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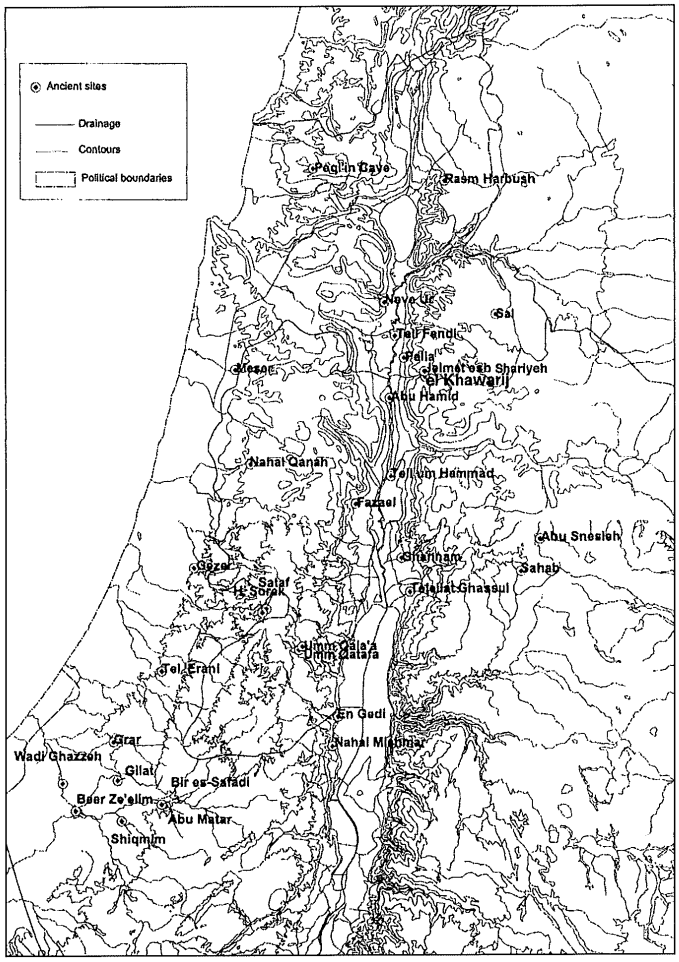
The Wādī ar-Rayyān Archaeological Project (WRAP): Investigating the Chalcolithic – Early Bronze Age Transition

Introduction

Chalcolithic sites in the Jordan Valley are now relatively well understood, and an overarching chronology is beginning to be established (Lovell 2001). In addition, specific questions about the nature of interaction are beginning to be addressed (*e.g.* Roux and Courty 1997). The nature of settlement and exploitation of highland regions remains under-examined and of great interest. Despite this most of the Chalcolithic sites so-far excavated come from low-lying areas (*e.g.* Tulaylāt al-Ghassūl, Abū Ḥāmid, Tall Findī *etc.*). Very few sites have been excavated above 400m, the natural habitat for olive, but if olive was the developing crop in the Chalcolithic then one would expect a fair number of sites in this highland ecology[1]. The two sites which form the focus of the Wādī ar-Rayyān Archaeological Project (WRAP) lie between 400 and 500m asl (FIG. 1) and excavation here is intended to examine the relationship between olive domestication, olive oil production and the transition from the Chalcolithic to the Early Bronze Age.

Geographic shifts have been suggested as part of the explanation for the apparent break between the Chalcolithic and Early Bronze Age periods (*see* Lovell 2002). Meadow's work (2001, 2005) suggests that olives were domesticated by the Middle Chalcolithic period, confirming an original surmise by Zohary and Spiegel-Roy (1975). It is generally presumed that olive oil was a feature of Early Bronze Age trade with Egypt (Ben-Tor 1986: 10, 14, 16, 1991: 8; Stager 1985; Joffe 1993; *cf* Ward 1991: 20, n 4), and we can also document a significant antiquity to interaction between the two regions (*e.g.* Bar-Yosef Mayer 2002). It may be that this new horticultural resource made it possible for Chalcolithic inhabitants to more fully exploit new highland territory (*see* Gophna and Portugali 1988).

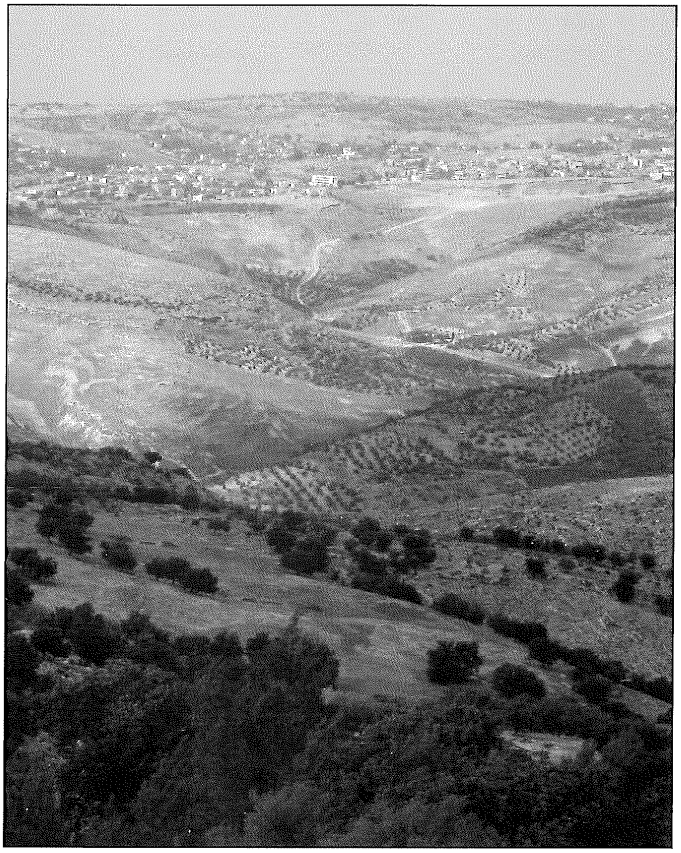


1. Map of southern Levant showing location of al-Khawārij and Jilmit ash-Shariyya.

[1] Visibility or identification of late Chalcolithic sites may be affected by our understanding of typology in this respect. Many sites in surveys are simply designated Chalco-EBA because dating survey sherds is notoriously difficult (see Lovell *et al.* 2005). The University of Toronto's Wādī Ziqlāb project (*e.g.* Banning *et al.* 1998) is redressing the balance by sounding a variety of sites up and down the wadi. It is hoped that the Wādī ar-Rayyān project may be able to integrate with their results.

The site of al-Khawārij lies on a long terrace (FIG. 2) overlooking the Wādī ar-Rayyān (previously known as the Wādī al-Yābis). The site was located in the Wādī al-Yābis survey in the 1980s along with another Chalcolithic site, Jilmit ash-Shariyya (Palumbo *et al.* 1990). The WRAP began in 2003 with an intensive survey of the site of al-Khawārij (Lovell *et al.* 2005), and has progressed to full-scale excavation in 2004[2]. WRAP was set up as an intensive, targeted survey and excavation program designed to investigate olive production in the upland region of Jordan at the end of the Chalcolithic period.

Preliminary results from recent seasons have already been published in brief format (Lovell *et al.* 2005, *forthcoming*). This paper will confine itself to matters of research design and application.



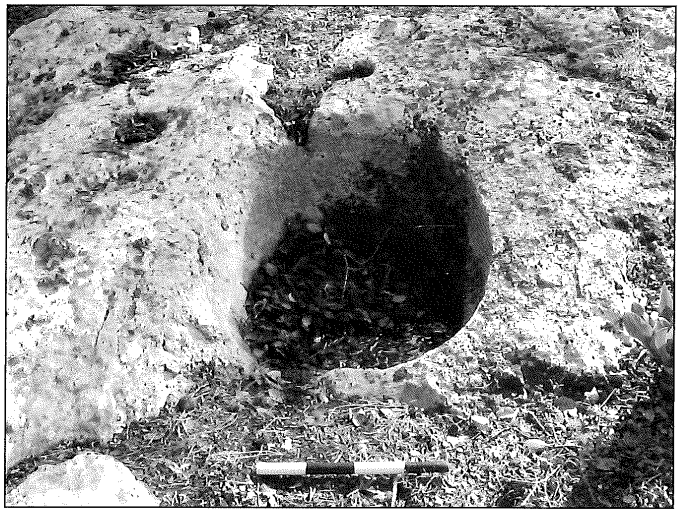
2. al-Khawārij, looking northeast from Ḥalāwa, 'Ajlūn district (Photograph: P. Kottaras for WRAP).

Survey (2003)

During preliminary visits to both al-Khawārij and Jilmit ash-Shariyya[3] we had noted the numerous rock-cut installations that peppered the protruding bedrock (FIG. 3). We felt that these might be associated with some kind of agricultural production[4]. Rock cuttings are notoriously difficult to date and it seemed that one way to attack the problem was via mapping the associated artefact scatters and examining the relationship of rock-cut installations to concentrations of artefacts[5].

The first step was to conduct a full survey of the site itself, the results of which have been published in preliminary form (Lovell *et al.* 2005). The aim was to map the frequency of artefact scatters and to produce a detailed map of the visible surface features that would later inform excavation.

Certainly some of the rock cut features, and perhaps some extant walls, date to post Chalcolithic times. There is evidence for Byzantine cisterns and well heads within our survey area (predominantly on hill tops or vantage points), but the vast majority of artefacts recovered dated to the Chalcolithic



3. Rock-cut installation Features 361, 362 and 363 in unit F9 (Photograph: A. Browne for WRAP).

[2] We particularly thank Dr Fawwaz Al-Khraysheh, Director General of the Department of Antiquities, and his staff in the 'Ammān and 'Ajlūn offices for generous assistance during our time in Jordan. The Wādī ar-Rayyān Archaeological Project is funded by the *Australian Research Council* (DP0342465). The project is based at the University of Sydney. We thank His Excellency, John Tilemann, and his staff at the Australian Embassy in Amman, for invaluable logistic support.

[3] A reconnaissance survey in 2001 was funded by an *Australian Academy of the Humanities* travel grant. I thank Alex Wasse (then Assistant Director, CBRL) and his trusty Landrover for generous assistance at that time.

[4] See also Gibson *et al.* 1991, who argued similarly for their site in the Judean hills.

[5] Van den Brink has made some headway with similar work at Nevallat (van den Brink *et al.* 2001, *pers. comm.*) and determining a *terminus ante quem* for similar rock cuttings via stratigraphic association is possible at other sites, see for instance Giv'at Haoranim (Scheftelowitz and Oren 2004).

period, with some possible EBA sherds (Lovell *et al.* 2005).

Excavation (2004)

The careful surface survey of 2003 located several areas of rectilinear architecture in association with dense surface scatters of artefacts. On this basis, after preliminary studies of the associated finds, six main areas were selected for excavation (Areas A to F) and in each of these areas at least two 5 x 5m squares[6] were excavated. The result of these excavations are still under study (Lovell *et al. in press*), however some brief points can be made concerning those areas that are of value in illustrating general approach and research aims.

Area C

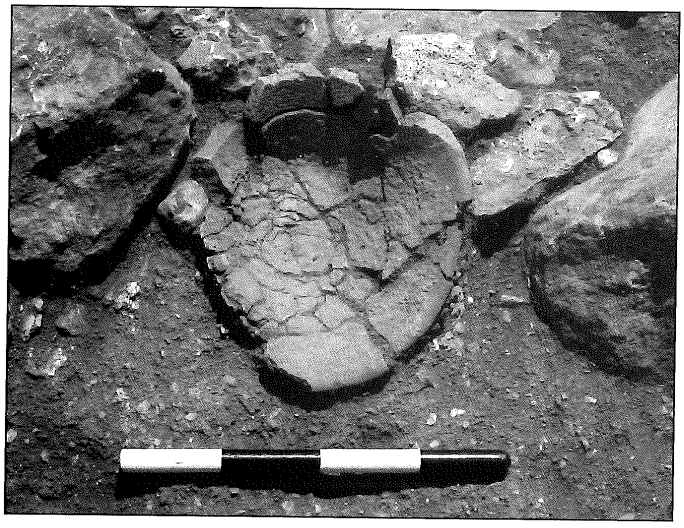
Area C is located in the southern portion of the site inside a modern corral (Lovell *et al.* 2005: Fig. 5). In this area three squares were excavated, revealing a rectangular structure and associated walls[7]. These trenches were excavated down to undulating bedrock (lying ca. 50-70 cm below the surface), which had rock-cut channels and pits within it. It is not immediately clear what these pits and channels might have been used for; careful examination of their contents may assist. However, the real interest lay in the structure itself. A corner of what appeared to be an intact building was revealed in trench C1, and this was picked up later in C2 and C3 (FIG. 4).

The structure is made of rough field stones and had a hearth, or other circular installation, directly in the centre of the room. The external dimensions of the structure are approximately 7 x 4 m, which compares reasonably well to other 'classic' Chalcolithic architecture in the region (*e.g.* Abū Ḥāmid, see Dollfus and Kafafi 1988: Fig. 41-42). Despite the shallow trench, it was clear that the deposits retained considerable integrity. While ploughing or other surface activities had made some impact (resulting in the breakage of some artefacts), it would appear that many still lay where they had been left. For example, a complete basalt bowl, although heavily cracked, lay presumably *in situ* in the corner of the building (FIG. 5). It is clear that in shallow sites one can excavate relatively intact deposits, and depth *per se* is no guarantee of a clean deposit.

4. Rectangular house structure in Area C showing installations (note bottom left hand corner shows removal of one corner of the building during excavation of C1) (Photograph: P Kottaras for WRAP).

Area D

To the north of Area C, on the main terrace, we excavated two promising areas. Area D[8] was located next to a rock-outcrop with a number of rock-cut installations (Lovell *et al.* 2005: Fig. 4). Whilst the architecture did not survive so clearly in this area, there were structural remains of single course walls as well as a number of important finds. Three 5 x 5 m squares were excavated. D1 was located where traces of architecture were noted during the survey (Lovell *et al.* 2005: Fig. 4). The excavator revealed a 2.5 m exposure of a single-course, 50-60 cm wide



5. Area C1, detail of basalt bowl (Photograph P. Kottaras for WRAP).

[6] On occasion the dimensions varied, *e.g.* 4 x 6m.

[7] I thank Tim Adams, field director and supervisor of this area.

[8] I thank David Thomas, field director of Areas D-F, and Guadalupe Cincunegui for her work as field supervisor in area D.

wall [1092], constructed of undressed, sub-angular stones and smaller stone infill, running approximately east-west. An almost complete small Chalcolithic churn was found in fill deposits beneath wall [1092] (FIG. 6).

To the north of this wall at least two large ceramic vessels, broken and lying on their sides, were excavated from lower topsoil. A complete basalt stone bowl was found in an underlying deposit, in the south-east corner of the trench. Another wall, [1096], was exposed beneath these deposits. It ran perpendicular to [1092], north-south, and was of similar construction and about 75 cm wide. It was constructed on bedrock and survived to a height of 25 cm. A 10 cm thick deposit of what appeared to be crushed, decayed and redeposited limestone bedrock formed a 'threshold' running through the southern part of wall [1096]. This deposit seems to have been deliberately laid[9] with patches of this same material were found at various points throughout the trench.

Of particular interest is a macehead, found just to the north of the 'threshold' (FIG. 7). It is made from greenish-grey igneous stone, a micro-granite or diorite[10]. A second, slightly smaller and fragmentary, example was found in area E. The stone appears not to be locally available and it may be

6. Area D1, showing relationship between context [1105] which lay directly beneath wall [1092] (Photograph P Kottaras for WRAP).

7. Area D1, detail showing the crushed limestone 'threshold' and the micro-granite macehead '*in situ*' (Photograph P. Kottaras for WRAP).

that it comes from Egypt. The object fits into the 'convex topped disc-shaped' macehead type as defined by Cialowicz (Cialowicz 1987: 15-17). This type derives from the Sudan but 2 of the 20 known pieces of this type, come from Egypt itself. The first from the Fayyūm (Caton-Thompson and Gardner 1934: 33, pl. 30.3)[11] and the other from Ma'ādī (Rizkana and Seeher 1984: Fig. 4, 7-8[12]). The type of macehead is dated to the Badarian – Naqada I period, and is therefore, in all probability, one of the earliest of the predynastic maceheads (Cialowicz 1987: 17). Given that these are most common in the Sudan, their existence in the oasis and further north at Ma'ādī appears to attest to contact between the upper Nile and lower Egypt. We can now add two more examples to this group from the 'Ajlūn

9 This was determined from its relatively homogenous appearance and more concentrated orangey grey colour, and from the fact that it seals 15cm of fill, above bedrock.

10 Another possible identification might be *syenite*, which is known from Badarian sites (e.g. Ashmolean 1929.439, a stone axe from Mostagedda 100).

11 Note that it was not actually picked up by Caton-Thompson and Gardner but was reportedly found in the Wādī ar-Rayyān divide.

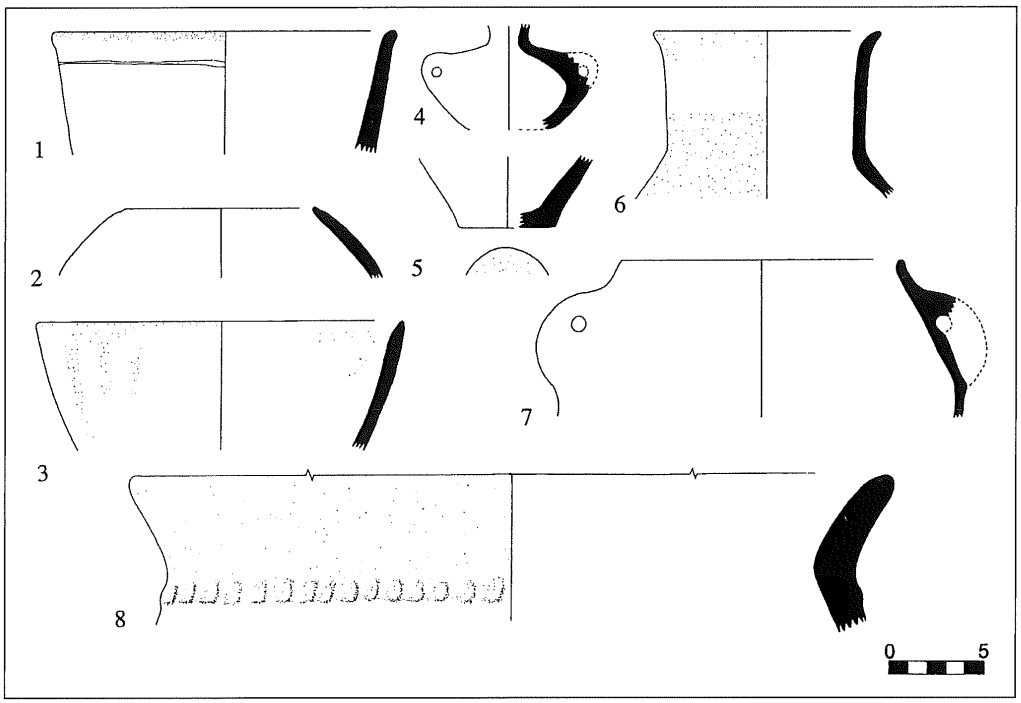
12 A Badarian piece from 'the villages' (Area 5500), of approximately the same size provides another instructive parallel. It is exactly the same shape (convex topped disc) and is described as a 'pink limestone whorl' (Brunton and Caton-Thompson 1928: 30, pl. xxiii). It was found along with other stone and ivory objects in a basket (Brunton and Caton-Thompson 1928: 6).

district of Jordan[13]. How these two objects came to be traded as far north and east as al-Khawārij is an intriguing question to be explored in future publications.

FIG. 8a shows selection of ceramics from the areas discussed above. All of these finds have good parallels in Chalcolithic contexts (Lovell 2001). FIG. 8b shows a selection of lithics from the site[14]. A fuller discussion of the ceramics, lithics and other finds associated with the excavation will be presented in Lovell *et al.* (*in press*).

Area E

Area E[15] is located on the southwestern edge of the



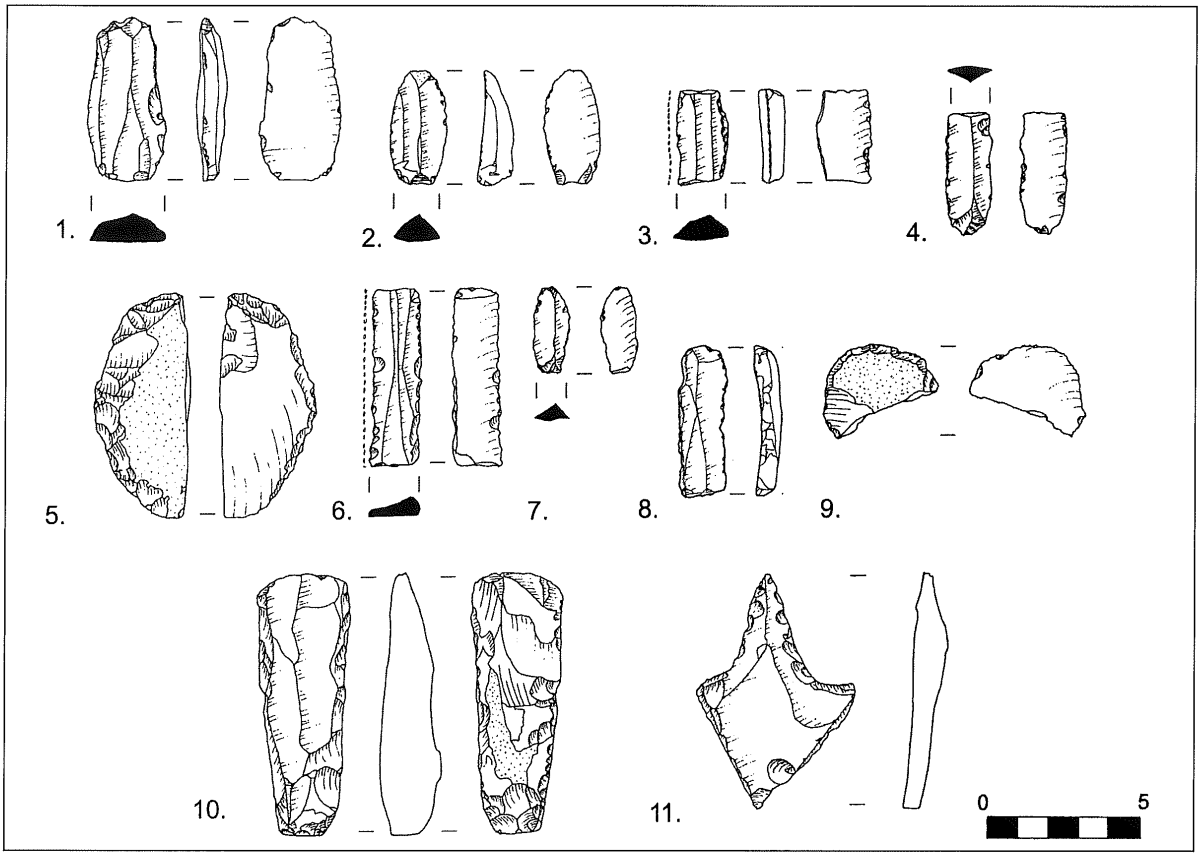
	Catalogue #	Area/ Trench	Context	Description
1	20114	A2	1079	Basin, out-turned rim, black paint / slip, incision or string impression below rim ext
2	20002	E2	1129	Holemouth, simple, red slip / painted ext
3	20090	E3	1282	Bowl, fine, red painted (linear) ext
4	20073	C2	1229	Churn, miniature, red painted (traces) ext
5	20118	C1	1222	Base, V shaped bowl, string cut
6	20059	A1	1077	Jar, tall neck, red painted (bands) ext
7	20099	C3	1351	Holemouth, fine, red painted (traces) ext
8	20021	D1	1088	Jar, storage, painted applied /impressed ext

8a. Ceramics from the 2004 excavations at al-Khawārij.

[13] The recently published Egyptian material from Tall al-Kharaz in the EBI (Fischer 2002) would suggest that the newly uncovered maceheads form the beginning of a longer story of Egyptian connections with this part of Jordan.

[14] For an extended discussion see Lovell *et al.* 2005.

[15] I thank David Thomas for his work in this area as excavator of E1, 2, 3 and 5 and field director of Areas D, E and F.



	Catalogue #	Description
1	1246	Simple, non-prismatic retouched blade
2	1209	Simple retouched blade
3	1359	Backed and truncated sickle blade segment
4	1248	Prismatic, simple retouched blade
5	1204	Tabular scraper-knife
6	1254	Backed and truncated sickle blade segment
7	1262	Retouched bladelet
8	1010	Straight-backed blade
9	1263	Tabular scraper fragment
10	1217	Straight edge axe
11	1231	Drill

8b. Lithics from al-Khawārij.

terrace area (see Lovell *et al.* 2005: Fig. 3) and revealed the richest complex of architecture including a large rectilinear structure with rooms running off the edges. The large, main room (excavated as trenches E3 and E5) has external dimensions of approx 13 x 5m. In places the walls were laid on bedrock, but at certain points they also lay upon actual deposit. The nature and proportions of the architecture are therefore similar to the long chain houses excavated by Epstein in the al-Jawlān (*e.g.*

Epstein 1998: 73, Fig. 100), although many of her examples are considerably larger[16].

In two adjacent trenches, E4 and E6, we uncovered a further long rectangular structure (external dimensions are estimated as: 12+ x 4.25 m)[16]. It is from this structure (FIG. 9) that we obtained our richest archaeobotanical remains. Within E4 and E6 there were a number of deposits ([1309], [1310], [1311] and [1312]) representing a continuous grey to yellowish cream floor surface. The finds from the surface and the deposits upon them included small 'v' shaped bowls and holemouths as well as jars. Quite a few pieces were decorated with red painted bands and all appear to fit within the Late Chalcolithic assemblage discussed above.

Al-Khawārij and the Olive

The shallow nature of these deposits and the *terra rossa* topsoil does not create an ideal environment for archaeobotanical preservation. However, because this project is driven by interest in olive production, archaeobotanical sampling was obviously a key priority and a number of samples contained appreciable numbers of well-preserved carbonised specimens (Meadows n.d.).

Bulk samples of sediment were collected from all securely-stratified contexts, and processed by machine flotation. Where possible, two large bags of sediment were collected per sample, giving a notional sample volume of 20 litres. Extensive contexts were sometimes sampled more than once. Light fractions (flots) were collected in 1.0mm and 0.3mm mesh sieves, and scanned briefly before being packed for shipment to Australia. They are currently undergoing more stringent laboratory identification. Preliminary identification indicates that the samples included seeds of a wild grass, probably *Lolium* sp. (rye grass, a common weed of cereal crops); grains of emmer wheat (*Triticum dicoccum*) and hulled barley (*Hordeum vulgare*), the typical cereal crops at Jordanian prehistoric sites; lentil (*Lens culinaris*), also a common cultivar, and at least two other pulses – probably pea (*Pisum sativum*) and bitter vetch (*Vicia ervilia*), as well as olive (*Olea europaea*) (see below). All of the above are quite 'at home' in a [Late] Chalcolithic assemblage (Meadows n.d.)[18].

9. Area E4 and 6 showing large rectangular structure and associated surfaces (Photograph P. Kottaras for WRAP).

Most of the olive stones recovered are suitable for measurement. Olive was found in all trenches across the site. Eight whole carbonised olive stones were recovered from seven contexts and at least twenty other samples contained fragments of carbonised olive stones, some of which may be large enough for radiocarbon dating[19] (Meadows n.d.). The plaster matrix of one surface also included a few voids in the shape of olive stones, which indicates that uncarbonised stones were present when the surface was laid.

Residue Analysis

In order to expand the ways in which we might explore the connection with oil processing and the site we are embarking on a programme of residue analysis. Recent research has demonstrated that unglazed ceramics absorb a substantial quantity of lipids (animal fats, plant oils, waxes, resins *etc.*) that were stored in them (Evershed *et al.* 1992; Herron and Evershed 1993). The fired clay effectively functions as a molecular trap that preserves the lipids during burial over many millennia. What this means is that residues do not have to be visible to be present. However the difficulty lies in unambiguous identification. Presuming that lipids are identified within the WRAP samples, separating and identifying an olive oil signature from other oil signatures will be the key problem (Evershed *et al.*

[16] For plans and photographs please see Lovell *et al. Forthcoming.*

[17] I thank Iona (Kat) McRae for her work as excavator of E4 and 6.

[18] I thank John Meadows for allowing me to use his unpublished report in this paper. For a fuller discussion see Meadows in Lovell *et al. forthcoming.*

[19] We thank the *Australian Institute of Nuclear Science and Engineering* (AINSE) for a recent grant of 10 AMS dates (AINGRA05104). We will shortly be submitting some of the archaeobotanical material discussed here for dating at their facility.

2001: 336; Serpico and White 2000: 412-420).

Following the discovery of highland sites in the al-Jawlān it was suggested that a number of artefact types (basalt bowls, spouted jars) may be associated with olive oil production (Epstein 1993). A detailed study of the repertoire at al-Khawārij will bring new insights. We aim to combine the archaeobotanical, residue and artefactual analyses in order to be more specific about what was produced at and exported from al-Khawārij.

The Broader Picture

Given the statements made by researchers in recent years regarding social complexity in the Late Chalcolithic period (Joffe 1993; Levy 1995), the development of tree crops and incipient long-range trade in horticultural produce would not be out-of-place. At Ashkelon, in the EBIa, we have some evidence that suggests sea traffic between Egypt and the southern Levantine coast in connection with olive oil (Gophna and Liphschitz 1996: 147-51). There is no reason to suggest that the Egypto-Levantine trade in oil products did not begin earlier (see Stager 2001).

The period of the Chalcolithic - Early Bronze Age transition is one of the least understood of late prehistory and we are hopeful that the excavations at al-Khawārij will be able to make a significant contribution to our understanding of why the Late Chalcolithic population chose to utilise this area and how communities might have negotiated their position within what we know as a wide and rich Late Chalcolithic material culture.

What we can already demonstrate is that objects perhaps associated with Egyptian/African material culture are present as far east as al-Khawārij in the Chalcolithic period[20], and that the site appears to have been involved in olive production and consumption on the very cusp of what others have termed the 'social power revolution' (Levy and van den Brink 2002: 5). Ongoing investigations aim to be more explicit about how Chalcolithic inhabitants were engaged in the trading networks of this period, and what part olive production might play in developing stories that archaeologists are weaving around this important transition.

Survey and Excavation

The 2004 excavations confirmed the utility of the surface survey. The surface survey allowed us to understand the site more intimately before excavation, and it allowed us to locate extant architecture. One thing we did notice was a greater concentration of later Bronze and Iron Age material in units E11, F11 and G11-12 (Lovell *et al.* 2005: Fig. 5). We suggested then that the architectural traces picked up in G11 and H11 might be later in date. Excavations in Area B did in fact reveal a Bronze – Iron Age structure – underlining, once again, the value of intensive pre-excavation surface survey.

Excavating Shallow Sites

It is equally important to note that the shallow nature of the deposits revealed at al-Khawārij does not negate their importance. It is true that the damage by ploughing and other recent activities has affected the archaeological integrity of some deposits, but despite this it is possible, with careful excavation, to reveal an intriguing and informative picture of Chalcolithic activities on the site. We are hopeful that ongoing investigations in the Wādī ar-Rayyān will reveal further valuable information via spatial analysis of artefacts and detailed artefactual and scientific studies (including use-wear *etc.*).

Conclusions

In terms of the research approach and design the WRAP project[21] has already made steady progress towards its final objectives. Although some might avoid excavation in these upland regions the survey and excavations at al-Khawārij have shown that, with appropriate method and thorough procedures, good results are not only possible, but highly valuable.

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[20] Note also that the invasively retouched tools picked up in the 2003 survey are also sometimes associated with Egypt, although these may date to the EBI (Rosen 1997: 81). Interesting our best example (Lovell *et al.* 2005: Fig. 10) seems very close to the Egyptian example from Tall Erani (Rosen 1997: 83, Fig. 3.40).

[21] In addition to myself, project members have included: Mr. Adeib Abu Shmais (Dept of Antiquities Representative 2003) Mr. Mohammad Al Balwaneh (Dept of Antiquities Representative 2004), Dr. Bruce McLaren (Field director 2003), Mr. Timothy Adams and Mr. David Thomas (Field Directors 2004), Mr. John Meadows (Archaeobotanist), Mr. Angus Browne and Ms. Pamela Kottaras (Archaeologists and photographers), Mr. Tobias Richter (Chipped stone), Mr. Jamie Fraser and Ms. Guadalupe Cincunegui (Archaeologists), Ms. I. Katherine McRae and Ms. Melissa Kennedy (Student archaeologists), and Abu Isa and Aladdin Madi (Camp managers) and Abu Sami (Cook). I thank Jamie Fraser and Stephen Bourke for proof reading and valuable comments; any errors are, of course, my own.

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