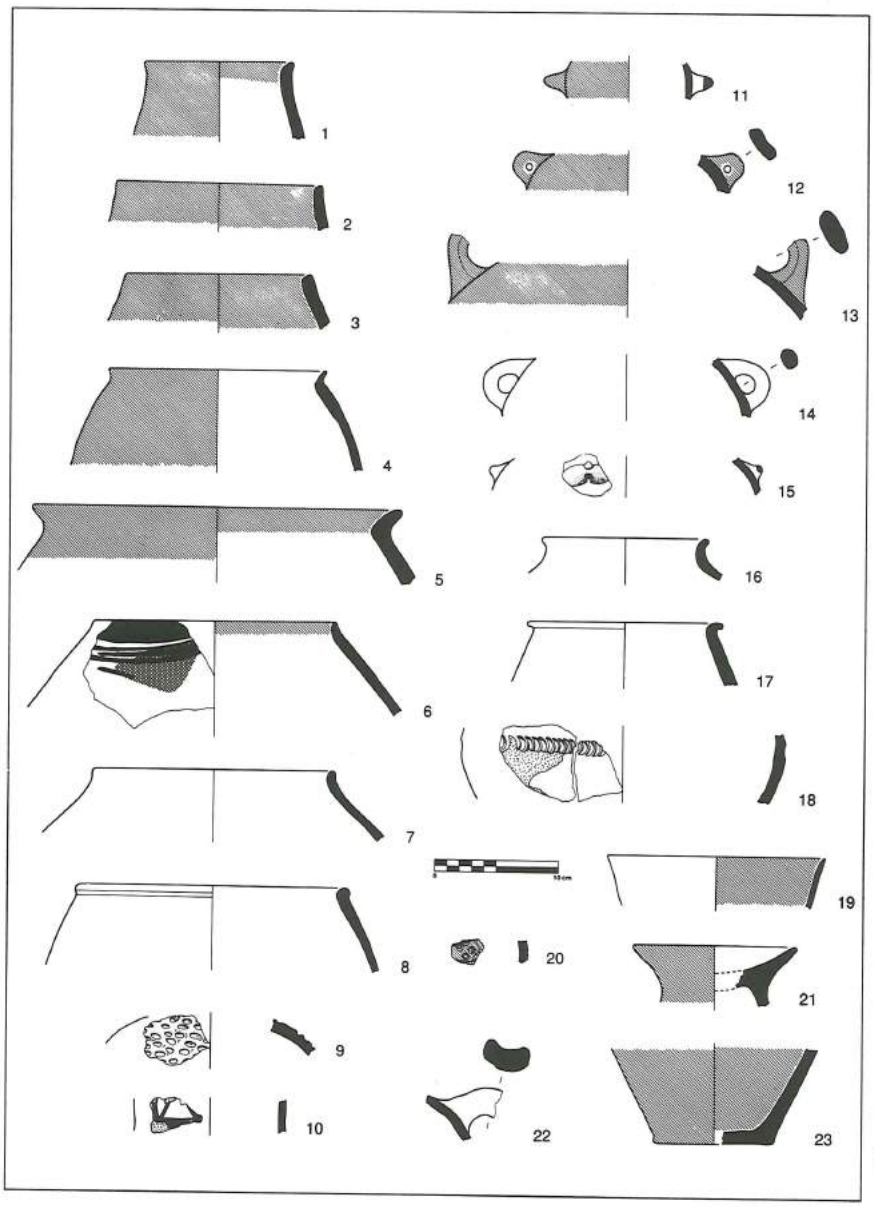
Bases are usually flat and V-shaped (Fig. 8: 23), with no evidence so far of mat impressions. Ring bases and concave bases are fairly common, but pedestal bases (Fig. 8: 21) are very rare.



7. Portions of large jars, some with applied or impressed decoration, and a large bowl (7) from site WZ 121 (J. Pfaff).

Handles are mainly strap handles with relatively flat (Fig. 7: 4), oval or somewhat U-shaped (Figs. 7: 1; 8: 22) sections (raised ridges on the two edges and a trough down the middle). There is often a large, flat void inside each handle attachment that results from folding of the clay during the handles' manufacture. Smaller handles are often round (Fig. 8: 14) or triangular (Fig. 8: 11) in section, and there are fairly frequent examples of small to medium pierced lug handles (Fig. 8: 15), again with either rounded or triangular sections. Ledge handles are virtually non-existent at the site.

Decoration consists primarily of applied and molded strips ("rope molding"), often



8. Smaller jars, handles and bowls from site WZ 121 (J. Pfaff).

arranged horizontally below the rims or necks of jars. One sherd (Fig. 7: 3) displayed both vertical and horizontal rope molding. Fairly common are jars with scalloped decoration apparently made by impressing and somewhat lifting the soft clay with a curved spatula, usually 2-3 cm in width ("spatula impressed,"Figs 7: 5; 8: 18). Much more rare are punctate sherds, one of which has been impressed with a hollow reed (Fig. 8: 20). Red slip and red or brown paint occurs on a low but substantial proportion of sherds. Notably we seem to have painted decoration on the sherds with the thick white or pinkish buff slip, but so far we have not been able to discern any geometric patterns in the painting that might relate it to the "cream wares" found at early Chalcolithic sites in the region, such as Kataret as-Samra (Leonard 1989), Tal Tsaf (Gophna and Sadeh 1989), or Tall Abū Hābīl (de Contenson 1960: 35; Leonard 1992: 71).

Lithics

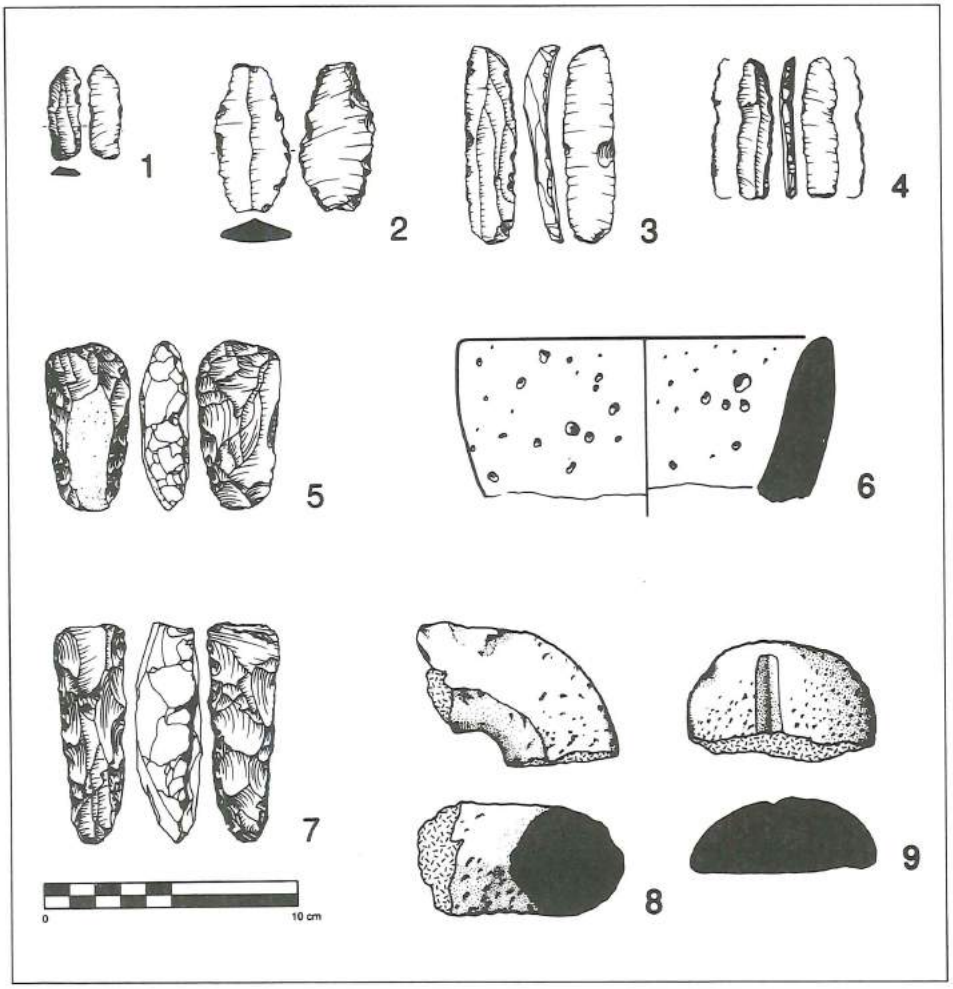
The lithic assemblage is predominantly "expedient," with high proportions of utilized but unretouched flakes and their fragments, and "amorphous"cores, but there is also an important component of formed

tools, including ground stone (cf. Fig. 9).

The chipped stone assemblage detailed here includes some 3430 artifacts recovered from Area N19 near the southern end of the excavations. This Area was chosen for preliminary analysis because all phases of occupation at the site are present. Because the proportion of the total assemblage so far analysed is small, it is currently impossible to determine to what degree this material is typical of the entire site.

The classification of this assemblage was by the same criteria used for the chipped stone assemblage from Tall Fendi (Blackham *et al.* 1998). As is typical for the Chalcolithic, it is dominated by debitage and *ad hoc* tools, with extensively retouched, formed tools making up only a very small proportion. Generally speaking, there does not seem to have been any significant changes in lithic production strategy, or in the intensity of reduction over the period of occupation at the site. In all phases flakes (including proximal fragments) make up 20 to 30% of the debitage, and outnumber blades by a factor of five to 20.

The range of formed tools is broadly similar to that typically found at other Chalcolithic sites in the region, including Tall Fendi (Blackham *et al.* 1998). One notable difference between this assemblage and the one from Tall Fendi is that the density of formed tools seems to be somewhat lower here. Interestingly enough, the proportion of the formed tool assemblage made up of heavily retouched utilized elements, however, is much higher. The implications of this are presently unknown, but explaining these differences will be an important focus of future research. Although the number of



9. A selection of lithics from site WZ 119, immediately downhill from site WZ 121 and probably derived from it. Included are a sickle blade (4), two adzes (5 and 7), a basalt bowl (6), a fragment of a ring-shaped weight (8), and a "shaft straightener" (9) (J. Pfaff).

formed tools recovered from Area N19 is quite small, some general observations can be recorded regarding the assemblage as a whole.

Among the formed tools (Table 2), several tool types typical of the Chalcolithic are common, including adzes (Fig. 9: 5, 7), sickle blades (Fig. 9: 4), and fan scrapers. Projectile points seem to be absent.

Adzes are perhaps the most interesting type of tool recovered at the site, and are relatively frequent in both excavations and on the surface of the site. All stages of production, use, maintenance [2] and discard are well represented in this assemblage. Adzes were manufactured from a coarse white chert, outcrops of which are present in the Upper Cretaceous limestones at the southern end of the site. This raw material was used only for the manufacture of adzes, and was probably selected because of its high fracture toughness as compared with other more finely grained raw materials. It is also noteworthy that the 1981 Wādī Ziqlāb Survey recorded several scatters of flakes and cores of this material just across the wadi to the west (sites WZ 93, 94 and 95), which may represent Chalcolithic quarrying sites rather than Palaeolithic scatters. Exploring the possibility that these tools were the product of specialized or semi-specialized labour will be a major research priority.

The sickle blades and backed blades are typically narrow, with nibbled or minimally retouched cutting edges and abrupt or semi-abrupt backing retouch and truncated or abruptly retouched ends.

The fan scrapers found at the site are of the oval or round types. Both end-struck and side-struck forms are present. These tools do not seem to have been made from true tabular flint; instead the curvature of the cortical surface seems to indicate that they were struck from large, flat-sided nodules.

Perforators are represented mainly in the form of broken bit fragments. Bits are triangular in profile, with unifacial abrupt retouch along both margins, and a triangular or trapezoidal cross-section.

Debitage composition (Table 3) is as expected for the Chalcolithic (see Blackham *et al.* 1998, for a brief description). "Debitage," as the term is used here, refers to all flakes, blades and fragments that have not been retouched to make formed tools, and excludes cores and core fragments (cf. Sullivan and Rosen 1985). Lithic production seems to have been based on the reduction of amorphous cores, with the aim of quickly producing large, minimally prepared flakes suitable for use as *ad hoc* tools. Given the small size of the assemblage from Phase 1, and the recent disturbances in Phases 3 and 4, it is impossible to state with any certainty whether or not there were any significant

Table 2. Summary of lithic formed tools from Area N19 at site WZ 121 by stratigraphic phase.

Tool	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*
Adze	-	-	-	1
Adze Resharpening Flake	-	-	-	1
Axe	1	-	-	-
Backed Blade	-	1	-	1
Discoid Scraper	1	-	-	-
Notch	-	2	2	1
Perforator Fragment	-	1	1	1
Retouched Element	2	9	-	5
Scraper	-	1	-	-
Sickle Blade	-	1	1	2
Tabular Fan Scraper Fragment	-	1	-	-
Total:	4	16	4	12

Table 3. Summary of debitage from Area N19 at site WZ 121 by stratigraphic phase.

Element	*Phase 1*	*%*	*Phase 2*	*%*	*Phase 3*	*%*	*Phase 4*	*%*
Flake	38	20.2	258	18.3	71	17.4	119	13.3
PF	20	10.6	128	9.1.	48	11.8	82	9.2
MDF	76	40.4	664	47.1	183	45.0	513	57.3
SDF	17	9.0	119	8.5	46	11.3	72	8.0
SDPF	3	1.6	20	1.4	2	0.5	0	0.0
SDMDF	34	18.1	220	15.6	57	14.0	109	12.1
Total:	188		1409		407		895	

Element	*Phase 1*	*%*	*Phase 2*	*%*	*Phase 3*	*%*	*Phase 4*	*%*
Blade	0	0.0	12	14.5	14	20.3	9	12.0
PB	3	50.0	19	22.9	12	17.4	17	22.7
MDB	2	33.3	41	49.4	38	55.1	39	52.0
SDB	0	0.0	2	2.4	1	1.5	3	4.0
SDPB	0	0.0	0	0.0	0	0.0	0	0.0
SDMDB	1	16.7	9	10.8	4	5.8	7	9.3
Total:	6		83		69		75	

Element	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*
Chunk	17	130	27	64
Core	0	6	0	7
CTE	0	5	1	5
Tool	4	16	4	12
Total:	21	157	32	88

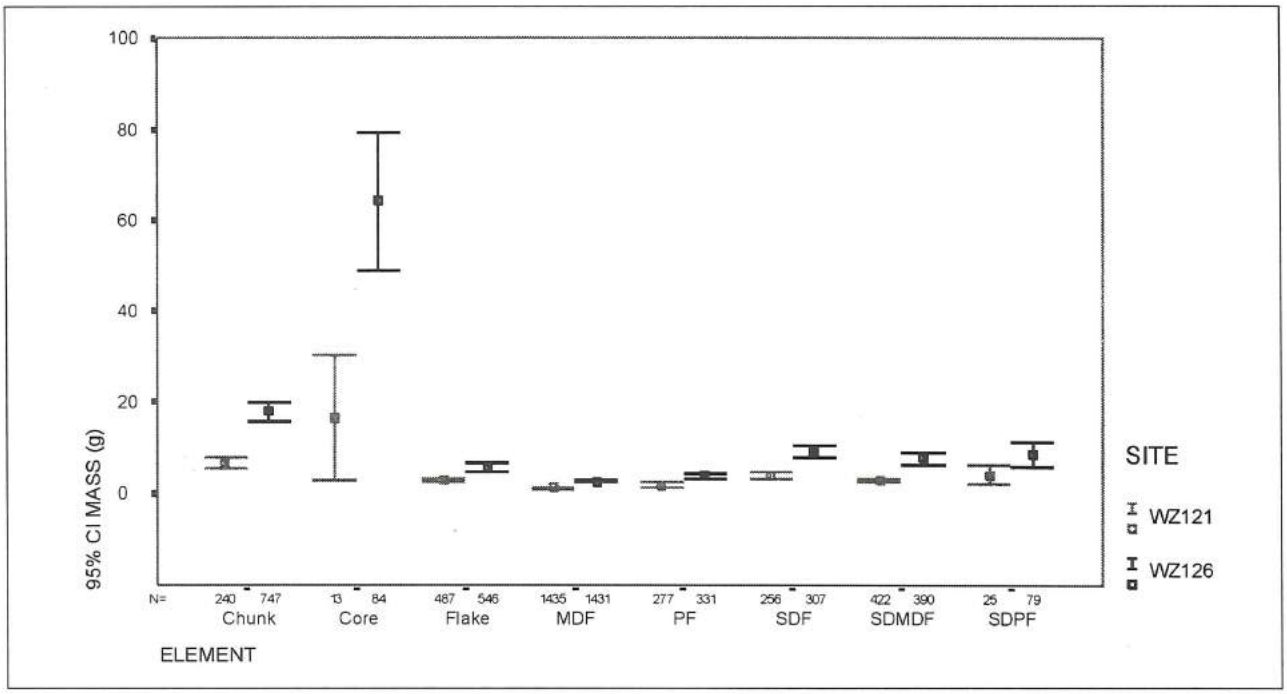
2. Note the adze-resharpening flake included as part of Table 2.

changes in lithic production strategy over time. Certainly the figures from Phases 1 and 2 would suggest that there were no major changes during the Chalcolithic, as these phases show remarkably consistent statistics. We can expect that most or all of the lithics in phases 3 and 4 are residual, representing Chalcolithic material redeposited in later times, but there may be some sorting there by size or shape.

What is interesting about this assemblage, as compared with the Chalcolithic debitage recovered from Tall Fendi (Blackham *et al.* 1998), is that the intensity of reduction seems to be far higher at Tubna. Greater reduction intensity can be seen in the debitage ratios (Table 4), which show that the number of flakes and secondary decortication flakes per core is far higher. The number of chunks per core is also much higher. All of this suggests that cores were being reduced to such an extent that they become unrecognizable as such, and are now classified as chunks. These ratios may be substantiated by the information in Figure 10, which shows that the average mass for each element type is significantly lower at Tubna (WZ 121) than at Tall Fendi (WZ 126). Unfortunately, it is impossible at present to determine with any certainty whether these differences are due only to variations in reduction intensity or are also influenced by differences in the average nodule size of the raw material. Smaller raw material would tend to result in smaller flake elements, and could also explain the scarcity of cores. Discriminating between these alternatives will be a priority for fu-

Table 4. Debitage assemblage ratios from Area N19 at site WZ 121 by stratigraphic phase.

Elements	*Phase 1*	*Phase 2*	*Phase 3*	*Phase 4*
Flakes per Blade	19.3	12.5	4.6	7.7
Flakes per SDF	2.9	2.8	2.5	2.8
Flakes per Core	-	64.3	-	28.7
SDF per Core	-	23.2	-	10.3
Flakes per Chunk	3.4	3.0	4.4	3.1
SDF per Chunk	1.2	1.1	1.8	1.1
Chunks per Core	-	21.7	-	9.1



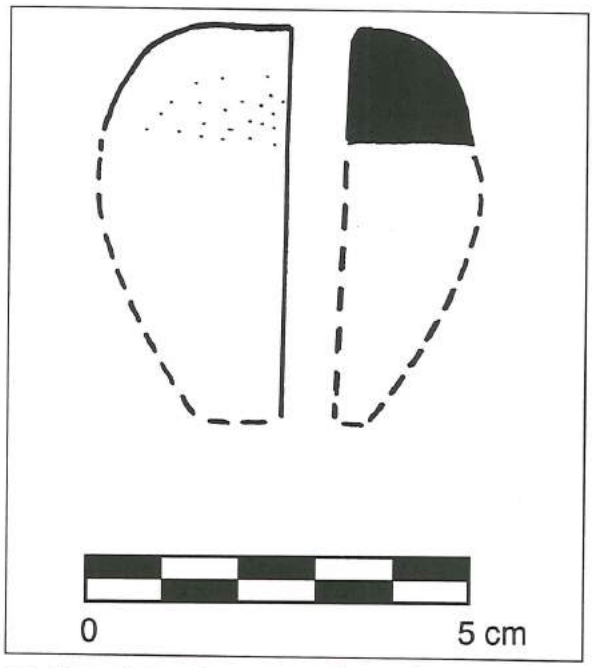
10. 95% confidence intervals or mean mass of element at Tubna (site WZ 121) and Tall Fendi (WZ 126). Flake and blade element counts are the sum of complete and proximal elements. PF = Proximal Flake Fragment, MDF = Mideal/Distal Flake Fragment, SDF = Secondary Decortication Flake, SDPF = Secondary Decortication Proximal Flake Fragment, SDMDF = Secondary Decortication Medial/Distal Flake Fragment, PB = Proximal Blade Fragment, MDB = Medial/Distal Blade Fragment, SDB = Secondary Decortication Blade, SDBPB = Secondary Decortication Proximal Blade Fragment, SDMDB = Secondary Decortication Medial/Distal Blade Fragment.

ture research. More intense reduction might well have been caused by the difficulty of obtaining raw material at Tubna, where the principal source seems to have been cobbles from the wadi bottom, some 100 m below the site, down a steep and treacherous slope. In contrast, the costs of raw material acquisition would have been much lower at Tall Fendi, where such cobbles are available in the channel of Wādī Ziqlāb, immediately north of the site.

Ground-stone technology appears to have been intensive at the site, although we found a higher density of fragments of grinding stones and weights downslope at locality WZ 119, where it may have come to rest after being discarded at the edge of WZ 121, than in the excavations at WZ 121 itself. Among the finer work in ground stone were fragments of what appear to have been chalices and of two haematite mace heads (Fig. 11). There were also fragments of several basalt bowls or mortars, as well as pestle fragments.

Osteological and Botanical Remains

As has often happened during the course of the Wādī Ziqlāb Project, preservation of osteological remains has not been very good, while preservation of plant macroremains has been extremely poor. Nonetheless, we did collect 12 sediment samples for floatation and a large number of bones and bone fragments. We also have sediment samples that we intend to use for phytolith analysis.



11. One of two fragmentary haematite mace heads from site WZ 121 (E. Banning).

Although a thorough understanding of the economic implications of the remains must await the completion of analysis, preliminary indications are that the fauna include substantial numbers of domesticated sheep/goat, cattle and pig.

Micro-refuse

One of the foci of our research is an attempt to identify activity areas through study of microscopic remains of lithic debris, bone and pottery chips, shell and other materials found on house floors and outdoor surfaces.

In three parts of the site, we gridded surfaces into quadrats of 25 cm x 25 cm and collected all the soil for this type of analysis, much as we did at the Late Neolithic site of Ṭabaqat al-Būma. Analysis of the these samples in Toronto is underway, under the direction of Paul Racher.

Residue Analysis

Another focus of our research is an attempt to identify the function of vessels through analysis of chemical residues absorbed into their fabric during use. We very carefully excavated and removed a sample of 81 sherds from good Chalcolithic contexts along with accompanying sediment volumes, enclosed them in aluminum foil and stored them in a freezer to await processing to remove organic compounds and analysis by Gas Chromatography-Mass Spectrometry (GC-MS). The reason for analysing a small sediment sample associated with each sherd is to check for contamination from the burial environment (cf.

Heron *et al.* 1991), while freezing is intended to prevent or slow down chemical alteration of residues in the sherds after excavation. Such chemical alteration could be accelerated by sudden increase in temperature or humidity.

It is our hope that prehistoric chemical residues (mainly fatty acids) will be preserved in at least many of the sherds, and that we will be able to associate them with vessels' former contents (cf. Rottlander and Schlichtherle 1978, 1983; Rottlander 1990; Skibo 1992; Haldane 1993). Among the substances with which we will compare any preserved residues are olive oil, wine, beer, and dairy products. If successful, this research will contribute to our understanding of the origins of dairying, which some authors would place in the Chalcolithic (e.g., Levy 1983), as well as of brewing, wine-making and olive pressing. Until recently, our only evidence for dairying in the Chalcolithic has been indirect: the presence of "churn" fragments among the pottery (Kaplan 1954: 97; Hanbury-Tenison 1986: 38-86). Liphschitz *et al.* (1991), meanwhile, have argued that "the earliest widespread use of olives in Israel was in the Early Bronze Age." If the residue analyses should show evidence for widespread use of vessels to store olives or their oil, however, we would have to reassess this statement. Alicia Beck will be undertaking the GC-MS work.

WZ 121 in a Regional Perspective

Site WZ 121, as one of very few partially excavated Chalcolithic sites in the hills of northern Jordan, allows us to begin to see how the Chalcolithic in this area fits into the southern Levant as a whole. Compared with Ghassulian and related sites in the southern Jordan Valley, and with Chalcolithic sites in the middle Jordan Valley (e.g., Tall Abū Ḥāmid (Dollfus *et al.* 1988, Pella (McNicoll *et al.* 1992), site WZ 121 seems to have a more dispersed settlement pattern and a much smaller repertoire of material culture. This material culture also seems to be rather more "rustic" in that the pottery is almost exclusively coarse wares, even in forms that are found elsewhere in thinner, finer fabrics. The lithics are dominated by "expedient" or *ad hoc* technology and heavy tools, such as adzes, and show some evidence of more intensive reduction.

An interesting but puzzling aspect of Chalcolithic settlement in and around Wādī Ziqlāb is evidence that it is highly clustered. Although most of the one-kilometre quadrats of the 1981 Wādī Ziqlāb Survey turned up no evidence of Chalcolithic material, the neighbourhood of Tubna appears to have been extensively occupied during the Chalcolithic. In addition to the single Chalcolithic sherd that the 1981 survey found at Tall al-'Ajami Tubna (WZ 6), there is a small but reasonably dense scatter of artifacts, apparently quite similar to those from WZ 121, in the fields and yards around some modern houses on the southeastern outskirts of Tubna (WZ 127). These include sherds from large jars (Fig. 7: 5, 6) with distinctive "scallop" applied decoration. There is a broad, low-density lithic scatter on the slopes near the boy's school at the south end of Tubna that probably dates, in whole or in part, to the Chalcolithic (WZ 129). Local informants claim that a cave on this slope that is now closed off contains a spring or well that could have attracted Chalcolithic settlement, and that there had once been another well closer to the southern end of Ottoman Tubna. In addition, lithic scatters on the west side of Wādī Summayl (WZ 93, 94 and 95), about halfway between Tubna and Kufr al-Mā', may have something to do with the production of Chalcolithic adzes, to judge from the raw material, which is the soft, chalky chert that is typically white with red or orange staining. Originally these rather non-descript, large flakes and amorphous cores were judged to be "Palaeolithic or later" in age, but now a Chalcolithic date seems

more likely. It is noteworthy that these upland sites are not only all at elevations around 500-600 m, scattered over an area of only some 3 km^2, but are also located near the eastern edge of relatively flat table-land, at elevations of 300-500 m, with Brown Stony Soils that are typically the most fertile in these highlands (Fisher *et al.* 1966: 26-27) and are currently heavily exploited for production of wheat and pulses.

Recently the Wādī al-Yābis Survey discovered what may be a similar cluster of Chalcolithic activity at an elevation near 500 m, in the neighbourhood of Tall Maqlūb (Palumbo *et al* 1990). There were found two Late Chalcolithic sites, one of which may be associated with a large dolmen field, that may "represent the first successful dry-farming and olive tree domestication on the highlands" (Mabry and Palumbo 1992: 68-69). Interestingly, these sites are also located fairly close to table-land with Brown Stony Soils that surrounds Kufr Abīl and occurs in patches near Ḥalāwa.

Apart from the cluster of Chalcolithic activity near Tubna, and the possible cluster in Wādī al-Yābis, the nearest Chalcolithic sites are much closer to, or in the Jordan Valley. These include Tall Fendi on the lower banks of Wādī Ziqlāb; Abū Hābīl, Abū Ḥāmid, al-Ḥandaqūq and Pella somewhat to the south; and Beth Shan, Jiftlik, and Neve Ur just across the Jordan River. At elevations much higher than Tubna, in or near the upper reaches of Wādī Ziqlāb, we currently have no evidence for Chalcolithic occupation. The lack of Chalcolithic sites on the plateau may in part be due to lack of intensive survey, as comparable terrain in the Jarash region turns out to have had fairly numerous Chalcolithic sites (Hanbury-Tenison 1986: Figs. 8 and 9). Around Jarash, too, sites seem to be fairly well-clustered, and occur at elevations around 700 m, only a little higher than in Wādī Ziqlāb or Wādī al-Yābis, in what Hanbury-Tenison (1986: 46) describes as "open steppe."

Another interesting aspect of Chalcolithic settlement pattern in the region is that sites are either low talls in the Jordan Valley, generally within about 2 km of the Jordan River, or are on the upper slopes of hills and ridges at elevations of 400-600 m. This appears consistent with Hanbury-Tenison's (1987) observation that in the Jarash region, "Chalcolithic sites are high up towards the top of south or west facing slopes, with access to water at some distance, and covering at least two hectares." In the case of site WZ 121, the closest and most convenient source of water would probably be the wadi floor some 100 m below the site, or a spring that locals tell us once occurred about 1 km to the south. 'Ayn Sirīn is really quite a difficult walk to the northeast.

Although our sample sizes are small, current evidence suggests that Late Neolithic sites in the region tend to occur either in the Jordan Valley or near the bottoms of deep wadis, while village sites of the Early Bronze Age seem to occur in the Jordan Valley and up on the plateau (elevations greater than 800 m) and small Early Bronze Age sites down in the wadi bottoms. One might well ask why the distribution of Chalcolithic sites in the region, by contrast, seems to show a cluster of sites on the upper slopes of hills about half-way up the plateau, at elevations around 400 to 600 m. It is possible that this distribution has something to do with the development of an olive-oil industry, as the zone around modern Tubna has been a prime area for the production of olive oil for many centuries (Banning 1985: 140-44). Local farmers have told us that the high elevations at the east end of Wādī Ziqlāb's drainage basin are too windy to produce good crops of olives, while the depths of the Jordan Valley are too hot. The rocky 'Terra Rossas' and 'Brown Stony Soils' around Tubna, however, are apparently ideal for olive trees (Fisher *et al.*

1966: 49). The area in central Wādī al-Yābis where Palumbo *et al.* (1990) have also found Chalcolithic sites and the areas near Jarash where Hanbury-Tenison (1986) reports Late Chalcolithic sites are similarly favourable for olive production. Sites in the Jordan Valley, such as Tulaylāt al-Ghassūl (Mallon *et al.* 1934: 40) and Pella (Hanbury-Tenison 1986: 80), show significant amounts of cultivated olive pits among their plant remains. As Hanbury-Tenison (1986: 87) points out, their presence at such sites "does not mean that the trees were irrigated, or that the environment was different in antiquity ... and olives could easily have been picked in the Transjordanian hills and carried to Ghassul." As noted above, Liphschitz *et al.* (1991) would date the beginnings of such an industry somewhat later, and one of the things that remains to be understood is exactly how olives may have been processed in the Chalcolithic period. It is possible that the wide repertoire of basalt "grinding" fragments at upland sites such as WZ 121 have something to do with the crushing of olives and pressing of oil (cf. Epstein 1993). It is also noteworthy that there are two "cup-mark mortars" at site WZ 121, similar to ones that Epstein suggests were used for extracting oil.

Conclusion

Site WZ 121 provides new evidence for variety among Chalcolithic sites in northern Transjordan, but does not provide enough of a stratified sequence to shed light on the transition from the Late Neolithic or to the Early Bronze Age. It does provide particularly good evidence for the nature of Chalcolithic settlement and economy in the hills bordering the Jordan Valley, where Chalcolithic farmers may have produced olives or olive oil to be consumed by more populous sites in the Jordan Valley and beyond. Upland sites like WZ 121 may also have been important loci for the production of pastoral products, such as ghee (clarified butter). These are hypotheses we hope to test through chemical analysis of absorbed residues in pottery.

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