

A FOURTH SEASON OF RENEWED EXCAVATION BY THE UNIVERSITY OF SYDNEY AT TULAYLĀT AL-GHASSŪL (1999) ¹

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General Introduction (SJB)

Sydney University renewed excavations at Tulaylāt al-Ghassūl in 1994 after a seventeen year hiatus (Bourke *et al.* 1995). The second and third seasons occurred in 1995 and 1997 respectively (Bourke *et al.* 2000). The fourth season took place between 3 January and 4 February 1999. Five areas of excavation (A, E, G, N and Q), all previously instituted, were further explored during 1999 (Fig. 1).²

The main aim of the fourth season was to intensify study of the Latest Chalcolithic phases of occupation in Areas E, N and Q. As well, investigation of what we have referred to as the Early and Middle Chalcolithic horizons of occupation continued in the deep soundings (Areas A, G and N). This report combines a stratigraphic/architectural summary with discrete reports on the ceramics, small finds, zoological, botanical and radiometric datasets.³

1. STRATIGRAPHIC SUMMARY (SJB)

Area A

The 5 x 5 metre excavation area of Trench

A XI in 1997 was slightly enlarged to 5 x 5.4 metres during the 1999 field season, to repair severe collapse along the south baulk. Excavations in 1997 had just exposed the tops of Trench A XI Main Phase 4 (equivalent to Hennessy Phase D) architecture and associated deposits. In 1999 an additional 80 centimetres of deposit was sampled across the trench. This saw two architectural phase excavated (A XI Main Phases 4-5), and another (A XI Main Phase 6) partly exposed.

In addition, a new 4 x 4 metre trench (A XIII) was laid out in the enlarged baulk area between Hennessy's original trenches A II and A III. This area had been left unexcavated to protect the collapsed 'Processional' wall painting discovered in trench A III in early 1977 (Cameron 1981; Hennessy 1982). Trench A III had been excavated down into Phase D/E deposits before the wall painting had been discovered, so our new trench A XIII began with the excavation of the few remaining (much eroded) Phase D levels surviving from the November 1977 removal of the wall painting. Over the course of the season two metres of deposit and parts of four architec-

1. The 1999 field season was directed by Dr. Stephen Bourke (ARC Research Fellow in Archaeology, University of Sydney). Major funding bodies were the Australian Research Council and the University of Sydney. We would like to thank Dr. Ghazi Bisheh, then Director-General of the Department of Antiquities, and Mr. Saad Hadidi, Inspector of the Salt Region, for their considerable interest and support. Equally appreciated was the interest and assistance provided by H. E. Ms. Merry Wicks, Australian Ambassador in 1999, and Embassy staff. We thank Ms. Alison McQuitty, then Director of the then BIAAH, and Institute staff for much logistical support and equipment hire.
2. Core staff members for the 1999 season were Stephen Bourke (Director, Photographer and Ceramics Registrar), Saad Hadidi (DoA representative), Ruth Ward (N I and G IV), Rachael Sparks (E XXIV and Finds Registrar), Phil Habgood (A XI), Natalie Franklin (A XIII), Samantha Gibbins (E XXVII), Penny Middle-

ton (Q I), Phil Karsgaard (Q III), Richard Hewitt (N III), Ian Edwards (Draftsman and Ceramic Technologist), Grahame Reed (Draftsman), George Findlater (Surveyor), Lachlan Mairs (Archaeozoologist), John Meadows (Archaeobotanist), Abu Issa (Foreman), Abu Sami (Chief Cook), Aladdin Madi (Cooks' Assistant), and a local workforce of twenty-five.

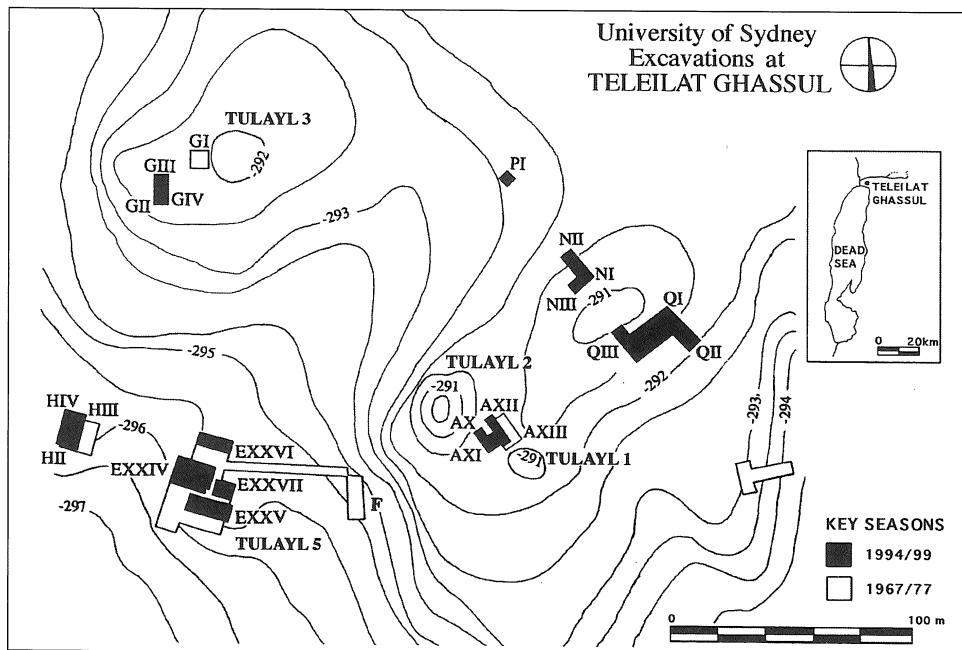
3. In this report, Bourke was responsible for trench descriptions and phasing, and the short report on carbon dates. Separate reports were contributed by Lovell (ceramics), Mairs (archaeozoology) and Meadows (archaeobotany). Responsibility for line art was shared between Ian Edwards, Graham Reed, Rachel Jackson, Cameron Petrie and Catriona Bonfiglioli. Plans and sections were inked by Rachel Jackson. Photographs were taken by Stephen Bourke. Some figure production and all figure layout was executed by Ben Churcher. Bourke edited the report.

tural phases (A XIII Phases 1-4) were sampled.

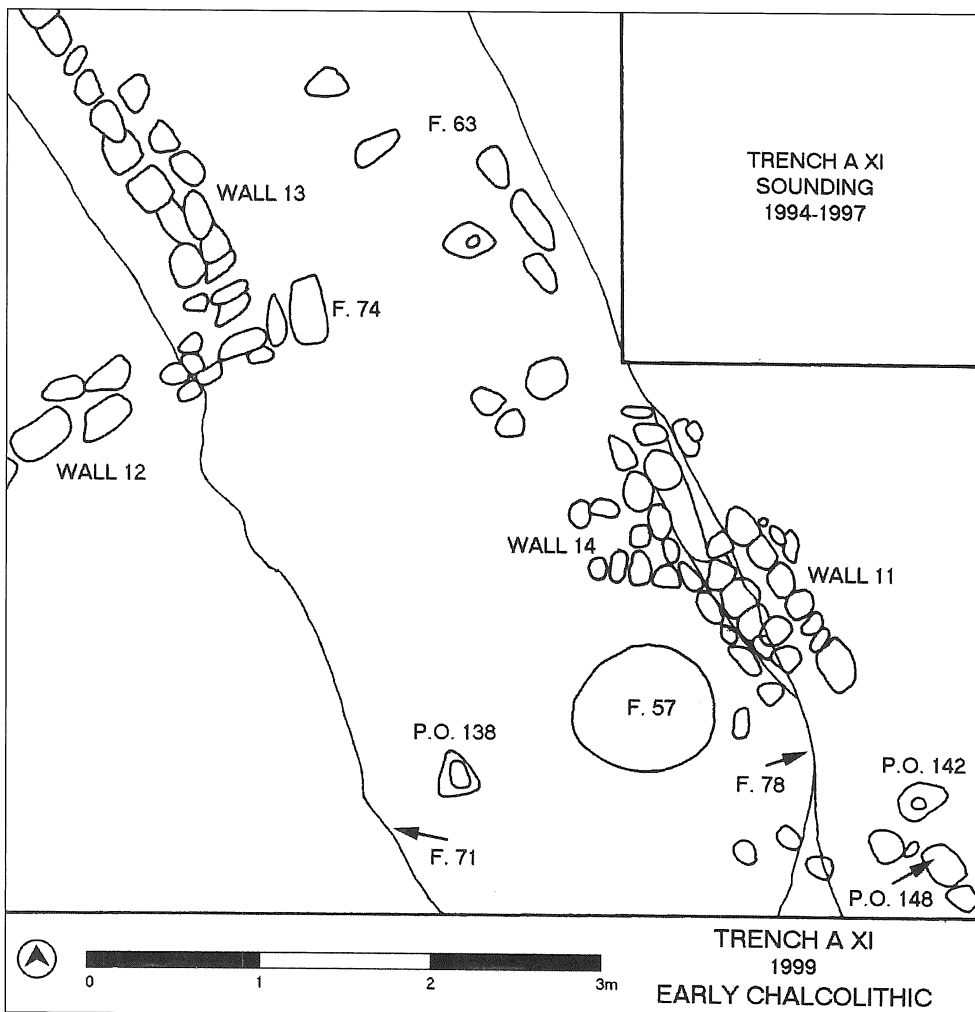
Trench A XI 1999 (Fig. 2)

A XI Main Phase 4: Excavations in trench A

XI in 1997 had ceased shortly after uncovering the corners of two mudbrick rooms, one in the northwest trench (Walls 12 and 13), and the other in the southeast corner (Walls 11 and 14),



1. Site Plan. Showing Trenches excavated between 1994-1999.



2. Trench A XI. Plan of Main Phase 4 Architecture.

separated by an open courtyard area. Together, these formed part of the fourth architectural phase encountered in the expanded A XI trench area (Bourke *et al.* 2000: 41).

After removal of inter-seasonal baulk collapse, the later deposits associated with the Phase 4 building corner (Walls 12 and 13) were excavated as Locus 77. The large stone-lined pit (F.68) uncovered towards the end of the 1997 season was excavated as 77.1. It had been cut into mudbrick debris (77.2) from the final collapse of the Wall 12/13 room. Occupation deposits (77.5) sealed below 77.2 were then removed.

The mudbrick superstructure of both Wall 12 (77.4) and Wall 13 (77.3) were cleared to expose a single course of medium fieldstone footings, F.73 (Wall 12) and F.74 (Wall 13) respectively. These footings were removed as 77.6 (F.74) and 77.8 (F.73). They were found to have been laid over a thin layer of slurried mudbrick (77.7/77.9).

South of the Wall 12/13 structure within the courtyard area, a series of occupational/debris layers and pit features were encountered. Below 1997 fill layer 64.1/70.5, thin grey occupation layers 76.1-3 were found to seal a fourth clay-lined fire-pit (F.70), excavated as 76.5. The pit was cut into a buff surface (76.6/76.11), which lay over a thicker grey-brown band of slurried bricky debris (76.10/76.13), into which a small pit (F.76) had been cut.

East of the Wall 12/13 structure, between Wall 13 and the 1994/95 sondage, further courtyard levels were encountered below 1997 bricky debris layer 70.4. These consisted of brick debris 76.4 (off Wall 13), into which a series of small postholes (F.67) had been cut, and below these, occupational debris (76.8) and a buff courtyard surface (76.9), which was related to 76.6/76.11 in the south. The surface (76.9) lay over brick slurry (76.17), equivalent to 76.10/76.13 in the south trench.

In the southeast corner of the trench, 1997 excavations had ceased just as the northwest corner (Walls 11 and 14) of a second structure had been exposed below 1997 debris layer 64.1. In 1999, excavations began with the removal (76.12) of a large pit (F.62) cut into the white mudbricks of n/s Wall 11. What had been taken as an e/w return to Wall 11 (Wall 14) was found to be an ar-

ticulated fragment of collapsed white mudbrick debris (76.16) off Wall 11. Below the bricky debris, sequential brown courtyard occupation layers associated with the west face of Wall 11 (76.15/76.18/76.20), had three sequential plaster-lined pits, F.72 (76.14), F. 77 (76.19), and F.79 (76.26) cut into them. The earliest courtyard surface (76.20) sealed a thin layer of decayed bricky debris (76.24), which pedestalled Wall 11 when removed. Wall 11 mudbricks (76.23) and stone footings (F.75) were then cleared, exposing the brown mudbricks (76.25) of Phase 5 Wall 17 immediately below.

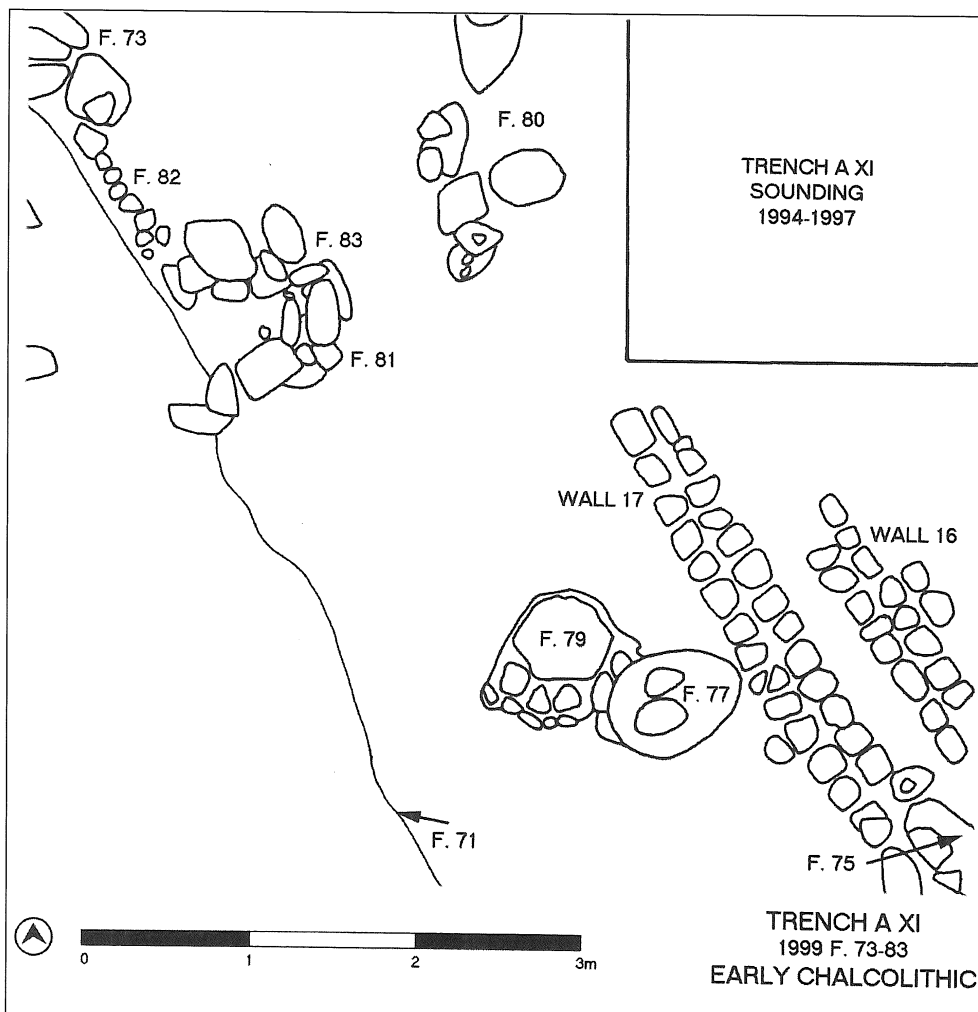
A XI Main Phase 5 (Fig. 3): In the northwest trench, three stone features (F.80-82), below brick slurry layers (77.7/77.9) mark the probable stone footings of an earlier phase of architecture, similarly aligned to Phase 4 Walls 12 and 13, which had been cut down into the fabric of the earlier Phase 5 structures during the Phase 4 constructional event. In the southeast trench, a similar circumstance seems to be at work, with the stone footings of Phase 4 Wall 11 (78.1) cutting down into the fabric of the earlier (and similarly aligned) Phase 5 Wall 17 (Fig. 4).

Phase 5 Wall 17 was associated with a series of occupational debris layers. Those within the structure to the east of Wall 17 were excavated as 78.1-2. Courtyard levels to the west were excavated as 76.21/76.22/76.24. The removal of these occupation layers pedestalled Wall 17. The brown mudbricks of the wall were then removed (76.25).

A XI Main Phase 6: In probes below Wall 17 towards the end of the 1999 field season, a series of grey-brown occupational fill layers (76.27-28) lay over a buff surface (76.29). This courtyard surface may have been associated with the west face of a new n/s brown mudbrick wall (Wall 16), exposed immediately to the east of the stone footings of Wall 17, but these later footings prevented the establishment of a clear association between wall and surfaces before excavations ceased.

Trench A XI 1999: Summary

Excavations in trench A XI uncovered fragments of three architectural phases. The very first deposits excavated consisted of a series of



3. Trench A XI. Plan of Main Phase 5 Architecture.



4. Trench A XI. View of Wall 17 and Pit Features 77 and 79. Looking South.

postholes (F.67), a large stone-lined pit (F.68), and a clay-lined oven (F.70), all dug into the bricky collapse of Main Phase 4, similar in form to Hennessy's campfloor horizons (Hennessy 1969: 7), which frequently intervened between major architectural horizons. Comparative stratigraphy would suggest equating the A XI post-Phase 4 pit and posthole horizon with Hen-

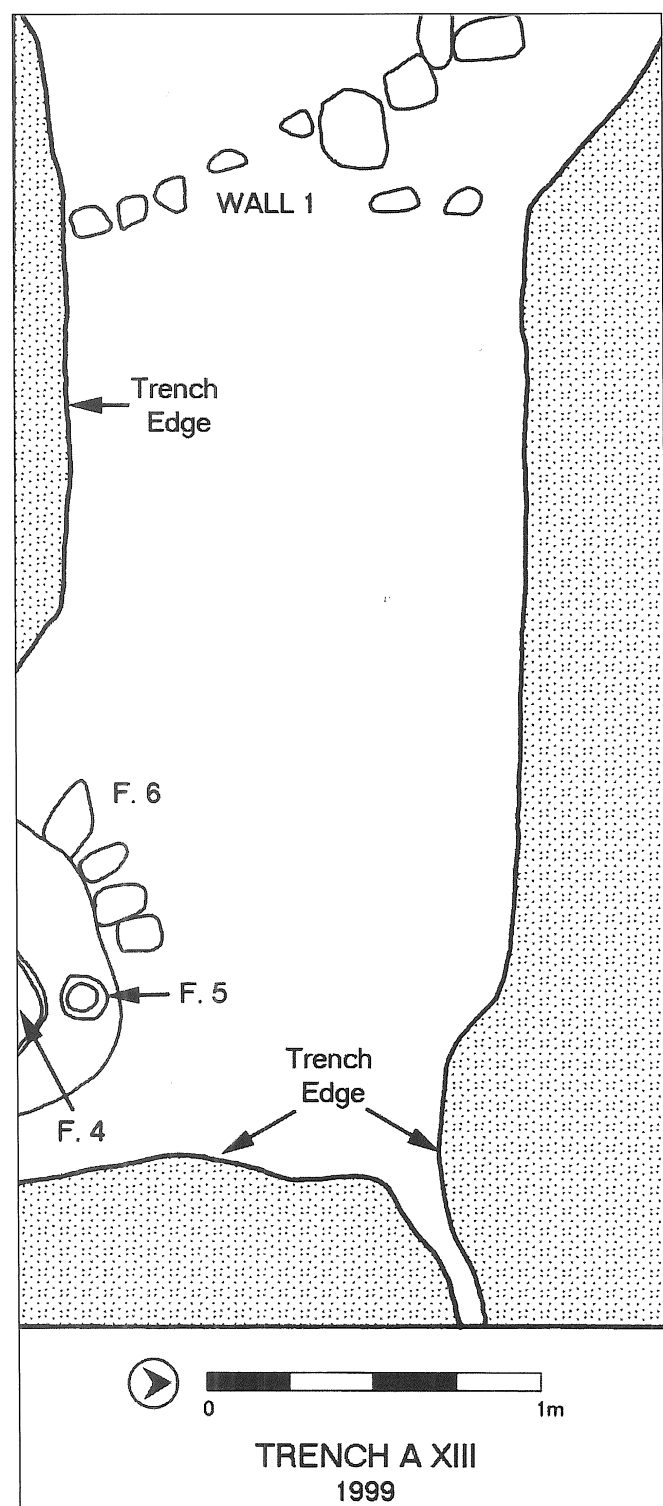
nessy's post-Phase D 'campfloor' horizon. Below the 'campfloor' deposits, the architecture of Phase 4 (Wall 11 and 12/13) and Phase 5 (Wall 17 and F. 80-82) was fully excavated. Phase 6 deposits (Wall 16) were in the process of being exposed when excavations ceased.

Trench A XIII 1999

Trench A XIII was laid out in the large baulk area between two of Hennessy's original 1967 trenches (A II and A III). The preserved 'island' of deposits between A II and A III, originally roughly 7 x 5 metres in extent, had suffered considerably from the effects of more than 20 years erosion. The area that remained was irregular in both plan and elevation, but sufficient remained after preliminary leveling and straightening to lay out a 4 x 3.5 metre trench in the northwestern region of the original 7 x 5 metre 'baulk island'. After initial cleaning of erosion deposits, the 4 x 4 metre excavation area was found to consist of a southern (4 x 2 metre) area at a significantly higher level than the northern half of

the trench. The southern trench area was excavated first (Loci 1-6), before excavation became general across the full 4 x 4 metre area of the trench (Loci 7-9) — **Fig. 5**.

After removal of thin eroded layers of grey white bricky debris (1.1), a fragment of a heavily eroded white mudbrick wall (Wall 1) was uncovered. To its north a room fragment was found

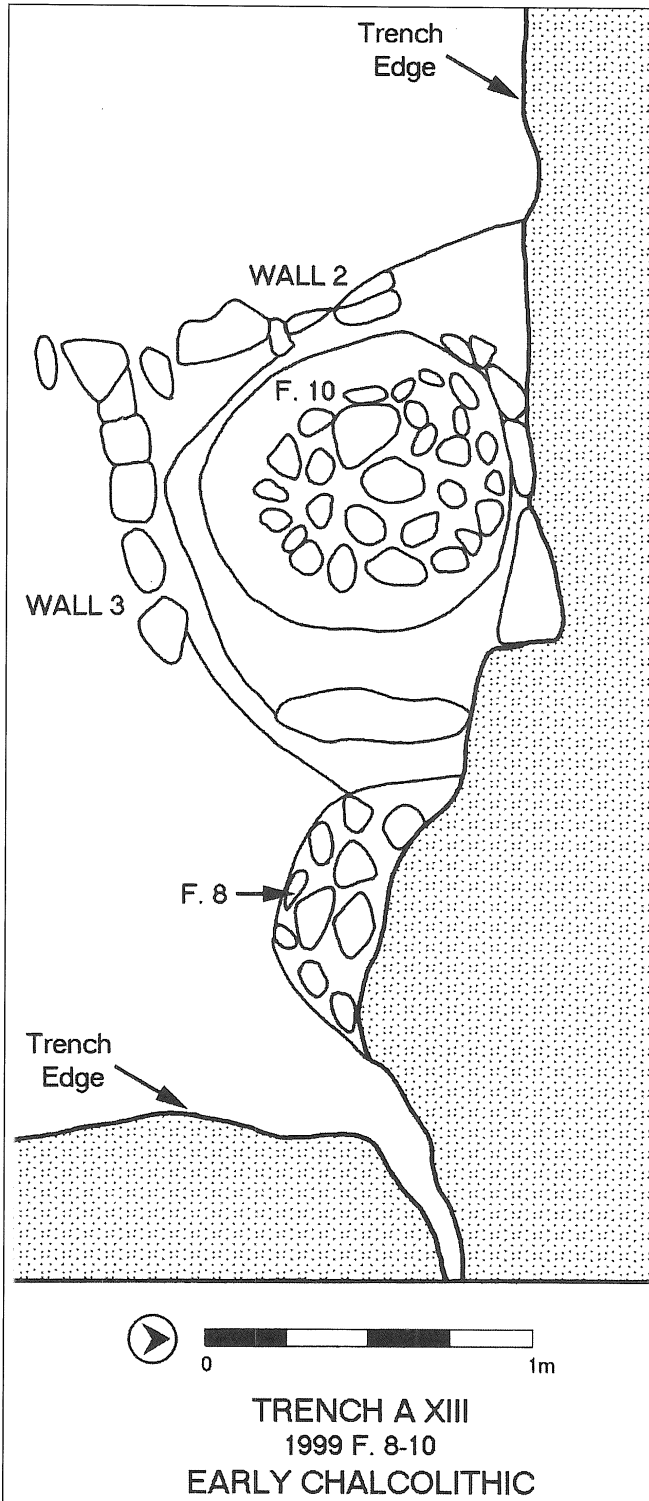


5. Trench A XIII. Plan of Phase 1 Architecture.

to contain the southern half of a two-phase mudbrick (F.3) and stone (F.6) storage facility. This was set within a semi-circular arrangement of postholes (F.4-5), probably the remains of some lightly constructed roofing structure (1.4-8). Two sub-phases of occupational debris (1.2 and 1.3) were associated with the wall and storage facility. In the far east of the area a deep pit-like cut (1.9) was found to have penetrated into this horizon. Examination of Hennessy's plans suggest this 'pit' is the northern edge of Hennessy's trench A II Deep Sounding, which was carried through all strata to sterile in March 1967 (**Fig. 6**).

Clearance of the scraps of the first structural phase (1.11) revealed an earlier architectural unit on much the same general alignment as Phase 1, sealed below thick layers of bricky debris (2.8/3.1-3/6.1-2). Two buff coloured mudbrick walls (Walls 2 and 3) defined a room corner, in which an earlier storage facility (F.10), similar in concept to later F.3/6 but much better preserved, was found to occupy much of the room corner. It also has two distinct building phases (F.10 and F.14), the later including a stone revetment (F.8/2.7), the earlier a fired mud-lined posthole (F.12/2.9) and a stone base. Deep ashy deposits were recovered from each phase of the storage facility, the latter fine grey white ash (2.2/2.4/2.6), the earlier dark grey ash with bricky debris (5.2). One good surface (2.1) was associated with later occupation within the room, and a grey ashy surface (6.3) and a pit (F.15/6.4) with earlier occupation outside the room, west of Wall 3. Removal of Walls 2 (4.1) and 3 (5.1), and thick bricky debris below the room interior (2.10/2.12) marks the transition between the built architecture of Phases 2 and 3 (**Fig. 7**).

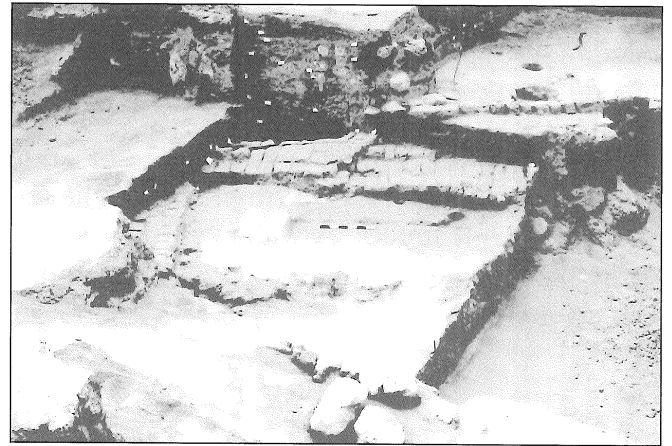
With the removal of Phase 2 constructions, the northern and southern halves of the trench were brought approximately into phase, and after preparatory cleaning of thin erosional deposits from the northern trench (7.1) and in the area of the Hennessy A II Sounding (7.2), thick layers of yellow bricky debris (7.3-4/7.8) were removed from the entire 4 x 4 metre area, to expose yet another room corner, made up of two brown mudbrick walls, Walls 4 and 6. A third mudbrick feature was initially thought to be a wall. But on excavation (7.12), it was found



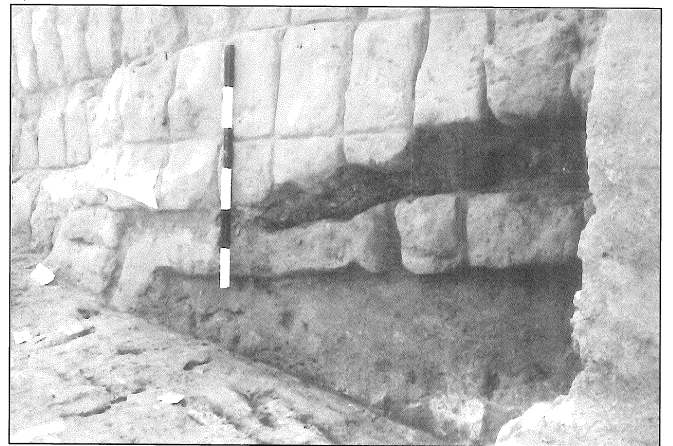
6. Trench A XIII. Plan of Phase 2 Architecture.

to be the collapsed face of Wall 4, which had broken off near its base and fallen east onto the room surface (Figs. 8 and 9).

In total, Phase 3 consisted of two walls (Walls 4 and 6), and an elaborate plaster and stone lined orthostat bin (F.16) set into the room corner. Thick brown ashy floor deposits (7.6/7.7), and a similarly coloured bin fill (7.5), were found to



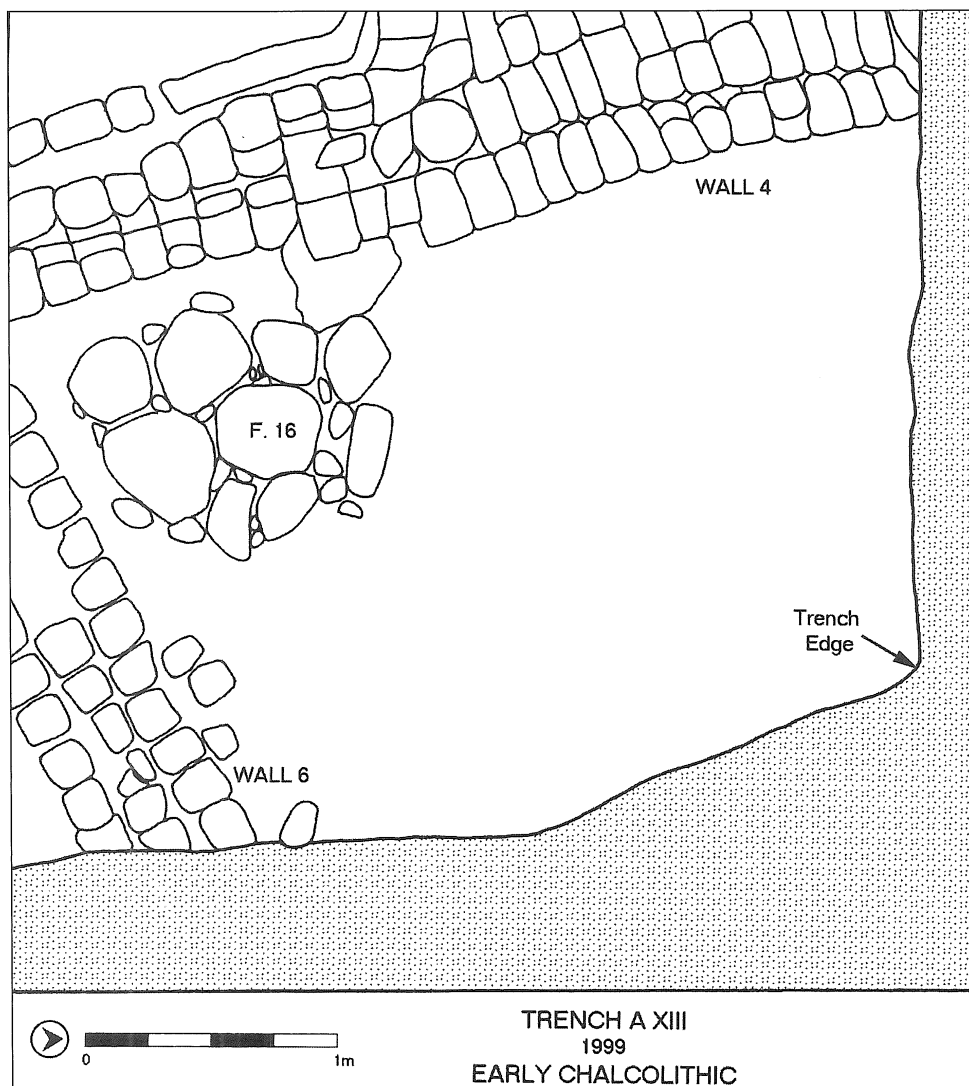
7. Trench A XIII. View of Phase 3 Architecture. Looking SW.



8. Trench A XIII. View of Wall 4 showing Earthquake Damage. Looking North.

seal a good mud floor (7.13) within the building, and an ashy courtyard surface outside and to the west of Wall 4 (8.1). These surfaces were laid over a thick deposit of decayed yellow-brown mudbrick (7.10/7.11), which marked the transition between Phase 3 and earlier deposits. The mudbricks of Walls 4 (7.15) and Wall 6 (7.14) were removed along with the bricky makeup deposits (Figs. 10 and 11).

Below the thick debris deposits (7.10-11), Phase 4 architecture was aligned in a similar manner to Phase 3, with two greenish brown mudbrick walls (Walls 7 and 8) defining a room corner in and along the south and west margins of the trench, more or less directly below the later constructions. The only structural novelty was the provision of two rows of fieldstone footings for each of the Phase 4 walls. The thick debris layer (7.11) that marked the break from Phase 3 deposits was found to seal a brown clay surface (9.1). Associated with the floor was a thickly



9. Trench A XIII. Plan of Phase 3 Architecture.



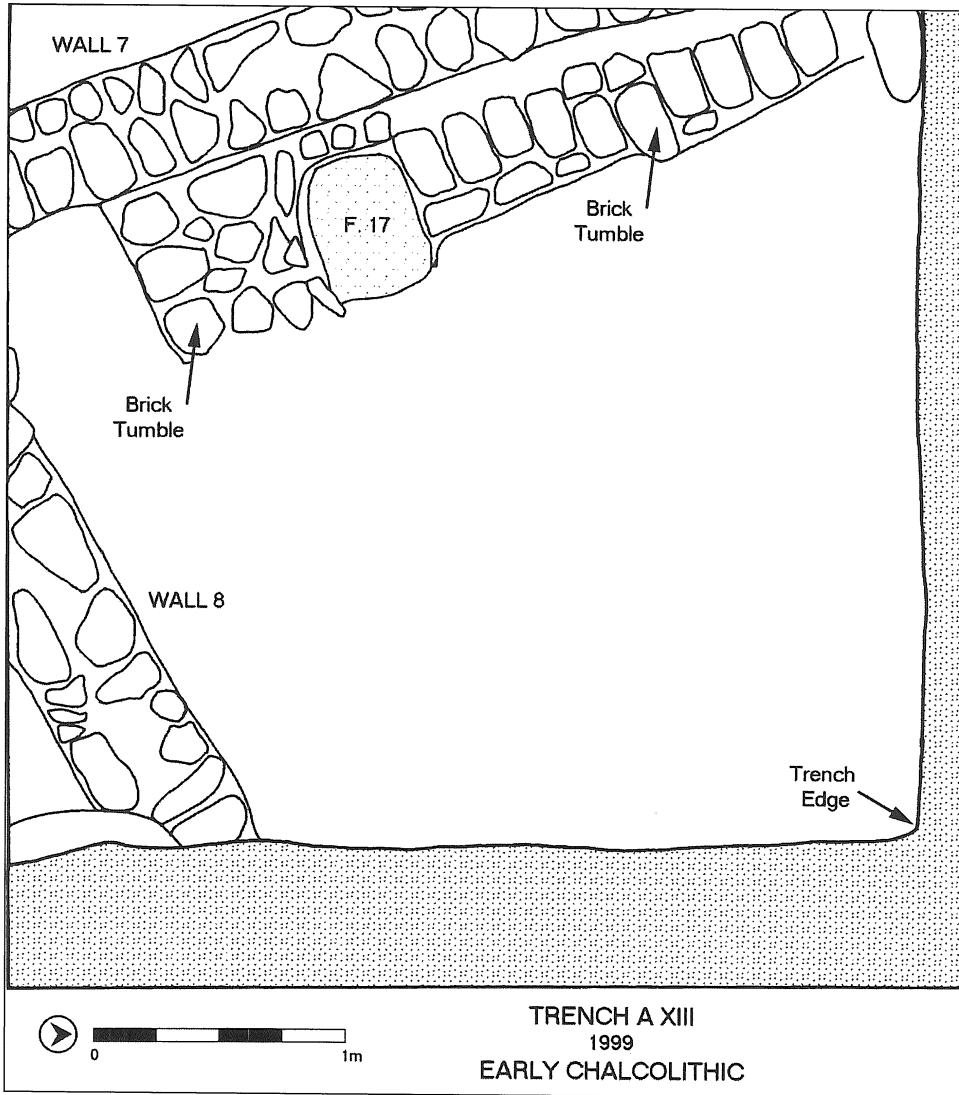
10. Trench A XIII. View of Phase 4 Architecture. Looking South.

plastered bin (F.17), set against the inner face of Wall 7 (9.3/9.11). This floor was separated from a lower brown clay surface (9.2), by a layer of brown occupational fill (9.4). The lower floor was laid over a thick deposit of stoney green-

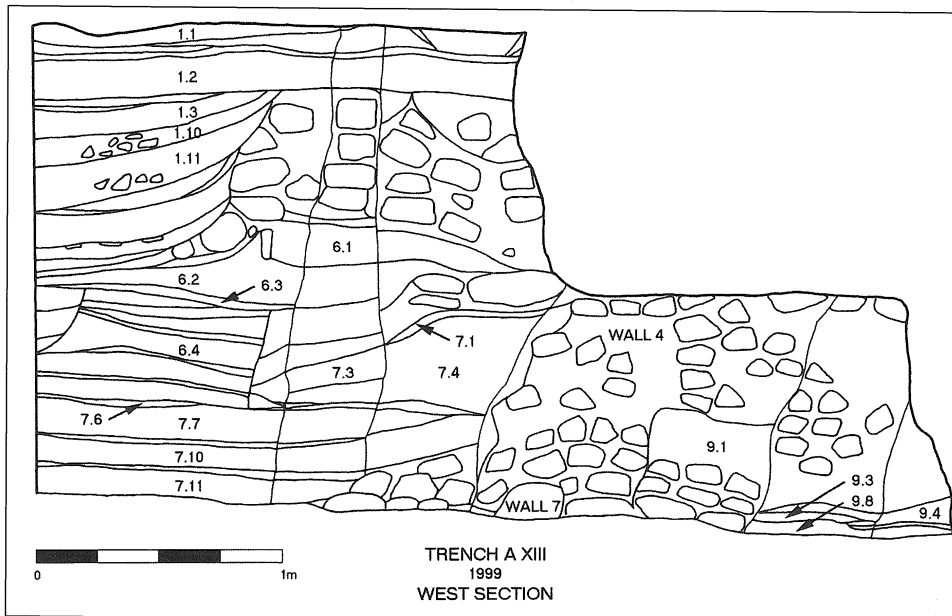
ish-brown clayey makeup (9.8/9.10/9.12), into which a small plaster-lined pit (F.18/9.13) had been cut. Towards the end of the season, the mudbrick superstructure of Wall 7 (9.7 and 9.9) and Wall 8 (9.6) were removed to facilitate planing. Excavations came to a halt at this point (Fig. 12).

Area A: Summary of Excavations

Excavations in trench A XI uncovered fragments of three architectural phases. The very first deposits excavated consisted of a series of postholes (F.67), a large stone-lined pit (F.68), and a clay-lined oven (F.70), all dug into the bricky collapse of Main Phase 4, similar in form to Hennessy's campfloor horizons (Hennessy 1969:7), which frequently intervened between major architectural horizons. Comparative stratigraphy would suggest equating the A XI post-Phase 4 pit and posthole horizon with Hennessy's



11. Trench A XIII. Plan of Phase 4 Architecture.



12. Trench A XIII. West Section.

post-Phase D 'campfloor' horizon. Below these 'campfloor' deposits, the architecture of Phase 4 (Wall 11 and 12/13) and Phase 5 (Wall 17 and

F. 80-82) was fully excavated. Phase 6 deposits (Wall 16) were in the process of being exposed when excavations ceased.

Ongoing comparative analysis would suggest a slight refinement to suggested equations between Hennessy's assemblage groupings and more recent work (Bourke *et al.* 2000: 42). We now believe that A XI Main Phase 1-3 deposits should be equated with Hennessy Phase A-C horizons only, and that A XI Phases 4 and 5 be equated with Hennessy's Phase D-E horizons. These are the later assemblages of the 'pre-classic' Early Chalcolithic occupation at the site.

Excavations in trench A XIII uncovered fragments of four architectural phases. Comparison with Hennessy's excavations suggest that the fragmentary upper two phases be equated with Hennessy Phase D/E assemblages. The largely undisturbed earlier phases recovered towards the end of work in A XIII are best related to Hennessy Phases F and G, the earlier horizons of 'pre-classic' Early Chalcolithic occupation at the site.

Area E

Excavations in Area E were resumed in two separate trenches. Trench E XXIV had been explored previously in 1994/95 (Bourke *et al.* 1995: 44-45; Bourke *et al.* 2000: 43-46), while E XXVII was newly opened in 1999, in the area northeast of Sanctuary B.

EXXIV 1999

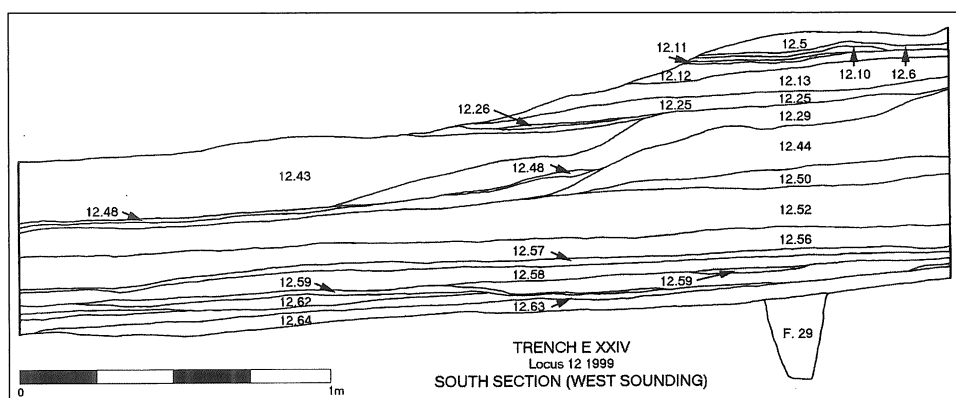
Last dug in 1995 (Bourke *et al.* 2000: 46), E XXIV was expanded slightly to the south, to excavate the small (2.4 x 7.2m) area which lay between the south baulk of E XXIV (1995) and the north baulk of E XXV (1997). This small area was excavated to examine in more detail a series of patchy white plaster surfaces which had been detected at the limits of the north extension to trench E XXV in 1997 (Bourke *et al.* 2000: 48).

Several of these surface fragments seemed to be later than those encountered in the southeastern courtyard area (E XXV) in 1995/97 (Bourke *et al.* 2000: 46-49). It seemed that this small area beside the substantial walls of Sanctuary A had been sheltered from the erosional effects of the southwest winds, so visible in more exposed southern regions of Area E. These very late deposits were examined in 1999 in the hope of gaining additional insights into the terminal occupational horizons in the Sanctuary area.

Excavations began with the removal of a series of windblown sand deposits (Locus 12.1-3, 12.7 and 12.16), which sealed a thin layer of brown decayed brick (12.4-5). This lay over the latest white plaster surface (12.6), an earlier fill (12.10) and a second plastered surface (12.11). These were all associated with Sanctuary A, but could not be traced across the excavated area to Sanctuary B.

These later Sanctuary A-related deposits sealed thick layers of decayed brick (12.12-13), stone collapse (12.14) and bricky debris (12.17 and 12.21), which seem likely to derive from a collapse incident which involved both Sanctuaries A and B. The extensive debris deposit sealed a thin grey occupation layer (12.15 and 12.18-19), which lay over a white plaster floor (12.20) and its brown clay makeup layer (12.24). Below this lay an earlier white floor (12.26) and grey clay makeup layer (12.27). These makeup/floor deposits linked both sanctuary buildings together. The earliest makeup layer (12.27) sealed a distinct horizon of sterile windblown sand (12.25), which may suggest an abandonment episode at this point in the sequence (Fig. 13).

Below the possible abandonment layer (12.25), thick deposits of decayed brick (12.30-32 and 12.39), stone debris (12.28 and 12.45)



13. Trench E XXIV. South Section.

and collapsed mudbrick (12.29 and 12.35), lay over a grey ashy occupational lens (12.36 and 12.43). It may be that these layers represent a campfloor horizon of occupation, subsequent to a major destruction episode which lay below it.

The debris and occupation layers of the potential campfloor horizon sealed a deposit of fallen brick (12.40), and a three-brick wide plaster-faced wall fragment (F.27), which had fallen from Sanctuary A (12.41). The collapse layers sealed a thin deposit of windblown sand (12.46-47), more extensive deposits of burnt bricky debris (12.42/12.48), and white mudbrick slurry (12.44). These destruction deposits lay over a white plaster floor (12.49).

At this point in the excavation, the trench was reduced in size to 2.4 x 3.0m, located in the western half of the original exposure. The white plaster floor (12.49) was the latest in a tightly stratified series of four surface/occupation sequences, which included four white plaster floors (12.49, 12.53, 12.55 and 12.57) and associated occupation/fill layers (12.58, 12.56, 12.54 and 12.50-52). All layers were directly associated with Sanctuary A, and may well have been associated with Sanctuary B, although direct connection was not established in 1999.

Below the earliest makeup/fill layer (12.58) in this west-trench sequence, a thin band of dark grey burnt destruction debris (12.60) marked the transition between earlier and later horizons of occupation associated with Sanctuary A. The destruction level (12.60) sealed a white plaster floor (12.59), built upon a thick brown clay makeup (12.61). This makeup/fill deposit lay over a thin grey surface (12.63/12.65), built upon a brown bricky fill layer (12.64). A small n/s channel (F.29) was cut into the bricky fill 12.64. The channel feature seemed likely to be associated with the north wall of Sanctuary A, although a direct connection had not been established by the end of excavations, which ceased shortly after the discovery of 12.64.

E XXVII 1999

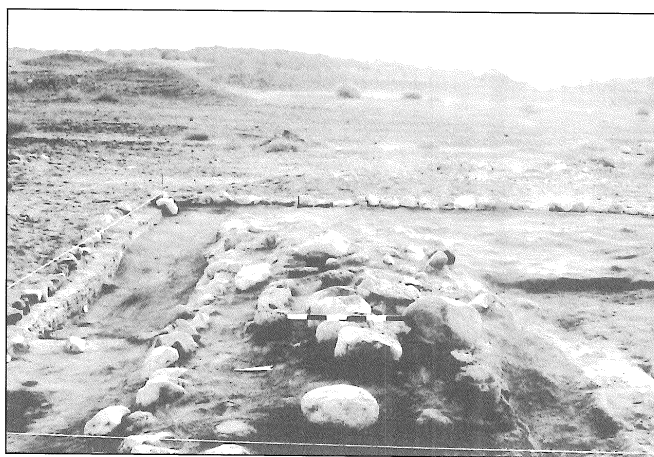
The new 2.8 x 4 metre trench (E XXVII) was positioned immediately east of Hennessy's long thin (20 x 1m) trench E XXIII (Bourke *et al.* 1995: 45), in the area between the northeastern corner of Sanctuary B and the eastern end of the north temenos wall. Trench E XXVII straddled

the temenos wall to examine what appeared to be several distinct building phases in this northern boundary wall (Fig. 14). Work aimed to further investigate the relationship of the temenos building phases to those of the Sanctuary B structure to its south, issues first addressed in trench E XXIV in 1994 (Bourke *et al.* 1995: 44-47).

Initial broad area clearance across the trench, seeking to delineate the eastern end of the north temenos wall, encountered extensive deposits of laminated windblown sand (1.1-2, 2.1-8, 2.10-12, 2.15, 2.17-21 and 3.1-2), and a series of small charcoal-filled firepits (Features 1-4 and 6; 2.13-14, 2.16, 2.22 and 2.27), which all seem post-Chalcolithic in date. The eastern extent of the north temenos wall was not clarified, as the present wall simply petered out into an area of deep erosion deposits, probably marking the western edge of an extensive wash gully.

The first reliable archaeological deposits consisted of the three remaining large fieldstones of the latest phase of the north temenos wall (Wall 1). A larger fragment of this wall had been planned during Hennessy's 1975 field season (Hennessy 1982). No floor or occupational surfaces associated with this temenos wall fragment were preserved in E XXVII. A small patch of white plastery surface (2.25) was preserved in association with the east wall (Wall 2) of Sanctuary B, immediately below windblown sand deposits (2.19). This small patch of floor may have been related to the Wall 1 temenos horizon, but a direct connection between the two could no longer be established.

Below these uppermost occupational fragments, a bricky debris layer (2.23) sealed the



14. Trench E XXVII. View of North Temenos Wall 1. Looking East.

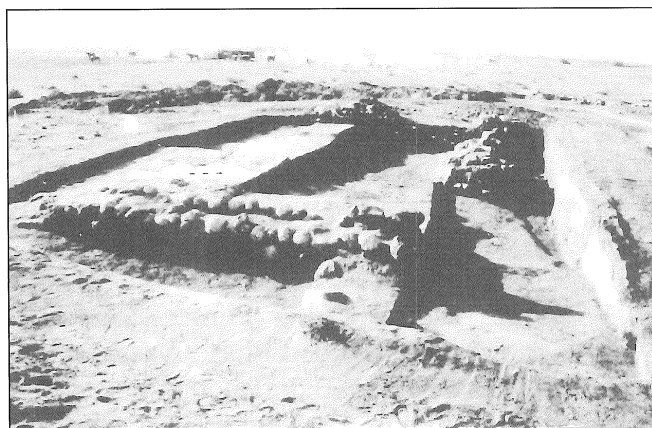
uppermost courses of an earlier phase of temenos wall (Wall 4A). This wall had distinct constructional features. An inner core of neatly-laid light brown and off-white mudbricks was faced with a single course of stone on both inner and outer faces. This combined mudbrick and stone 'sandwich' construction is very similar to that employed in the Sanctuary A building.

Occupational buildup in association with the south face of Wall 4A consisted of numerous fine laminated deposits (2.26 and 2.29-30), which overlay a patchy off-white surface (2.32). These Wall 4A deposits are partly equivalent to a sequence of deposits in association with the east wall of Sanctuary B (Wall 2). These consist of laminated deposits (2.28 and 2.33) on top of a bricky debris layer (2.38/39) sealing a good white plaster floor (2.40/41). Together, these two sequences link the upper phase of the Wall 4 temenos with a later phase of Sanctuary B occupation. The white floor (2.40/41) and orange clay makeup layer (2.42) mark the transition from upper phase horizons to earlier deposits.

The early horizon is marked by difficulties of interpretation as to the nature of temenos wall construction. One view sees an early stone wall (Wall 4B), consisting of large facing stones and a small stone and rubble core, associated with a small white mudbrick bench-like construction (Feature 8), built against its inner (southern) face. A second interpretation views the Wall 4B construction (2.51) as nothing more than the foundational sockle for Wall 4A (2.46/2.48), which together are cut down beside an earlier mudbrick construction. In this second scenario, mud-brick Feature 8 (2.49/50) is viewed as a stand-alone earlier-phased mudbrick temenos wall. This latter interpretation (Feature 8 as mudbrick temenos wall) is adopted here, but both interpretations remain stratigraphically possible (Fig. 15).

Associated with the mudbrick temenos (Feature 8) and an early phase of Sanctuary B are a series of orangey fill deposits (2.43 and 2.47), which seal a fine white plaster floor (2.44/45). This floor links the south face of Temenos Feature 8 with the north wall (Wall 3) of Sanctuary B. Associated occupational deposits north of Temenos Feature 8 (3.3) mark the first secure extramural deposits excavated in trench E XXVII.

Sanctuary B and Temenos Feature 8 were



15. Trench E XXVII. View of Excavations. Looking South.

built upon a series of thick ashy debris layers (2.52-55). The earliest of these levels (2.55) was sampled in 1999, but not fully excavated. It consisted of a compact burnt black deposit. It clearly pedestalled all Temenos and Sanctuary constructions encountered in E XXVII, and seemed to be a prepared (burnt?) surface on which structures were subsequently built. Thin laminated ashy deposits (2.53-54) sealed 2.55, and in turn were sealed by a harder grey makeup level (2.52). The first course of the Sanctuary B walls (Walls 2 and 3) and the mudbricks of Temenos Feature 8 were laid directly onto this surface.

Area E: Summary of Excavations

Excavations in Area E focused on issues concerning the stratigraphic relationships of the various phases of the northern Temenos wall and the Sanctuary A and B structures. Much effort was expended to sample the final (most fragile) occupational horizons associated with all three structures. Perhaps predictably, these proved to be both fugitive and much disturbed by later events.

Trench E XXIV deposits excavated in 1999 are to be broadly related to the 1995 E XXIV depositional sequence (Bourke *et al.* 2000: 46) in the following way:

- Post-Chalcolithic: Phase 1 (Firepits and Erosional Deposits)
12.1-3, 12.7 and 12.16
- Latest Occupation: Phase 2 (Sanctuary A only 1999)
12.4-6 and 12.10-11
- Main Occupation: Phase 3 (Sanctuary A and B)

3E: 12.12-15, 12.17-21, 12.24 and 12.26-27
3D: 12.25
3C: 12.28-32, 12.35, 12.39 and 12.45
3B: 12.40-44 and 12.46-48
3A: 12.49-12.58

- Early Occupation: Phase 4 (Sanctuary A only 1999)
12.59-64

When correlating earlier Phase 3 materials with the newly sub-divided Phase 3 assemblages, 1995 E XXIV Phase 3 destruction debris layers (1995 3.8-10 and 4.8-9) and large extramural clean-up pits (1995 Features 17-18) probably correlate with the main Phase 3B destruction horizon in the 1999 Locus 12 sequence. Earlier 1995 E XXIV occupation layers (1995 7.1-5) are associated with the primary Phase 3A occupation horizon within the Locus 12 sequence. The Locus 12 Phase 4 horizons (1999) were not sampled in 1995 E XXIV excavations.

Trench E XXVII deposits were related to the E XXIV depositional sequence (Bourke *et al.* 1995: 45) in the following way:

- Post-Chalcolithic: Phase 1 (Firepits and Erosional Deposits)
1.1-2, 2.1-8, 2.10-22, 2.27
- Latest Occupation: Phase 2 (Temenos Wall 1 and Sanctuary B)
2.9 and 2.25
- Main Occupation: Phase 3 (Temenos Wall 4 and Sanctuary B)
2.23, 2.26, 2.28-30, 2.32-33, 2.37-42, 2.46, 2.48 and 2.51
- Early Occupation: Phase 4 (Temenos Feature 8 and Sanctuary B)
2.43-45, 2.47, 2.49-50 and 2.52-55

In 1994, the first E XXIV 2 x 5 metre probe was positioned immediately west of Hennessy's long thin (20 x 1m) trench E XXIII, which linked the north face of Sanctuary B and the northernmost trenches E XX-XXII (Hennessy 1978). Trench E XXVII was positioned immediately east of the southern four metres of E XXIII, against the northeast corner of Sanctuary B. The 1994 E XXIV and 1999 E XXVII sequences are closely comparable, but such comparison requires a slight re-working of the original phasing.

The Post-Chalcolithic Phase 1 horizons in both trenches are identical and to be equated. The 1994 E XXIV Phase 2 and 3 deposits are now viewed as a single (Phase 2) horizon, as the

1994 Phase 2 green mudbrick wall (1994 Feature 5) turned out to be collapse off the Phase 3 stone temenos wall (E XXIV Wall 1, equivalent to E XXVII Wall 1). The 1994 E XXIV Phase 4 deposits are therefore to be renumbered Phase 3, with 1994 E XXIV Temenos Wall 2 equivalent to E XXVII Wall 4 (Bourke *et al.* 1995: 45).

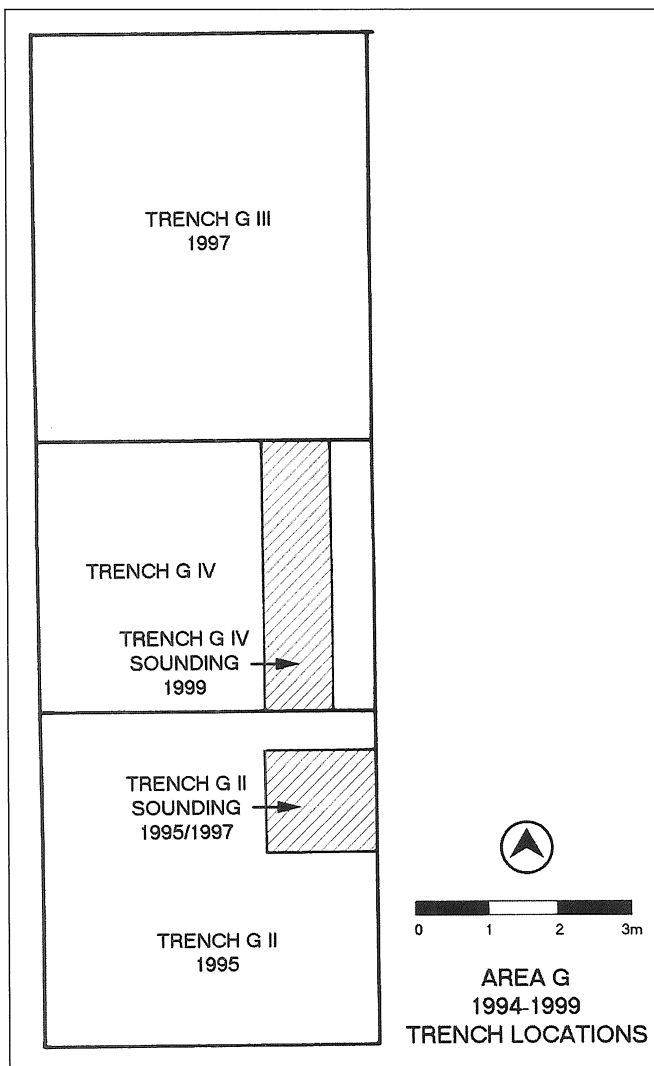
The 1994 E XXIV probe did not penetrate into the earliest deposits reached in 1999 in E XXVII (Phase 4). However, the 1994 probe within and below Hennessy trench E XXIII did reach this horizon (Bourke *et al.* 1995: 45). The 1994 E XXIII Phase 1 strata (Loci 50.1-4 and 51.1-5) include what was then deemed a 'pre-temenos' mudbrick wall, now seen to be equivalent to E XXVII Temenos Feature 8. The 1994 E XXIII Phase 1 deposits are therefore broadly equivalent to 1999 E XXVII Phase 4 horizons. The 1994 E XXIII Phase 2 'pre-Sanctuary' layers (Loci 52.1-6) represent the earliest horizons reached in renewed excavations in Area E, and may now be deemed Phase 5 within the Area E Master Sequence.

Area G (Fig. 16)

In 1994, a 15 x 5m step trench was laid out across the central northern face of the PBI Tulayl 3 excavation field, in the region of PBI Square A6 (Lee 1973). Two small (2 x 1m) sondages were excavated to sample the stratigraphy of the upper phased deposits exposed during cleaning of the large irregularly stepped area (Bourke *et al.* 1995: 48-49). In 1995, the southern third of the 15 x 5 metre trench cleaned in 1994 was re-designated trench G II Locus 50, and more thoroughly investigated (Bourke *et al.* 2000: 52). In 1997, the northern third of the 1994 cleaned area (re-designated trench G III), already partly sampled in the first of the small sondages excavated in 1994, was explored across its entire 5 x 5 metre extent (Bourke *et al.* 2000: 53). Only the 'middle' 5 x 5 metres of the 1994 cleaned area remained to be studied, and this area (re-designated trench G IV) was sampled in a 4 x 1 metre probe along its eastern extent in January 1999.

Trench G IV 1999

The second of the small sondages excavated in 1994 (GII Locus 20) had sampled a 2 x 1 metre area in the northeast corner of what became trench G IV in 1999. That material was des-



16. Area G. Trench Locations 1995-99.

ignated Phase 5 in the 1994 Area G sequence. Excavations in 1999 began at the base of 1994 bricky debris layer G II 20.19 (Bourke *et al.* 1995: 49).

With the removal of decayed bricky layers (30.1 and 30.9), the first architecture, a fragmentary sub-round stone alignment (Feature 1) with an eroded mudbrick casing (Wall 1), was uncovered straddling a prominent east/west earthquake split. The split separated deposits in the northern half metre of the trench from those to the south. The circular mudbrick and stone structure (Wall 1/F.1) appear to form a stone-lined brick-sealed storage installation. Several ashy fill levels were excavated within the circular installation (30.2 and 30.4-6). A grey occupation level (30.3) abutted its southern face, and sealed two levels of stoney makeup (30.7-8) and a deep deposit of decayed brick (30.11). Excavation of 30.11 pedestalled the circular installation, which was

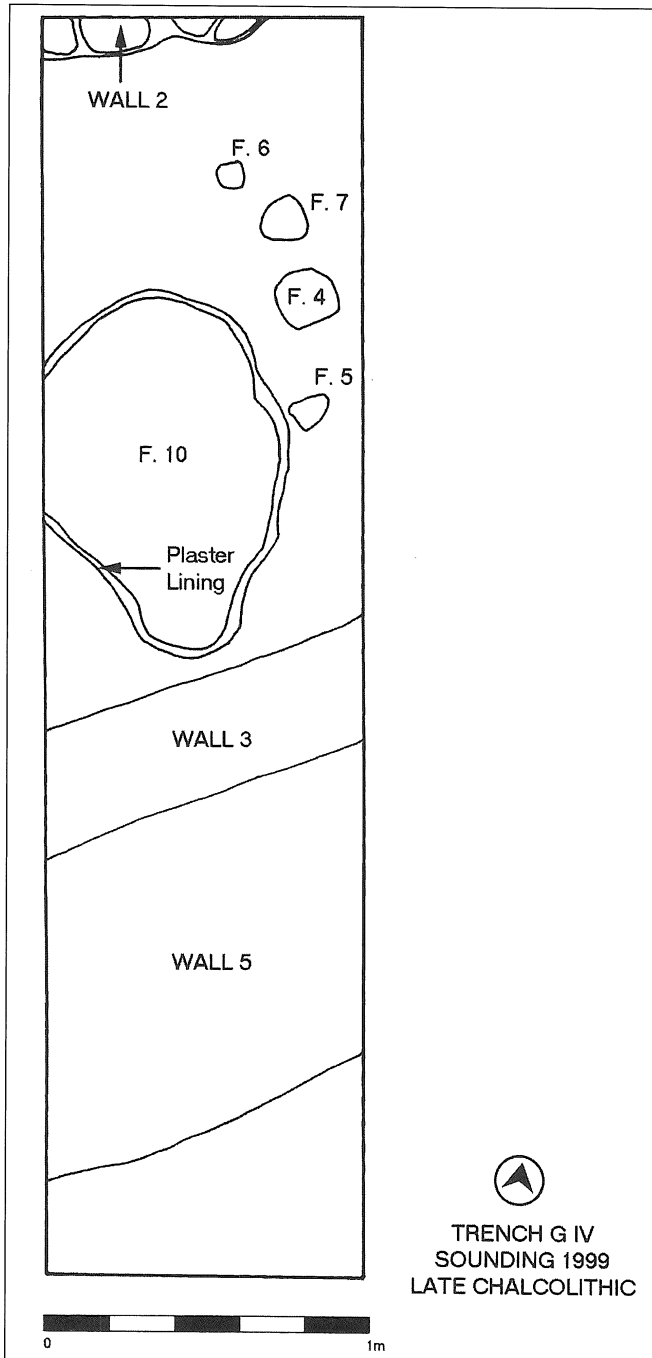
then removed (30.12).

The decayed bricky layer (30.11) separated the F.1/Wall 1 storage installation from earlier deposits. These consisted of bricky debris (30.13), two layers of grey-brown ashy occupation (30.14-15), two stone-filled collapse layers (30.19 and 30.21), and two laminated grey ashy surfaces (30.16-17). These were set over another layer of bricky collapse (30.18). Removal of further silty bricky debris (30.22) below 30.18 revealed the eroded top of n/s mudbrick Wall 4, and e/w mudbrick Wall 3, which abutted Wall 4 to the south.

With the detection of the e/w earthquake split and the discovery of e/w Wall 3, excavations within the G IV probe were carried out in three separate units. The first consisted of all deposits north of the e/w earthquake split (Wall 2 and associated levels). Deposits between the split and Wall 3 were dug as the second unit, and those south of Wall 3 as the third (Fig. 17).

In the small area north of the e/w earthquake split, below decayed brick (30.9) and an ashy occupation lens (30.10), a narrow mud facing of an e/w mudbrick wall (Wall 2) was exposed against the north baulk. A patchy white surface (30.20), and below it a layer of grey/brown silty occupation (30.45), ran up to the south face of the wall. Removal of 30.45 pedestalled the grey mudbricks of Wall 2, which were then removed (30.46). A series of fine grey silty layers (30.47) below 30.45 sealed a thick deposit of yellow/orange mudbricks (30.48), which were probably tumbled structural material from Wall 4. Below this bricky debris a white plaster surface (30.49), and two layers of occupational debris (30.50-51) were probably to be associated with Wall 3, although a direct connection was not secured (Fig. 18).

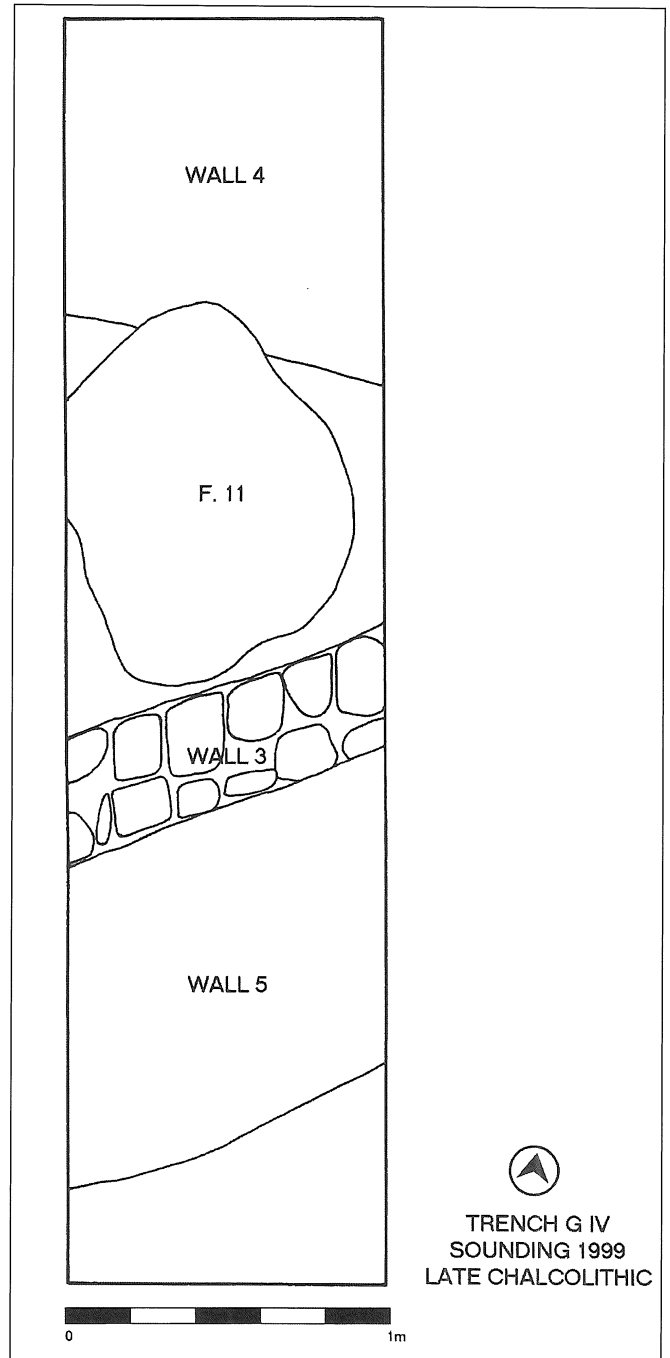
Excavations south of the earthquake split uncovered a series of six medium/small mud-plaster-lined postholes cut into the top of the badly eroded superstructure of Wall 4. These six postholes (Features 4-9) formed a semi-circular arrangement, and each was found to be filled with soft brown soil when excavated (30.23-26, 30.28 and 30.30). The arrangement (nearly two metres in diameter) suggests the presence of a circular installation with the edge defined by large wooden stakes. A very large two-stage ash and debris filled pit (F.10-11) lay at the heart of



17. Trench G IV. Plan of Phase 2 Architecture.

the installation, suggesting the circular posthole arrangement may have formed part of a protective barrier (roofed?) for the deep storage pit. The later pit (F.10) contained three layers of laminated ashy fill (30.27, 30.29 and 30.31), and was cut into an earlier, slightly larger pit (F.11), which was filled with ash and charcoal (30.32 and 30.38).

With the removal of the large pit/storage installation (F.10/11) and a thick layer of brick slurry (30.33), several patches of occupational debris (30.34-36) which linked Walls 3 and 4



18. Trench G IV. Plan of Phase 3 Architecture.

together were exposed. These lay over a thick deposit of yellow brick debris/makeup (30.37 and 30.39), which on removal pedestalled Wall 4. Wall 4 was then removed (30.40).

Below Wall 4, a series of earlier occupational layers (30.41-44) associated with Wall 3 were then excavated. Work ceased north of Wall 3 with the excavation of 30.44. The area south of Wall 3 (Locus 31) was cleaned towards the end of the season. This cleaning (below brick slurry 30.18) exposed the hard orange mudbricks of Wall 3 (31.1) and the very eroded traces (31.2)

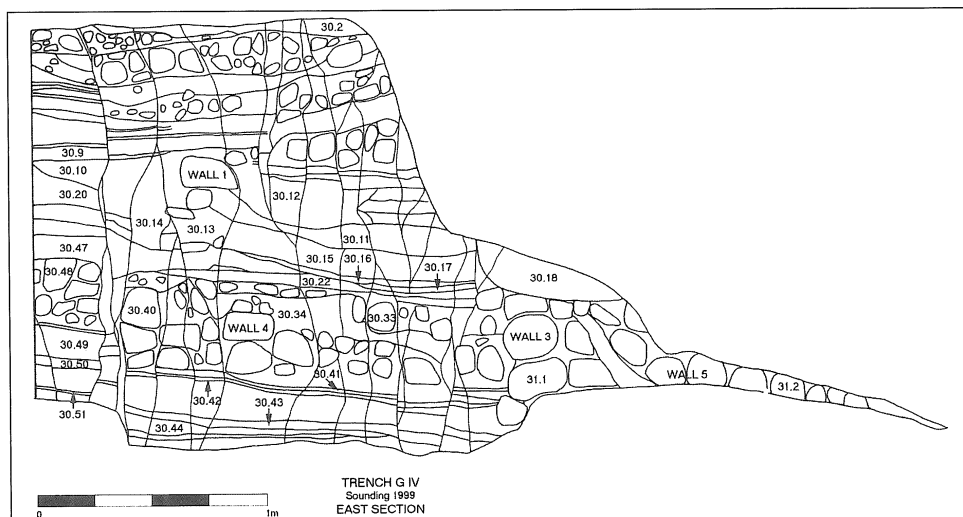
of a fifth yellow/grey mudbrick wall (Wall 5), built against the southern face of Wall 3. It is probable that Wall 5 and associated deposits were related to the later sub-phase of Wall 3 occupation connected with Wall 4 (Fig. 19).

Area G: Summary of Excavations

Excavations in Area G had one main aim, which was to complete the linked sequence of small stratigraphic probes through the 15 x 5 metre step trench laid out in 1994. To do this, the middle 5 x 5 metre step had to be sampled. Excavation was much complicated by the presence of a series of large pits (always a problem in narrow probes) and the ever present earthquake faulting. Even so, at least five distinct horizons of construction were isolated in trench G IV, and the earlier sequences in trench G II (1995) were successfully connected with the later occupational horizons in trench G III (1997). However, intensive botanical sampling was restricted by the presence of the earthquake splits and exten-



19. Trench G IV. View of Excavations. Looking NE.



20. Trench G IV. East Section.

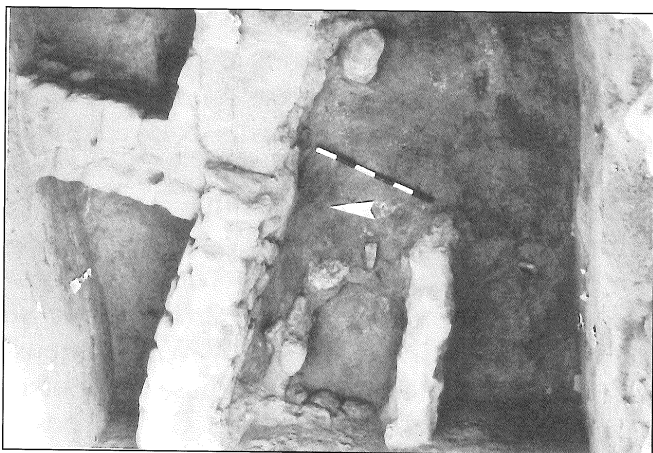
sive pitting (Fig. 20).

The Trench G IV horizons are earlier than G III deposits (Hennessy Phase A). For the most part, they are later than deposits excavated in G II Locus 50 (Hennessy D-G), and are best associated with early Late Chalcolithic assemblages (Hennessy Phase B-C). G IV Wall 3 deposits relate to G II Phase 4, with G IV Wall 3 the probable continuation of G II Wall 2 (Bourke *et al.* 2000: 52 and fig. 10). The G IV Wall 4 deposits probably relate to the G II Phase 3 architecture of Walls 15-16. The earliest G IV deposits reached towards the end of the season (30.42-44), are equivalent to G II Phase 4, tentatively associated with Hennessy Phase C/D horizons.

Area N

Area N was laid out in 1995 approximately 100 metres northeast of Hennessy Area A. Two 5 x 5m trenches (N I and N II) were excavated early in the 1995 season, and the uppermost phases of occupation sampled in both. Thereafter, a deep sounding was commenced within the northeastern quadrant of southern trench N I, and several additional phases of occupation sampled in this more restricted area. The deep sounding within trench N I was further excavated over the course of the 1997 season, where an additional six phases of occupation was sampled before excavations ceased (Bourke *et al.* 2000: 59-65). In 1999, excavations continued within the N I sounding, and reached sterile after sampling further occupational horizons.

As well as continued work in N I, a new 5 x 4m trench (N III) was commenced immediately west of the original 5 x 5m trench N I, to further



21. Trench N I Sondage. View of Phase 10 Architecture. From Above.

explore the latest archaeological horizons in this area, and to excavate fully the western half of the well preserved mudbrick building defined by N I Walls 1-3 in 1995 (Bourke *et al.* 2000: 60 and fig. 14). Parts of four horizons of occupation were sampled across the 5 x 4 metre extent of N III before work ceased.

Trench N I 1999

Excavations continued exclusively within the 2.5 x 2.5m sounding in 1999. Final work in 1997 had excavated the main occupational deposits in three rooms defined by five mudbrick walls (Walls 10-14), designated Phase 9 in the N I sequence (Bourke *et al.* 2000: 62). At the very end of the season, an earlier sub-phase of use (Phase 10) was in the process of being uncovered when work ceased.

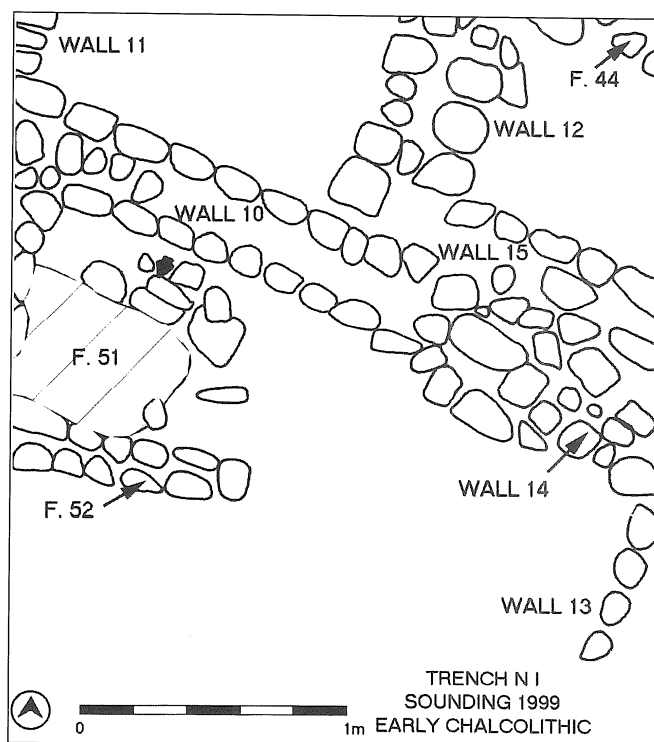
Considerable amounts of backfill had to be removed from the sounding before excavations could resume, but this had the advantage of protecting fragile deposits. After removing over a metre of backfill, the first excavations in 1999 began by exploring the hitherto unsampled Phase 9-10 deposits south of the main e/w dividing walls (Wall 10/14) of the Phase 9-10 architectural complex (Fig. 21).

Thick layers of brick collapse (12.1-3) sealed at least two phases of occupation south of the Wall 10/14 wall line. The upper occupation deposits consisted of grey fill (12.4) and patches of greenish-grey surfaces (12.5). These lay over thick mudbrick collapse layers (12.6-7 and 12.10), which mark the division between upper (Phase 9) and lower (Phase 10) horizons. Lower deposits consisted of a thick layer of grey-

brown occupation debris (12.8), which sealed a large pit (F.48/F.55) in the southwest corner (12.9 and 12.26), and uncovered the east face of an orange mudbrick wall (Wall 16), which ran down the western edge of the sondage to join the south face of Wall 10. Six courses of orange bun-shaped bricks were preserved beneath a thick yellow mudplaster facing.

A small mudbrick bench (F.52) ran east from Wall 16 perhaps a metre south of Wall 10. In the small recess defined by Walls 10 and 16 and Bench F.52 (12.18), a squarish plaster-lined bin (F.51) was situated. It had been neatly constructed of yellow mudbricks (12.17), and filled with thick brown silt and bricky debris (12.11 and 12.14). The debris from this bin lay over a small ceramic jar (P.O. 23), and a number of ground stone items, including a hammerstone (P.O. 22), and a basalt quernstone (P.O. 25). Several other worked basalt pieces (P.O. 26 and 28), and a bone point (P.O. 27) were sealed within the bin structure (12.18). Thick grey-brown occupation deposits east (12.12) and south (12.13) of the bin sealed a thin greenish-grey floor surface (12.15) (Fig. 22).

A large flat stone (F.50) was set into this floor (12.15) against the middle of the south baulk. Whilst this may have served as a large potstand, the carefully chocked foundations (12.16) sug-



22. Trench N I Sondage. Plan of Phase 10 Architecture.

gested it probably functioned as a pillar-base. In the northeastern area of the locus a square threshold stone (F.53) was set into the floor (12.15), marking the base of a small staircase down into the building from the southern side of Wall 14. Beside the threshold, a sub-square posthole (F.54) cut into the floor probably marks a doorpost (12.24). Earlier deposits (12.20-21) below the floor (12.15) may represent an earlier sub-phase of occupation, or a makeup layer for the floor.

These deposits mark the earliest horizons associated with the Phase 10 architecture, as below them a series of sandy laminated deposits (12.22-23, 12.33, 13.1, 14.4 and 15.3-4) and a thick brown clay lens (12.25) mark off the mudbrick architecture of Phase 10 from the posthole and pit constructions that lay below (Fig. 23).

The final occupational phase (Phase 11) encountered in the N I sounding consisted of a series of medium sized pits and smaller posthole installations. These seem to delineate parts of perhaps two sub-circular structures built of wood and reed. These were associated with a thin deposit of brown loamy fill (15.6), which lay over a compact yellow sandy clay (15.7). These thin occupational layers sealed a hard buff plaster-flecked clay surface (12.27). Two large shallow pits (F. 60-61) containing grey occupational debris (15.2 and 15.5 respectively), were cut into the compact yellow sand (15.7).

An arrangement of larger postholes can be differentiated from an associated group of smaller sub-square stakeholes. The large posthole arrangement describes an arc-like pattern across the excavated area. It consists of three postholes F. 56 (12.28), F.58 (12.29), and F. 65 (15.11), which may indicate the presence of a sub-circular dwelling. Slightly north and east of the posthole arrangement, a collection of four smaller sub-square stakeholes F.59 (15.1), F. 62 (15.8), F. 63 (15.9) and F.64 (15.10), appear to form an irregular line, perhaps the remains of fencing.

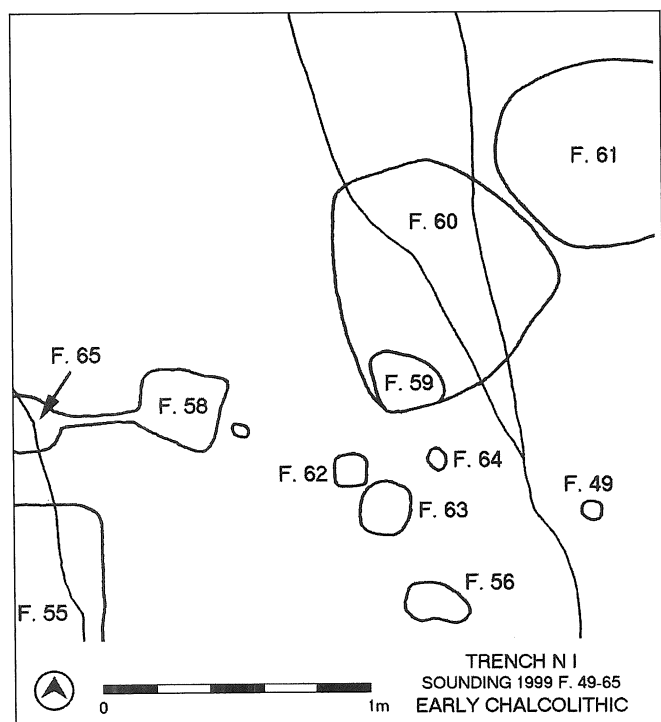
Together the post and stakehole arrangements, the thin occupational debris layers (15.6-7), and the plaster-flecked surface (12.27), make up a short-lived horizon of semi-permanent 'camp-floor' occupation, not unlike those detected by Hennessy during earlier campaigns (Hennessy 1969: 7). No further occupational deposits were detected below this campfloor horizon. A series of sterile layers of yellow-brown silty sand (15.12), red silty clay (15.13), thick dark red-brown clay (15.14) and a fine greenish-yellow sand (15.15) lay below the occupational strata in trench N I (Fig. 24).

Trench N III 1999

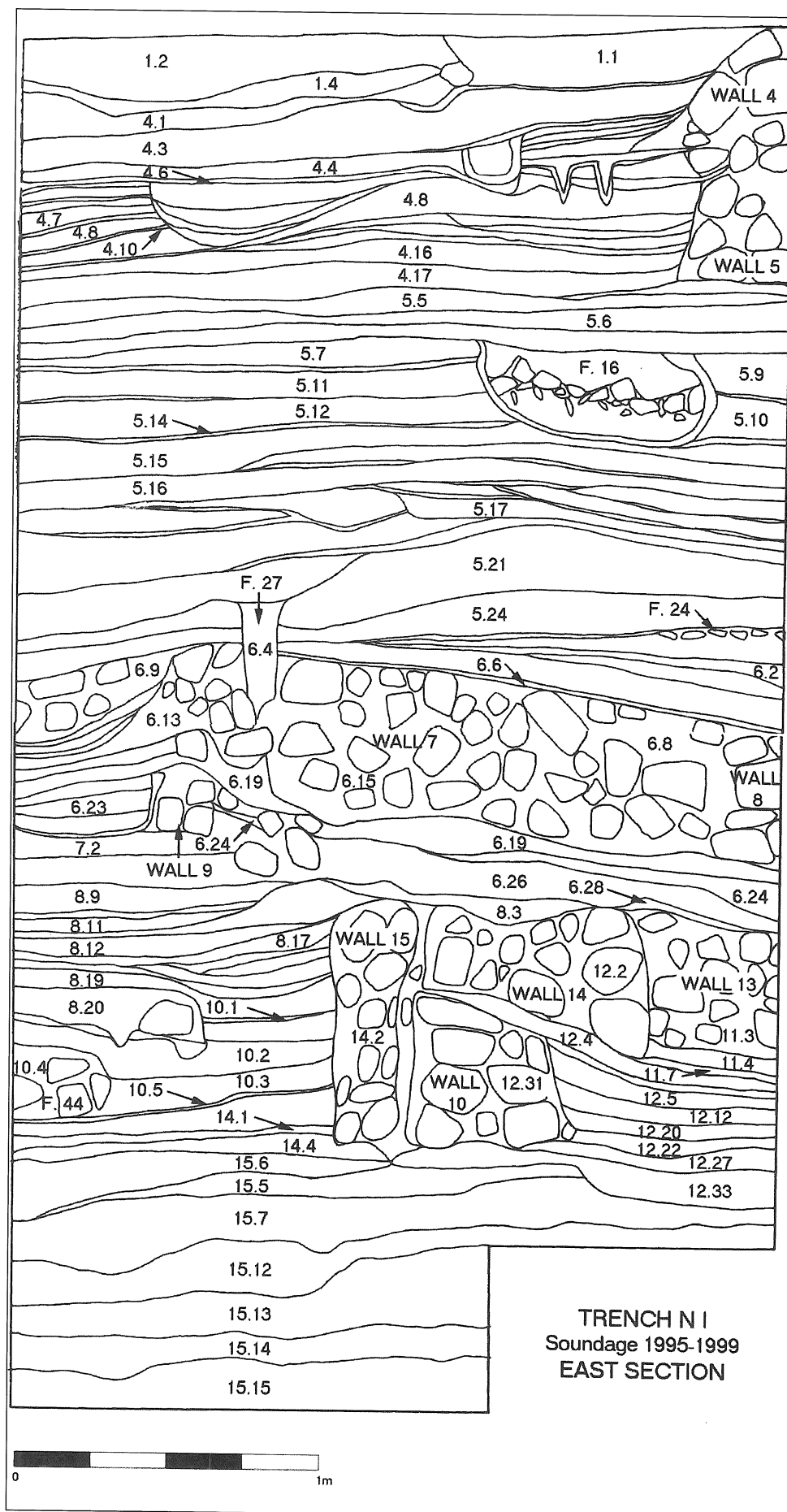
Trench N III was newly instituted in 1999, to continue the exploration of the latest archaeological horizons in Area N, while completing the excavation of the well preserved mudbrick building partially explored in trench N I in early 1995 (Bourke et al. 2000: 60 and fig. 14).

Initial work consisted of the removal of thick layers of windblown sandy topsoil (1.1 and 1.5-8), which exposed three small stone-filled post-Chalcolithic firepits (Feature 3:1.3; Features 7-8:1.9/5.5 and 1.10), and the very shallow traces of what were probably once three mudbrick walls (Features 1 and 11-12). These mudbrick features were situated immediately above earlier phased mudbrick walls (Walls 1-2), and probably represent a re-build. The final phase of occupation within the western half of the substantial building first explored in trench N I in 1995 consisted of a patch of black occupation (1.2/2.3), sealing a fragment of off-white plaster floor (1.4/2.1) (Fig. 25).

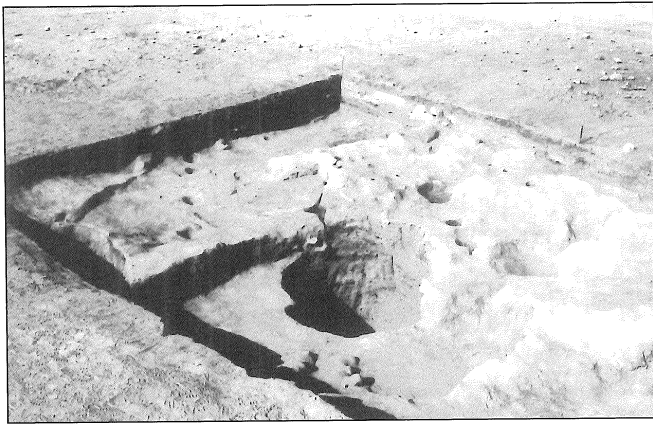
A large pit (Feature 9) had been cut into the room deposits, and had removed a significant amount of the living surfaces within the south-



23. Trench N I Sondage. Plan of Phase II Pits.



24. Trench N I Sondage. East Section.



25. Trench N III. View of Phases 1-3. Looking NW.

ern half of the room. The pit had several distinct deposits within it, the uppermost consisting largely of building debris (2.2/2.7). Lower deposits were mainly of burnt organic materials (2.7-10 and 9.20-22), predominantly olive. An earlier sub-phase of occupation, more firmly associated with the well-defined mudbrick walls (Walls 1-2), consisted of a dark grey occupation layer (2.4), laid over an earlier greenish-white plastery floor (2.5/6.1).

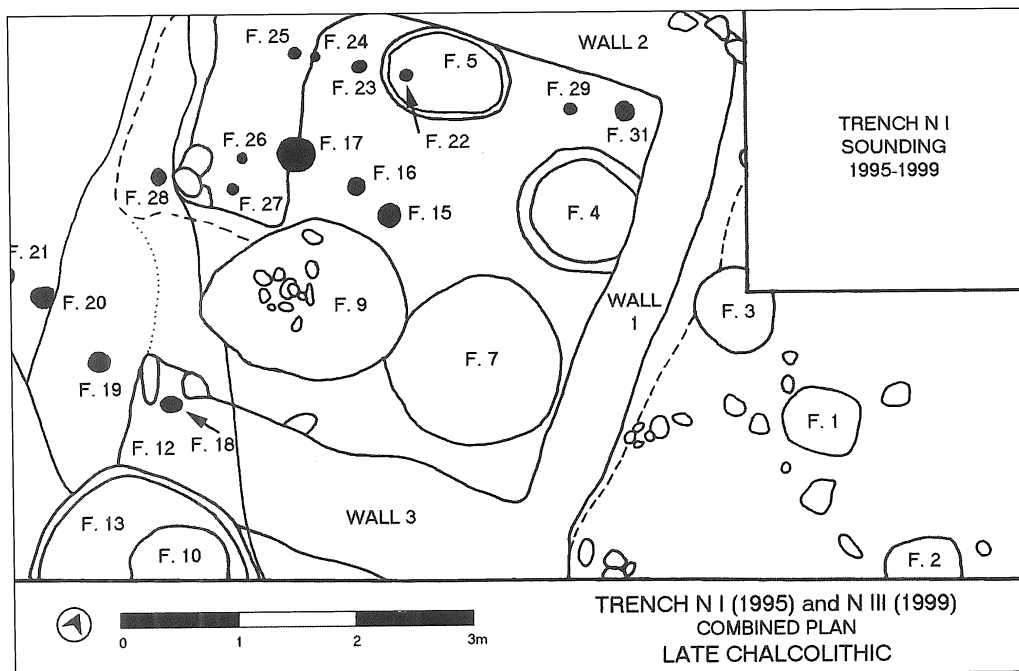
Outside the building to the northwest, patches of an off-white plastery surface (3.1/3.6/7.8-9) were encountered directly below the topsoil (1.1). These surface patches were built upon two layers of bricky makeup (3.2-3/7.6-7) which overlay a thin band of sandy silt (3.4). This silt layer separated the later surfaces from an earlier greenish-white plastery surface (3.5/7.1).

Outside the building to the south and south-

west a thin layer of ashy occupation (5.1) sealed a plastery surface (5.2), through which one medium-sized (F.10) and one large (F.13) brick-lined pit had been cut. The fill of the smaller pit consisted of two distinct layers, an upper debris layer (5.3) and a lower of burnt organic material (5.4). The larger pit/silo (F.13), partly sectioned by the southern baulk, was constructed of small brown mudbricks and lined with thick off-white mudplaster. It also had upper layers consisting of debris (8.1-2) and lower levels of decayed plaster lining mixed in with burnt organic debris (8.4-7). A bricky makeup layer (8.3) supported the upper surface (5.2), through which the pits had been cut. Below the makeup layer, an earlier occupational subphase was represented by several ashy deposits (8.8-10), sealing an earlier off-white plastery surface (8.14).

The upper occupational horizon in N III consisted of two distinct sub-phases, an upper sub-phase of ephemeral structural features (Features 1 and 11-12), large pits (Features 9-10 and 13) and patchy surfaces, which could only be very loosely associated with an earlier subphase of surfaces both external and internal, linked to the mudbrick architecture of Walls 1-2.

The upper phase was separated from an earlier 'post and stakehole' horizon of occupation by a thick layer of slurried bricky collapse (1.11/6.2/7.2/8.15/9.1-2/9.7-8/9.19). Into it were cut three distinct collections of linear post and stakehole arrangements (Fig. 26).



26. Trench N III. Plan of Phase 1-3 Architecture and Pits/Postholes.

The northern alignment of three 25 x 15cm postholes (Features 15-17: 6.4-6) were flanked to the north by a line of four smaller 10 x 5 cm stakeholes (Features 22-25: 6.7-10), and to the east by two (Features 26-27: 6.11-12) similarly sized stakeholes. Together this northern-most post and stakehole arrangement seemed to chart the position of the western end of a substantial rectilinear wooden structure, consisting of large central postholes and somewhat less massive peripheral wall supports.

Further to the southwest, a second alignment of four postholes (Features 18-21: 7.4-5 and 8.12-13) may suggest the presence of another structure, although only one isolated stakehole (Feature 28: 6.13) was detected in rather loose association with this southern alignment.

There are very few occupational deposits that can be reliably associated with the 'post and stakehole' structures. A patch of occupation (7.3) to the northwest of the northern alignment is probably associated, as are a series of occupation and floor deposits, shattered by a network of n/s earthquake splits, and dug as four separate but broadly equivalent sequences. Dark greyish brown occupational deposits (9.3-4, 9.9, 9.12-14 and 9.16-17) were found to lay over a yellow-brown bricky surface (9.6/9.10/9.15/9.18).

In a small sounding against the southeast baulk, earlier deposits below the yellow-brown bricky surface (9.6/9.10/9.15/9.18) were uncovered. It appeared that the post and stakehole structures and accompanying occupational horizons had been built upon a thick layer of decayed mudbrick with interleaved sandy lens (9.23-26), which served to mark the division between the posthole structures and an earlier phase of rectilinear mudbrick architecture, which was in the process of being uncovered when excavations ceased.

Area N: Summary of Excavations

The sounding in trench N I was carried through to sterile, although the depth of deposit in the sounding was rather less extensive than originally supposed. Phase 9 architecture was removed and the primary Phase 10 architecture fully excavated. Below the substantial architecture of Phase 10, only a scrappy campfloor horizon (Phase 11) intervened before sterile deposits were encountered.

In trench N III the latest preserved archae-

ological horizons were examined in detail, although as suspected they were very badly disturbed by modern ploughing, isolated firepits and erosion. Even so, a shallow horizon of pits and surface fragments, loosely associated with an earlier badly damaged mudbrick structure, was isolated above an equally ephemeral horizon of post and stakehole constructions. Sealed below the posthole constructions, an earlier phase of substantial mudbrick architecture was encountered just as excavations ceased.

The newly excavated materials from trench N III are mainly to be associated with the first three horizons excavated in trench N I (Bourke *et al.* 2000: 62). The uppermost pit/silo and mudbrick wall phases are related to Horizons 1-2 in the N I master sequence, with the posthole constructions broadly equivalent to Horizon 3. The distinct phase division marked by the bricky debris layer N I 5.16 (Bourke *et al.* 2000: 61) is equivalent to that encountered below the Phase 3 posthole horizon in trench N III. The few earlier deposits are therefore likely to relate to Horizon 4 in the N I sequence.

Further comparative work between the Area N sequence and that recovered in Hennessy's Area A excavations (Hennessy 1969: 5-7), suggests a slight modification to previously suggested equivalences. The Horizon 1 and 2 materials in Area N probably relate to the ephemeral post-Phase A campfloor horizon and the slightly earlier architecture of Hennessy Phase A. The posthole constructions of Horizon 3 may relate to the campfloor occupation above Hennessy Phase B. This suggests that the substantial architecture of Area N Horizon 4 relates to the upper sub-phases of Hennessy's Phase B architecture. Within the N I sounding, the Area N Horizon 5-7 materials probably relate broadly to Hennessy Phase B-C assemblages, with the well executed architecture of N I Horizons 8-10 associated with the substantial Phase D/E constructions discovered by Hennessy in his 1975/77 excavations in Area A (Hennessy 1977: 5-10). The campfloor occupation (Horizon 11) at the base of the Area N sequence may relate to a dense complex of pit and posthole features which sealed Phase F architecture in Area A (Hennessy 1977: fig. 4).

Area Q

Area Q was newly opened in 1997 to explore

the eastern region of the central settlement area (Bourke *et al.* 2000: 66). Two trenches were opened in 1997 (Q I and Q II), with the former much expanded by the end of that season, having encountered a substantial mudbrick building with associated bin and silo features (Bourke *et al.* 2000: 67), along with a cache of high prestige finds in the small eastern room of the structure (Bourke *et al.* 2000: 71). The southern trench (Q II) preserved traces of wall lines flanking a courtyard area, which contained an elaborate centrally-placed double bin feature (Bourke *et al.* 2000: 68). Severe disturbance in the south and east of the trench dictated closure at season's end.

In 1999 trench Q I was expanded 6 x 7m immediately to the west of the 1997 trench boundary (making a 13 x 6m exposure), to explore more of the western room of the mudbrick building. This area was subsequently expanded a further two metres to the north to explore the northern margins of the west room, leading to a final Q I exposure 13 x 8m in extent. As well as expanded work in trench Q I, a new 10 x 6 metre trench (Q III) was positioned a metre west of the 1999 Q I extension to explore the area to the west of the Q I structure.

Trench Q I 1999

Excavations in the 6 x 7m westward extension first removed thick deposits of windblown topsoil sand (14.1 and 18.1), before encountering a series of harder modern surfaces (14.2-3, 18.2-3 and 21.3), disturbed by numerous shallow ploughlines and animal burrows (15.9).

These modern deposits overlay a thin lens of yellow decayed brick (14.4, 15.1 and 16.1), which in turn sealed many shallow 'scoops' of grey ashy occupational debris, interleaved with thin off-white surface fragments (14.5, 15.2-3, 15.19, 17.3-4, 21.1-2 and 23.1). These occupational deposits were associated with seven small/medium pit features (F. 27: 15.10 and 15.13; F.29: 17.5; F.30: 17.6-7; F.32: 15.4 and 15.11; F.34: 15.5; F.36: 15.17-18 and 15.21; F.37: 15.20 and F.42: 21.4), all cut into and often through the ash and brick debris of the first occupational horizon.

Less securely associated with this horizon was a small stretch of what may well have been a heavily eroded mudbrick wall (F.45: 21.5). This

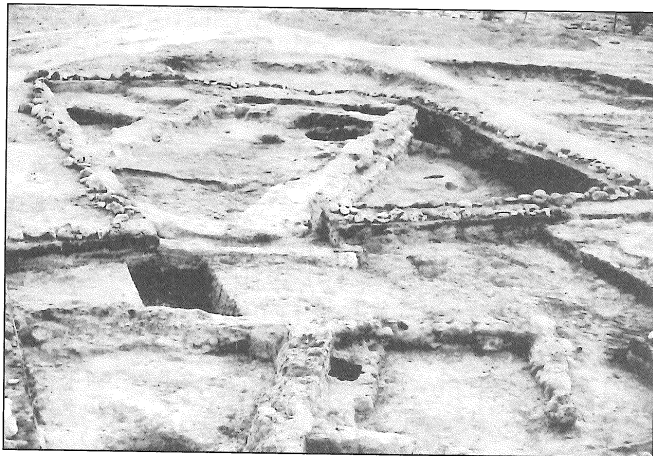
poorly preserved feature ran west from the area of the west wall (Wall 12) of the Q I building to intersect an equally poorly preserved possible wall fragment located in the eastern margins of trench Q III (Feature 5). Together these two structural features seemed to form a small room corner built against the west face of the original Q I building. This small room contained a medium sized plaster lined pit (F.42), filled with ashy debris (21.4).

This uppermost phase consisted of a thick horizon of interleaved ashy scoops, sand lenses and patchy surfaces, pits and mudbrick wall fragments. It overlay a thicker band of decomposed yellow mudbrick, which sealed the substantial architecture of the mudbrick building complex first exposed in 1997 excavations (Bourke *et al.* 2000: 67).

Sealed below the upper 'campfloor' horizon, a thick yellow bricky debris layer (15.5, 15.8, 15.12, 15.22, 15.25, 17.1-2, 17.8, 17.14, 17.19, 17.22-23, 19.1, 20.1, 21.6-7 and 22.4) lay over the mudbrick architecture of the Q I building complex. It was found to consist of a large (10 x 4m) western room, adjacent to the much smaller (4 x 1.5m) eastern room, which contained several child burials, miniature vessels, shell jewellery, the macehead and stamp seal (Bourke *et al.* 2000: 72-73).

The western room was constructed of neatly laid yellow sub-rounded mudbricks, which formed substantial mudbrick walls on the south (Wall 9), west (Wall 12), north (Wall 7/10) and east (Wall 3) sides of the room. A large courtyard opens out to the south of the longhouse south wall (Wall 9), and a sondage through courtyard deposits against the outer southern face of Wall 9 revealed two courses of stone footings 40cms below the preserved brick height. As excavated, Wall 9 was nearly a metre wide and was preserved to a height of over 80cms. If its construction was typical of the other less fully exposed walls, then the Q I building was the most massively constructed complex investigated by the current expedition (Fig. 27). Overall size and main constructional features are similar to both Maison 2 and Maison 26 exposed by Mallon in Field I (Mallon *et al.* 1934: pl.15.1-2).

Below the bricky debris that sealed the complex, occupational deposits can be divided into those within the west room, those in the court-



27. Trenches Q II/Q III. View of Excavations. Looking SE.

yard area to the south, and a few deposits excavated north of the north wall (Wall 7/10).

Within the west room, main occupation deposits consisted of thin grey silty debris layers (17.3, 17.9 and 17.12). They sealed a good reddish-brown floor surface (17.10), into which was set three neatly constructed features. These consisted of two plaster-lined rectilinear basins (Feature 38: 17.16-18 and Feature 48: 17.24), set against the inner northern face of Wall 9, and a medium-sized plaster-lined silo (Feature 40: 17.13 and 17.20-21), located in the southeast corner of the room. The thickly plastered basins (both approximately 180 x 50cms in size) were set against the south wall, and seemed associated with the manipulation of liquids, perhaps bread-making. The large (120 x 65cm) plaster-lined silo was constructed of brick and lined with off-white plaster. It had a slightly raised rim relative to the floor, was built of sub-rounded stones, and plaster-sealed. Although largely full of building collapse when excavated, it may originally have been intended for grain storage.

The basin and silo horizon represents the latest coherent occupation within the west room. Earlier deposits were sampled in small soundings against the inner face of the north wall (Wall 7/10). These consisted of a thin band of light grey silty occupation (17.11), which lay over an earlier yellow plaster floor (17.15 and 22.1-2). This earlier material may still be associated with the basin and silo features, although direct connections had not been established by the end of work. Even earlier occupational debris (22.3 and 22.5-6) was explored below the yellow floor (22.1-2), although this material was not reliably associated with any structural

feature. Within the building, excavations ceased with the removal of 22.6.

In the southern courtyard area, below the brick debris, thick bands of yellow-grey ashy silt (15.7 and 15.16) sealed a good red-brown surface (15.6 and 15.19), that ran south from Wall 9. In the small area excavated to the west of Wall 12, a brick-lined pit (Feature 47: 23.2-3) was set into an ashy grey surface (23.1), which ran up to the west face of Wall 12. To the north of the longhouse structure, below bricky debris (19.1 and 20.1), two thin (one brick wide) n/s walls (Walls 11 and 13) served to define two small bin-like rooms (Loci 19 and 20) built against the northern exterior face of Wall 7/10. Occupational debris layers (19.2-3 and 20.2) were recovered from within each bin/room. The discovery of small bin-rooms built against the outer wall of more substantial structures was a feature of Hennessy's first season of excavations in trench A I (Hennessy 1969: pl.IVb).

In a 4 x 1m sondage against the west baulk, earlier occupational horizons within the courtyard were sampled. A series of deep ashy occupational deposits (15.26-28) and a small section of a larger pit (Feature 44) were encountered above a layer of bricky debris (15.29). Below this, earlier grey ashy occupational layers sealed a hard yellow courtyard surface (15.23 and 15.32), into which a small posthole (Feature 37: 15.24) had been cut. All these deposits seemed to be in association with Wall 9, although earliest layers (15.29-32) might have been associated with a distinct early phase of the wall, as here the stone footings at the base of Wall 9 were situated slightly to the south of the later alignment, perhaps hinting at an earlier phase of construction on a closely similar alignment. Excavations ceased at this point.

Trench Q III 1999

Newly instituted trench Q III was initially laid out as an 8 x 4 metre area, before being expanded two metres to the north and west over the course of excavations. After initial topsoil removal, the southern 6 x 4 metre area proved to have been heavily ploughed, so that the majority of 1999 excavations were confined to a 6 x 6m area in the northern half of the initial exposure.

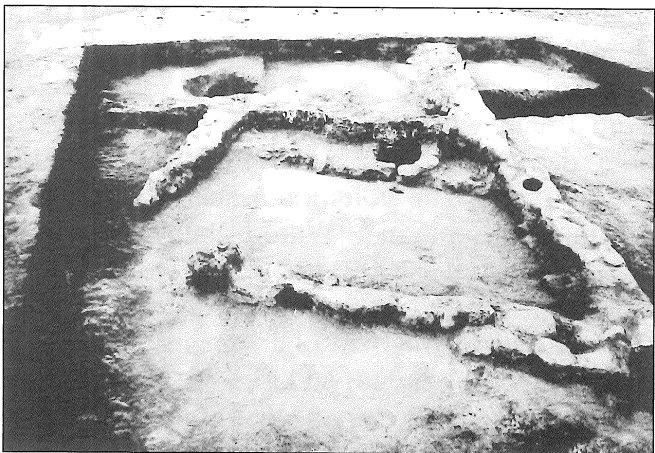
Excavations in this northern 6 x 6m area explored two main occupational horizons below

a thin layer of windblown topsoil (1.1/2.1/4.1), a firepit (Feature 16: 4.2) and a probable post-Chalcolithic stone installation (Feature 1). A series of thin sandy abandonment surfaces (1.2/1.4/2.2) sealed the first of two occupational horizons.

This first horizon consisted of traces of two mudbrick features (Features 3 and 5: 1.3 and 1.5), which may have been the very eroded remains of mudbrick walls, preserved no more than 3cm below the modern surface. Associated with these two mudbrick features were a series of laminated ashy grey layers (1.6 and 1.8-9), which seemed likely to be external courtyard surfaces. These were more loosely associated with a horseshoe-shaped mudbrick installation (Feature 2: 1.7) and five mudplaster-lined post-hole features (Features 7, 10-12 and 14: 1.13, 1.15-16 and 2.4). Most postholes were substantial, between 20-25cms in diameter, and between 15-25cms deep. They were cut into a thick layer of underlying collapsed mudbrick (1.10-11, 2.3, 4.3, 4.5 and 4.7), which separated the posthole and brick constructions of the upper horizon from the more substantial mudbrick architecture of the lower phase.

The removal of the thick bricky debris layer across the trench uncovered five neatly laid mudbrick walls (Walls 1-5) which defined four walls of one small mudbrick bin/room (Locus 6), and two walls of a second more substantial structure (Locus 7), immediately north of the first. These two rooms were situated in the western half of the trench, and separated from an eastern mudbrick boundary wall (Wall 6) by a three metre wide roadway (Fig. 28).

The southern room, roughly 1.5 x 1.5m in



28. Trench Q III. View of Southern Room. Looking North.

extent, was lightly constructed of a single line of neatly laid orange mudbricks (Walls 1, 4 and 5), built against the south face of a much more substantial mudbrick wall (Wall 3). This Wall 3 probably formed the southern wall of the main structure, to which the southern (exterior) bin-room was attached. The southern face of Wall 3 was sealed with grey-white mudplaster (Feature 6), with a neatly constructed 30 x 30cm sub-square bin feature (Feature 15) attached to its exterior face. The bin proved to be full of a burnt black organic deposit (3.1). Within the southern room, a thin layer of sandy silt (6.1) was sealed below the bricky collapse deposit (4.7), perhaps suggesting a short abandonment phase before structural collapse occurred. A black ashy surface (6.2) lay below the sandy silt layer, and ran up to all four walls (Walls 1 and 3-5) of the room. Exterior courtyard surfaces south and west of this southern room (4.4) were also isolated below thin layers of bricky collapse (4.3).

The northern room was more substantially built of a triple line of orange bun-shaped mudbricks (Walls 2-3), sealed below thick layers of building collapse (4.5). Large amounts of shattered pottery, a fan scraper, a spindle whorl and a worked bone object were sealed within this collapse. Below the collapse, a thin band of grey occupational debris (7.1) linked the two walls. Sealed by the debris (4.5), and cutting through the occupation (7.1), were three pit features. One large plaster-lined pit (Feature 17), sectioned by the north and west baulks, was filled with bricky collapse (4.6), as was the latter (Feature 19) of two intercut pits (7.2), which contained large amounts of shattered storage jar ceramic. The earlier pit (Feature 18), cut through by Feature 19, was filled with a yellow bricky debris and burnt black organic material (7.3).

East of the two rooms, a thick band of laminated roadway surfaces (1.12/1.17) linked the western structures with an eastern mudbrick wall (Wall 6). A narrow sondage in this street area between Walls 2 and 6 established that earlier roadway surfaces (1.14 and 5.1) ran from Wall 2 across to Wall 6. An even earlier series of grey ashy laminated surfaces (5.2-4) were associated with Wall 2 alone. Below these, an even earlier black ashy surface (5.5) pedestalled Wall 2 and the western building complex. It seems probable that the early street surface deposits (5.2-5) rep-

resent an earlier structural sub-phase before the construction of Wall 6, and possibly that of the southern bin-room, which final investigations in 1999 suggested to be later than the primary Wall 2-3 building.

Area Q: Summary of Excavations

Excavations in trench Q I completed the exposure of the mudbrick structure first detected in 1997, revealing it to be a 12 x 6 metre two-room complex, with associated built features on its north, west and eastern sides. The southeastern corner of a second structure was detected three metres to the west of the first in newly opened trench Q III. The Q III building also seemed to have a bin feature attached to its southern wall. The two buildings were separated by a three metre wide street, which opened into an enlarged courtyard area to the south of the Q I/III structures.

Little beyond the uppermost phase of occupation within these mudbrick structures was sampled during 1999, as work concentrated on the delineation of final occupational horizons. A thick 'campfloor' occupational phase was found above the Q I/III mudbrick buildings. A similar 'campfloor' horizon was detected across Area A during Hennessy's excavations, sealing more substantial mudbrick constructions (Hennessy 1969: 7). Hennessy viewed these two horizons in Area A to be associated with Phase A-B assemblages.

It may be that the latest pits within the Area Q 'campfloor' horizon (such as Q I F.30) post-dates Hennessy Phase A, and the deepest deposits within the Q I courtyard sondage (15.29-32) could pre-date Phase B, but the vast majority of deposits excavated in 1999 fall within Hennessy Phases A-B, broadly to be equated with the Classic Ghassulian assemblages defined by PBI Level IVA-B.

2. CERAMIC ANALYSIS (JLL)

The 1999 season at Tulaylāt al-Ghassūl significantly expanded the Late Chalcolithic corpus, specifically that pertaining to the uppermost phases. It also expands that relating to the earlier Chalcolithic occupational horizons. A selection of material is presented below, with broad parallels to previously published assemblages, expressed in terms of Hennessy Phase equiva-

lences (Bourke *et al.* 1995, 2000; Lovell 2001).

Area A: Trenches A XIII and A XI

The assemblage from Trench A XIII (Fig. 29: 1-10) expands that previously published from adjacent trenches A X and A XI (Bourke *et al.* 1995: 36-37; Bourke *et al.* 2000: 38-43). Parallels to other published material associates these loci firmly with Hennessy Phase D-F horizons. Decorative schemes exhibited by this material conforms to 'pre-classic' Ghassulian practices, with red slip, 'Tsaf-like' painted decoration and red painted bands all featuring.

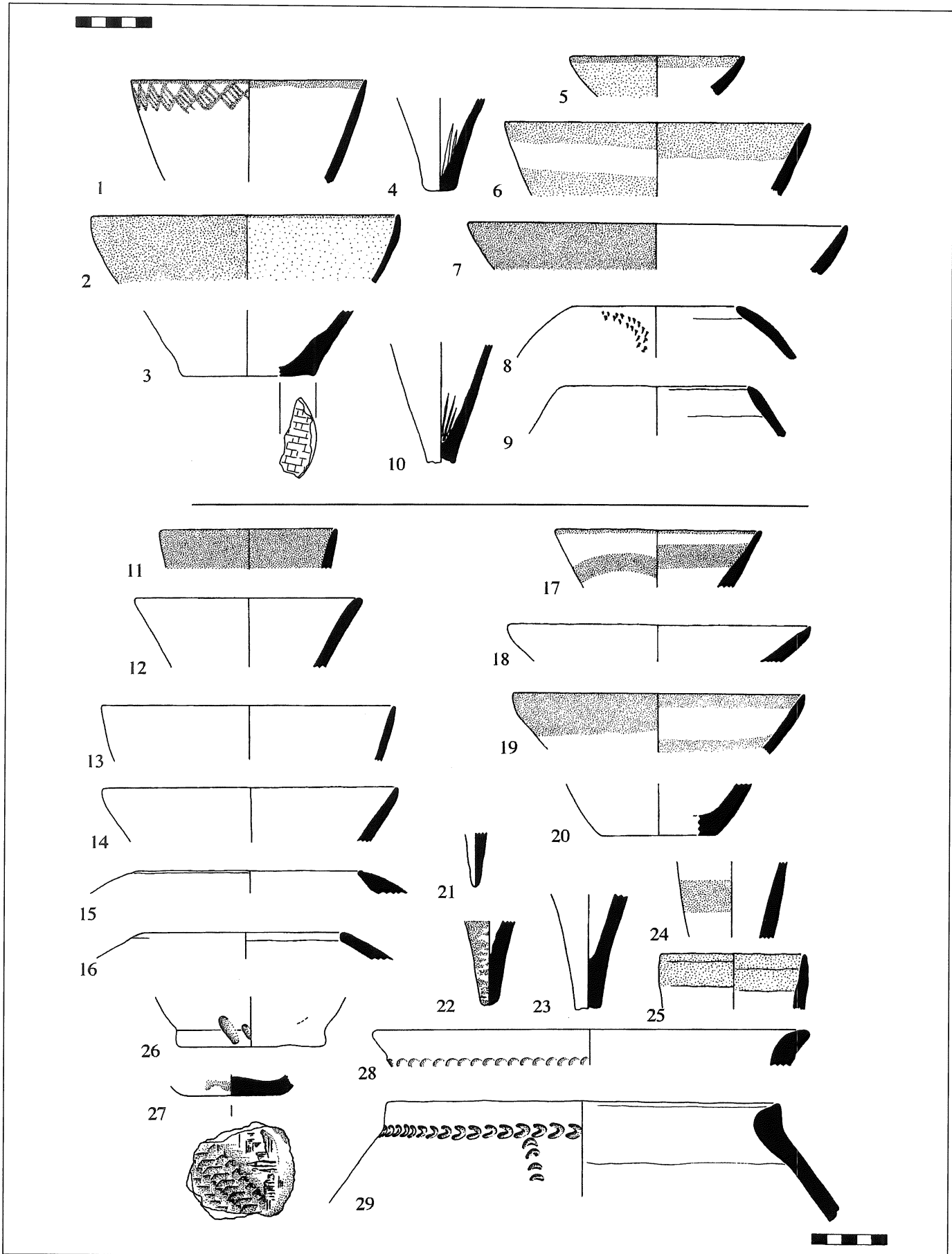
Not all of the Trench A XI material illustrated here (Fig. 29: 11-29) has good parallels within the previously published corpora. It features red slipped forms and vessels decorated with red painted bands. Occasional pieces show parallels with Hennessy Phase F-G horizons. It is worth noting the presence of cornets in these deposits. Cornets occur from Early Chalcolithic times, and are common through Hennessy Phase D-F horizons (Lovell 2001: 208 and fig. 4.62).

Further to this, Gilead (2003: 221) recently suggested that previously published cornet numbers from the Area A sequence appeared to be inflated. Percentages published in Lovell (2001) drew upon rim and base sherds (typed), as well as bodysherds (not generally typed), since cornets (as opposed to many other forms) can be reliably identified from body sherds.

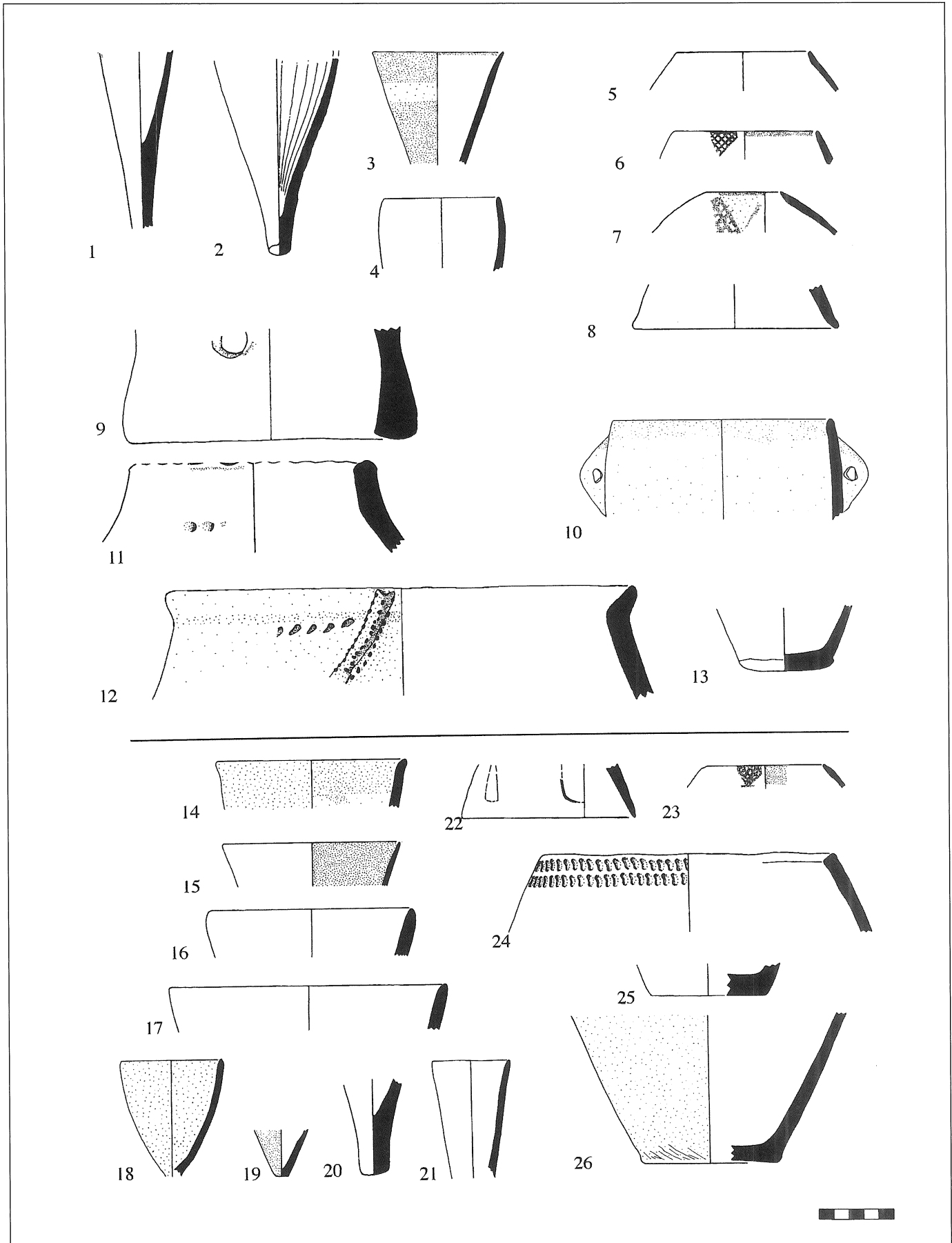
Area E: Trenches E XXIV and E XXVI

The material illustrated here (Fig. 30: 1-13) demonstrates that although the trench E XXIV loci excavated in 1999 are amongst the latest deposits recovered in Area E, they still contain significant amounts of residual material from Hennessy Phase D-E horizons.

Similar residual materials (Fig. 30: 14-26) were found within the generally Late Chalcolithic deposits in Trench E XXVI (Bourke *et al.* 2000: 49-50). The holemouth jar (Fig. 30: 24), would be at home in a 'Wādī Rabāḥ' phase repertoire (Garfinkel 1999: 130-1, fig. 81.12, 82.1), and does not find precise parallels within previously published Ghassulian forms. The small fine painted holemouth jar (Fig. 30: 23) exhibits the 'Tsaf-like' decorative scheme, which generally appears in Hennessy Phase D-F horizons at Tulaylāt al-Ghassūl. The fine 'V'-shaped bowl



29. Trenches A XIII/A XI. Pottery.



30. Trenches E XXIV/E XXVII. Pottery.

(Figure 30:15) also finds good parallels in Hennessy Phase D assemblages, although the form probably has a considerable production life. While much of the trench E XXVI corpus has form parallels in the Late Chalcolithic (Hennessy Phase A-C) assemblages, it is noteworthy that 'streaky wash' decoration was very rare in this assemblage.

Area N: Trenches N I and N III

Previous excavations in trench N I had unearthed ceramics associated with Hennessy Phase A-C horizons (Bourke *et al.* 2000: 63 and fig. 15), including examples of a 'streaky wash ware' of particularly fine execution (Bourke *et al.* 2000: fig. 15.6 and 8), that has been termed 'specialised streaky wash' (Lovell 2001: 47). Assemblages excavated in 1999 appear to be consistent with Hennessy Phase Phases D-F horizons. While some examples find earlier and later parallels in the type series, many of the forms in question are relatively simple.

The examples shown here (Fig. 31) derive from N I Phase 10 deposits, and include the widespread use of painted, applied and thumb impressed decoration. Characteristic Hennessy Phase D-F short-necked jars appear in this phase (Fig. 31: 11-12), as do storage jars (Fig. 31: 15-16).

The material from trench N III samples some of the latest occupational horizons at al-Ghassūl (Hennessy Phase A-B). Interesting new forms include concave bases (Fig. 32: 9-10), which are probably associated with cups or small bowls, and the jar with applied decoration (Fig. 32: 8). The extended corpus retrieved from these upper phase deposits strengthens the case for the association of 'specialised streaky wash ware' bowls and jars with the latest phases of occupation on the site. Small pots (or holemouths) with lug and ledge handles were rare within the corpus retrieved in 1994-97, but can now be demonstrated to be characteristic of the latest occupational horizons on the site. Such conclusions draw support from discoveries at Neve Ur (Perrot *et al.* 1967: fig. 15.11-12, 14 and 16), the upper phases at Abū Ḥāmid (Vaillant n.d: fig. 9.9, 10.3) and, to a lesser extent, in the Beersheba corpus (Comméngé-Pellerin 1990: fig. 36).

The N III corpus contained numerous large pots and holemouths (Fig. 33). These forms have good parallels within previously published mate-

rials. However, upper phase deposits in trenches N I and N II have revealed large numbers of pithoid jars (Bourke *et al.* 2000: fig. 16), suggesting that the entire area might well be considered an industrial zone, or one that specialised in bulk storage.

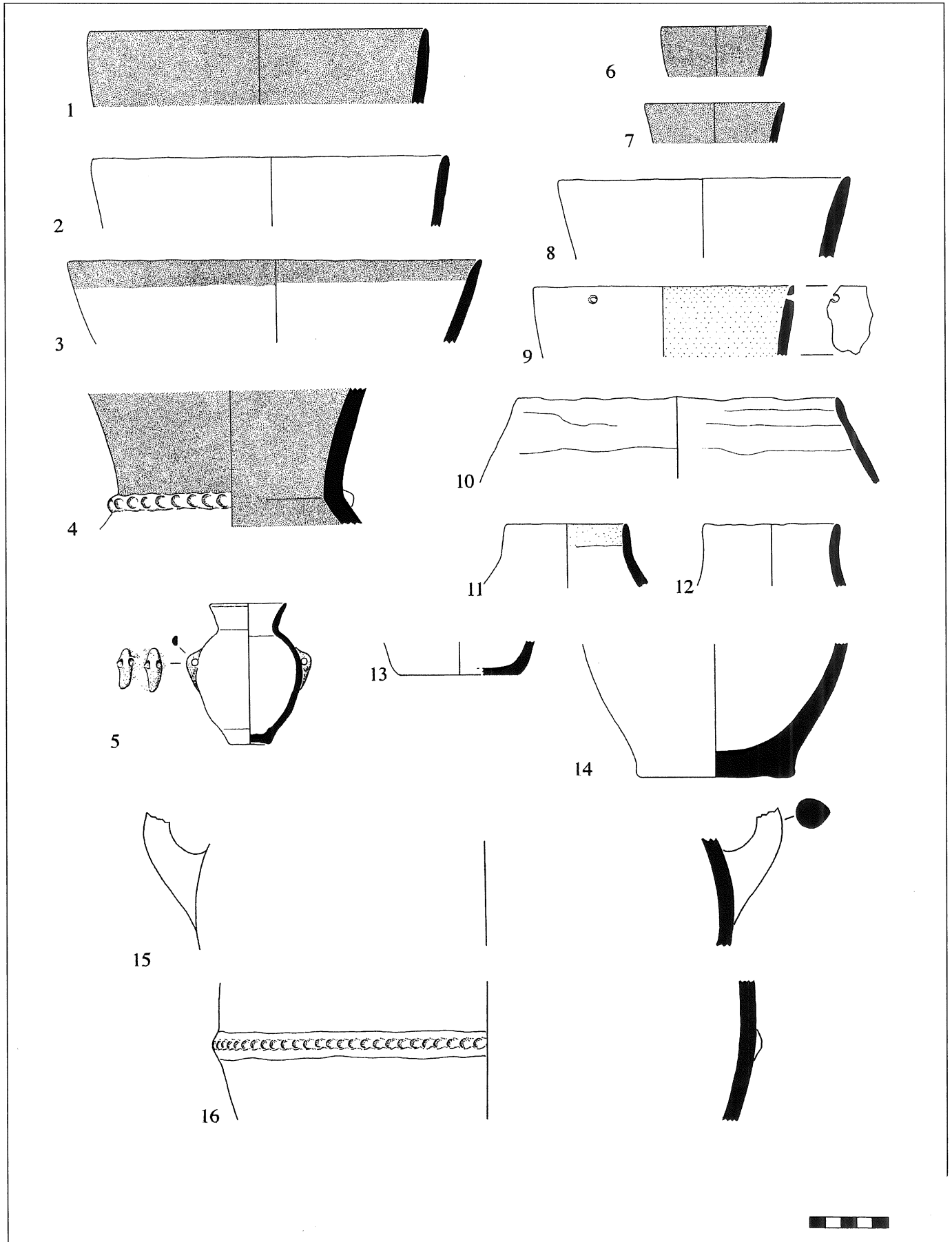
Area Q: Trenches Q I and Q III (Fig. 34)

Work in Area Q greatly expanded the corpus of materials pertaining to the latest horizons on the site. This material (and that from Trench N III) enables further delineation of the typological shifts which occurred in the final phases of occupation. Cups and goblets are much more common than cornets in these final phases. It seems possible that straight-sided cups may be a slightly later type than convex-walled cups. Streaky wash decoration is very common, although found in association with painted decoration, often highly elaborate. Notable in these assemblages are Cream Ware imports (Bourke 2002: 155), and bowls which closely resemble the classic 'V' shaped bowls of the Beersheba corpus. Spouted holemouths (Fig. 34: 15) are also common in this horizon.

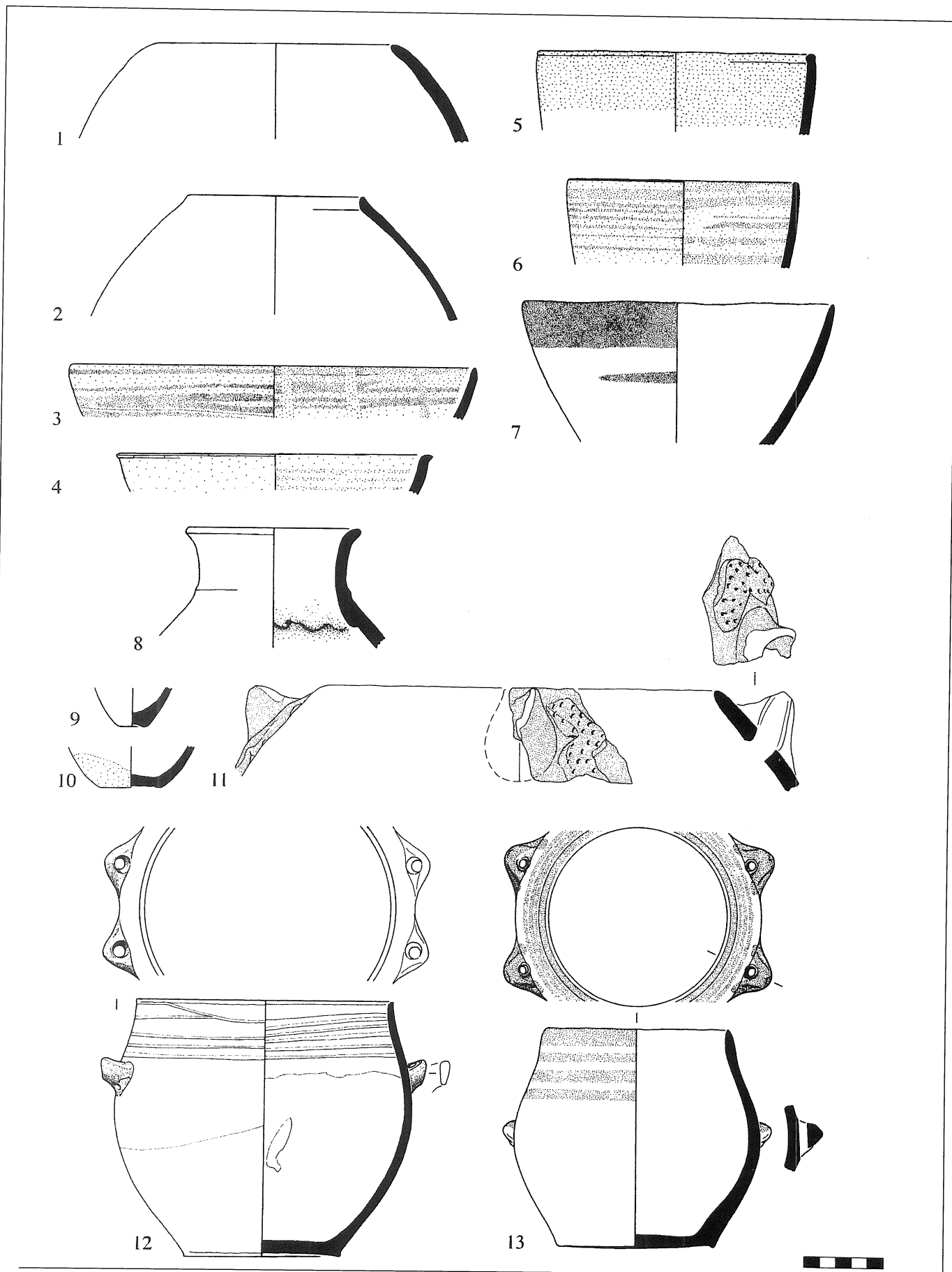
3. ARCHAEOZOOLOGY (LDM)

This report covers the 1999 season of excavation, and builds on previous reports on the 1994-1997 seasons (Bourke *et al.* 2000: 75-79). The bone counts will be compared statistically with previous seasons. Previously we examined the possibility of detecting a 'secondary products revolution' at some stage within the Chalcolithic (Bourke *et al.* 2000: 77-78). The data from 1999 will be used to examine this issue in greater detail.

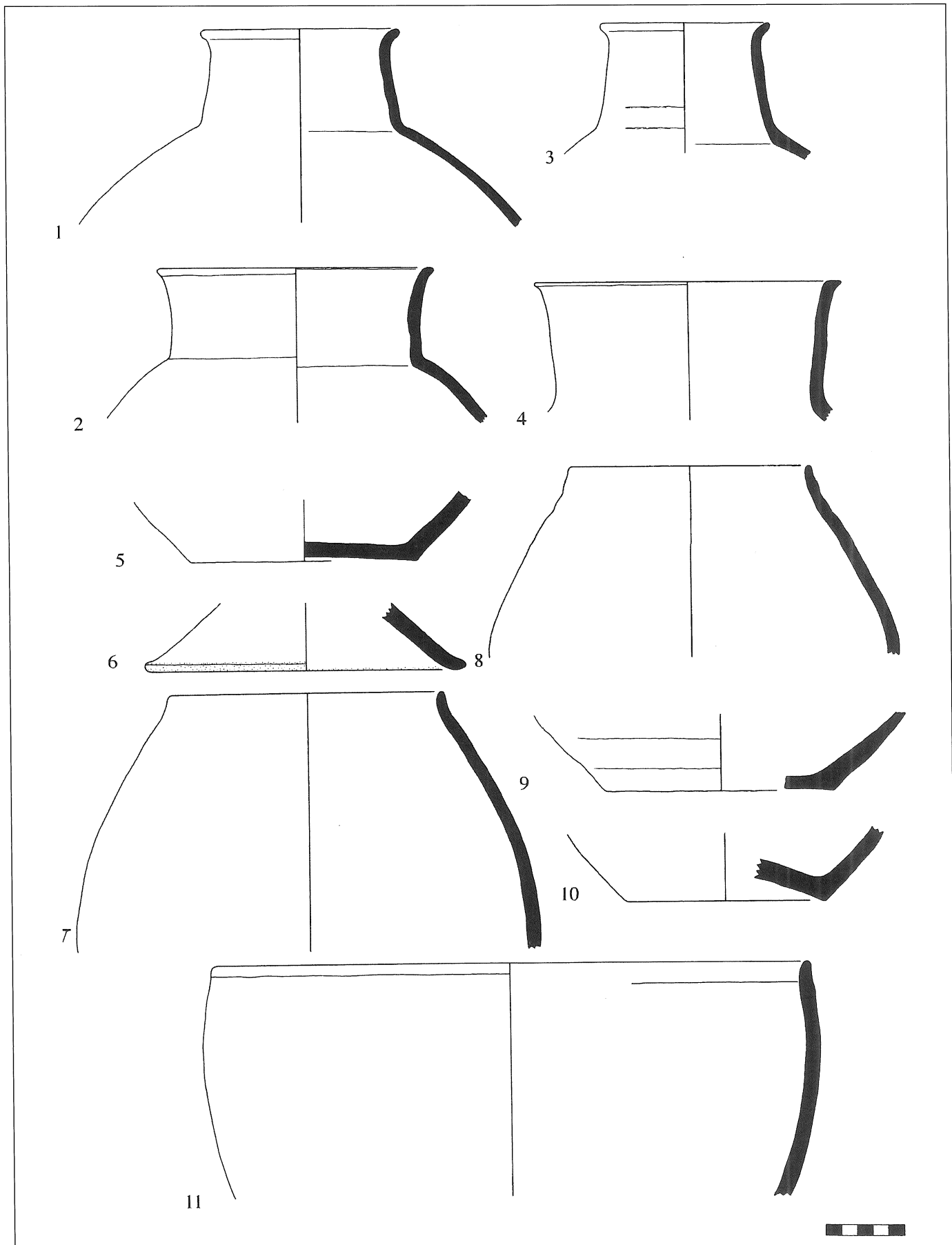
The total bone count for 1999 came to 6653, raising the combined total for the four seasons of excavations to close to 22000, with the number of identifiable fragments or specimens (NISP) for the major domestic and wild animals reaching 5095. This translated into a minimum number of individuals (MNI) of 1433, with meat equivalent numbers based on the MNI of 3960.5. The MNI values were calculated using the maximum distinction method, on the number of individual animals in any given level in any given trench. The meat equivalent values were calculated according to a formula that is discussed below.



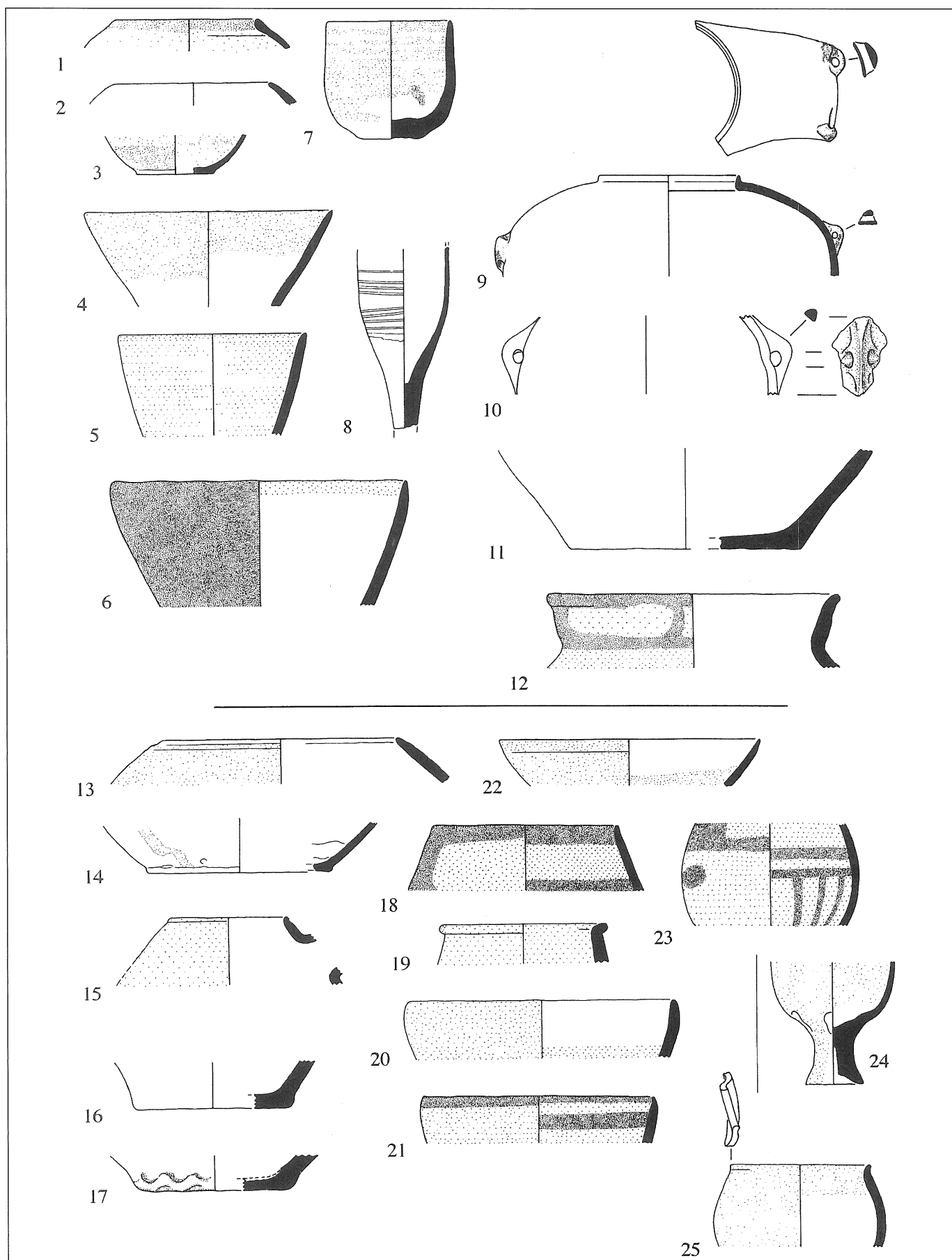
31. Trench N I Sondage. Pottery.



Trench N III. Pottery.



33. Trench N III. Storage Jars.



34. Trenches Q II/Q III. Pottery.

Discussion

Trenches dug this season were exclusively Chalcolithic in date, with the majority of the material drawn from Late Chalcolithic horizons. No new Neolithic deposits were excavated. The analysis of the data was carried out in the manner described previously (Bourke *et al.* 1994: 122-123). Meat equivalent ratios in my analysis count sheep and goats as ‘one sheep-goat equivalent’ (1 SGE) and all other species as multiples of this value. In this regard, cattle represent approximately 12 SGE and pigs 1.5 SGE.

These estimates, however, are not direct ratios derived from modern slaughter-weights. If they had been, then cattle would represent approximately 16 SGE and pigs, on average, about 2.25 SGE. Sheep are usually slaughtered between 27-32kgs (Hammond 1974: 121), cattle between 460-510kgs (Hammond 1974: 93), porkers between 45-90kgs and baconers around 90kg (Hammond 1974: 156). This would raise the profile of both cattle and pigs higher than calculated below. The reasons behind current approximations are based on the fact that a lot of the ovicaprines are mature, most of the pigs in general are immature, and the cattle tend to be rather small. This means that the ovicaprines may well have been slaughtered above 30kg bodyweight, the pigs probably at the lower range of 45-90kg and the cattle at around 360-400kg. Whatever the approximate ratios, however, it is obvious that cattle played an eminent role in the

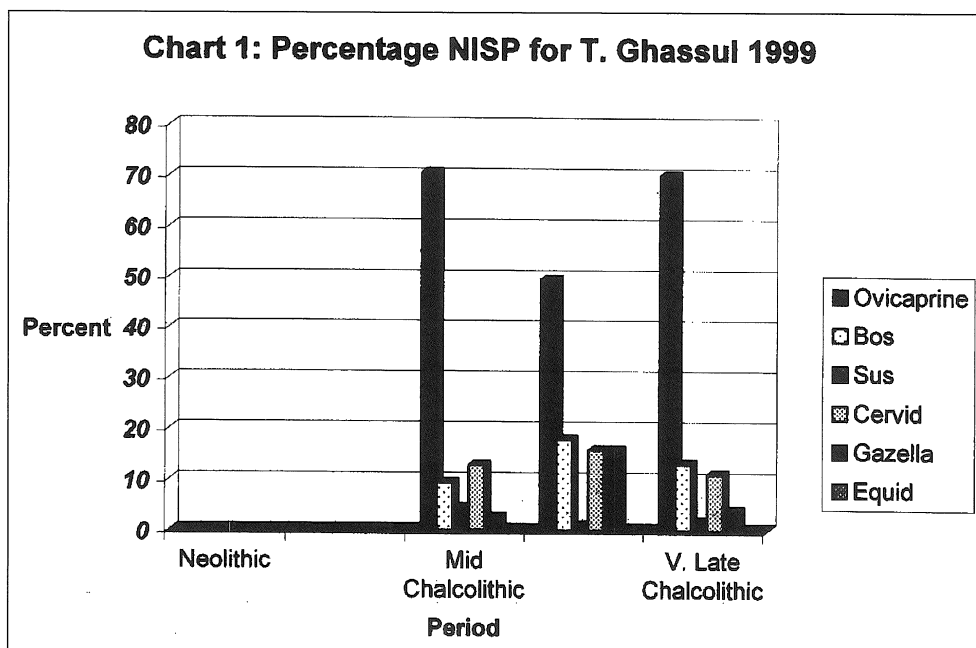
diet of the Ghassulians, pigs a relatively minor role, and sheep and goats a median role.

As well as the main food producing animals the remains of a number of cats, dogs, fish, birds and rodents were also recovered. Chi tests on NISP values were used for statistical analyses (see Figs 35, 36, 37 and 38; Tables 1, 2, 3 and 4).

Husbandry Practices and Climate

The general domestic economy trends illustrated in previous seasons at al-Ghassūl are reflected in the figures from the 1999 season. Previously I have commented on age-at death ratios in sheep and goats and what this may mean for the husbandry of these species (see Fig. 36). In this analysis, proportional relationships between sheep and goats will be examined. The 1999 data suggest that the sheep:goat numbers are broadly similar over time, except when examining material from Trench E XXVII (the Sanctuary), in which no goat remains were found in the 1999 season (see Table 5). However, only two of the 12 individual ovicaprids represented in this Late Chalcolithic deposit were identifiable to species level, both being sheep — one mature and one immature. Unfortunately, the statistical relevance of this is unremarkable.

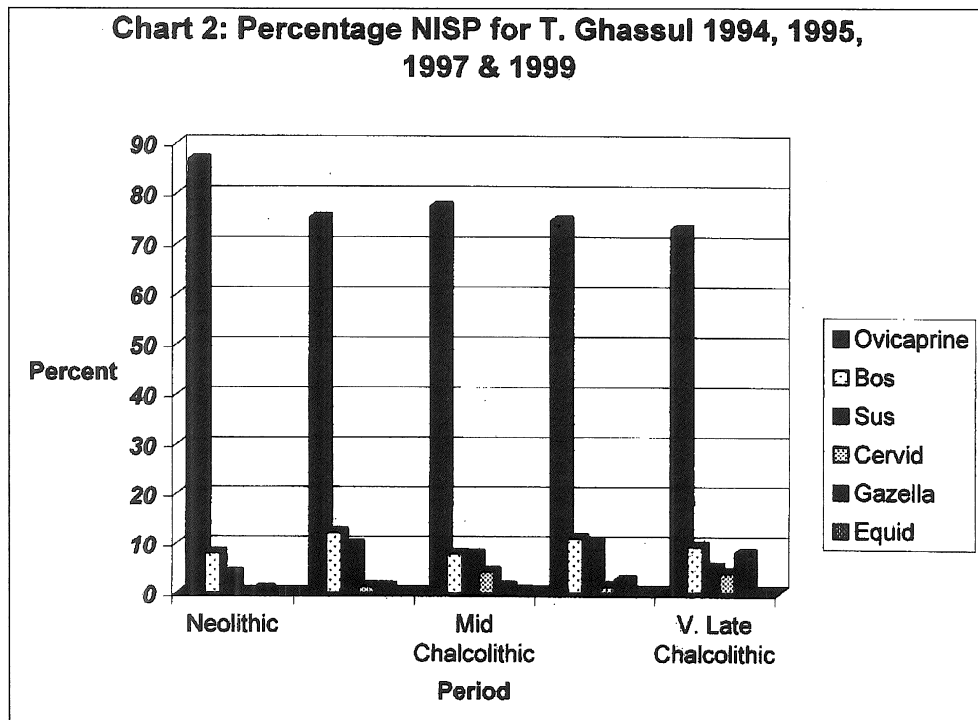
The high proportion of goats may indicate a slightly marginal environment, with the 1999 data suggesting that this does not vary much over time (see Table 5). Previously (Bourke *et*



35. Chart 1. Percentage NISP. 1999.

Table 1: NISP Values by Period: Main Food Production Animals 1999 Season.

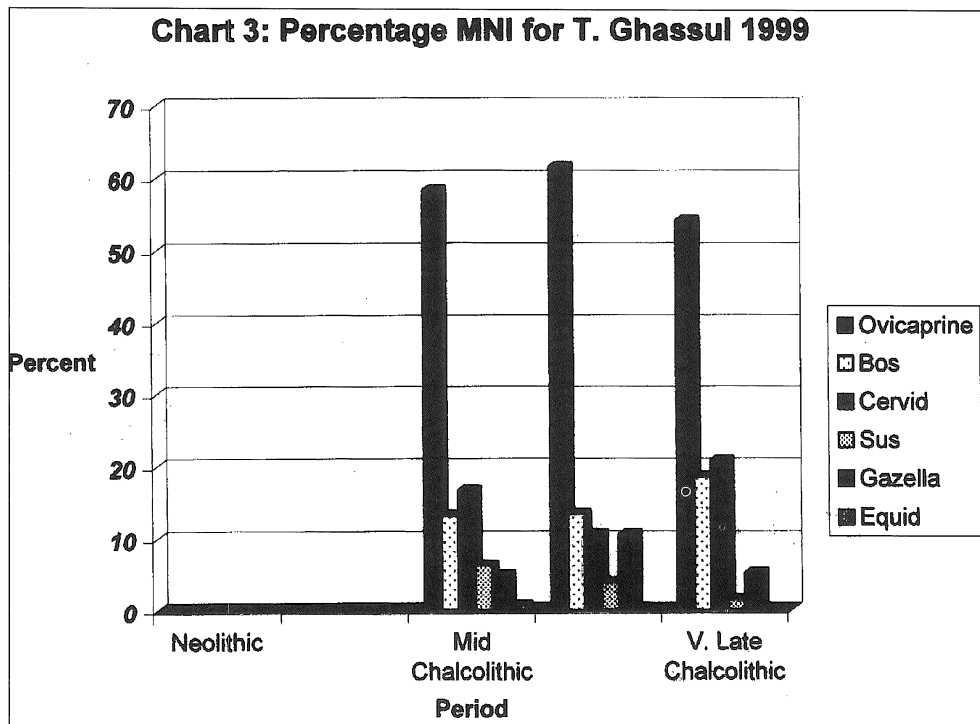
	Neolithic	Early Chalcolithic	Middle Chalcolithic	Late Chalcolithic	Terminal Chalcolithic	Total
Ovicaprine		62	217	47	584	910
Bos		11	25	17	109	162
Sus			15	1	15	31
Cervid		6	48	15	93	162
Gazella		1	9	15	33	58
Equid			1			
Total NISP	0	80	315	95	834	1324



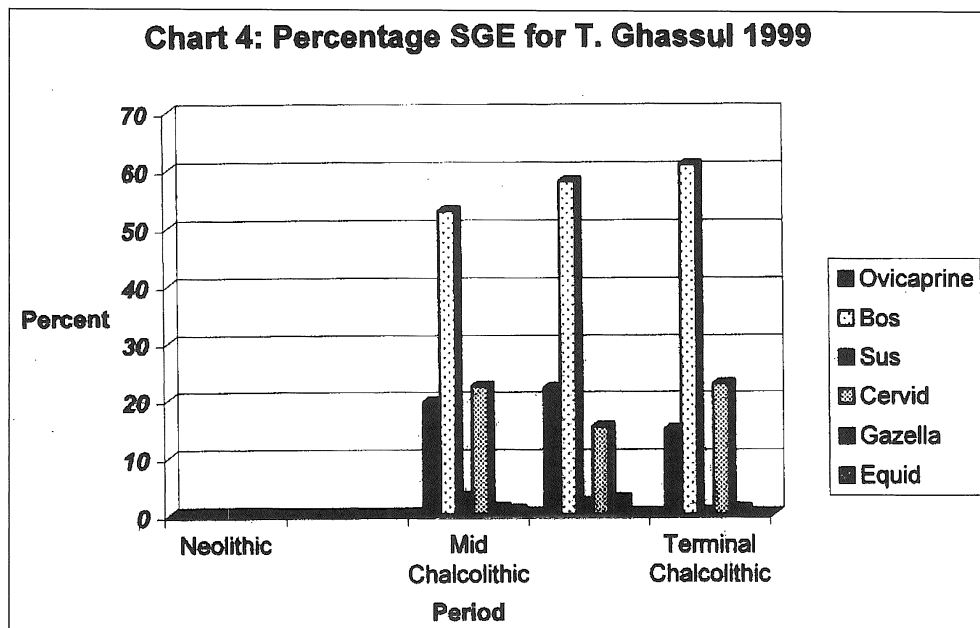
36. Chart 2. Percentage NISP. 1994-99.

Table 2: MNI Values by Period: Main Food Production Animals 1999 Season.

	Neolithic	Early Chalcolithic	Middle Chalcolithic	Late Chalcolithic	Terminal Chalcolithic	Total MNI
Ovicaprine		18	66	64	73	221
Bos		7	12	14	25	58
Sus			9	4	2	15
Cervid		1	23	11	28	63
Gazella		1	6	11	7	25
Equid			1			1
Total MNI	0	27	117	104	135	383



37. Chart 3. Percentage MNI. 1999.



38. Chart 4. Percentage SGE. 1999.

Table 3: Meat Equivalence (SGE) by Period: Main Food Production Animals 1999 Season.

	Neolithic	Early Chalcolithic	Middle Chalcolithic	Late Chalcolithic	Terminal Chalcolithic	Total SGE
Ovicaprine		18	66	64	73	221
Bos		84	144	168	300	696
Sus			13.5	6	3	22.5
Cervid		4	92	44	112	252
Gazella		0.75	4.5	8.25	5.25	18.75
Equid			4			4
Total SGE	0	106.75	324	290.25	493.25	1214.25

Table 4: Meat Equivalence Percentages (%SGE): Main Food Production Animals 1999 Season.

	Neolithic	Early Chalcolithic	Middle Chalcolithic	Late Chalcolithic	Terminal Chalcolithic	% Mean
Ovicaprine		16.9	20.4	22	14.8	18.53
Bos		78.7	44.4	57.9	60.8	60.45
Sus			4.2	2.1	0.6	1.73
Cervid		3.7	28.4	15.2	22.7	17.5
Gazella		0.7	1.4	2.8	1.1	1.5
Equid			1.2			0.3
Total	0	100	100	100	100	100.01

Table 5: Sheep/Goat (NISP and MNI): Sheep Percentages by Trench and Period.

Period	Trench	Sheep		Goat		% sheep	
		NISP	MNI	NISP	MNI	NISP	MNI
Terminal Chalcolithic	Q.I	15	9	15	9	50	50
Terminal Chalcolithic	Q.III	10	6	5	2	66.7	75
Terminal Chalcolithic	N.III	6	2	3	1	66.7	66.7
Totals		25	15	20	11	61.1	63.9

Late Chalcolithic	G.IV	4	4	11	3	26.7	57.1
Late Chalcolithic	E.XXVII	2	2	0	0	100	100
Late Chalcolithic	E.XXIV	4	2	3	3	57.1	40
Late Chalcolithic	A.XIII	1	1	2	2	33.3	33.3
Late Chalcolithic	N.III	7	3	0	0	100	100
Totals		18	12	16	8	63.4	66.1

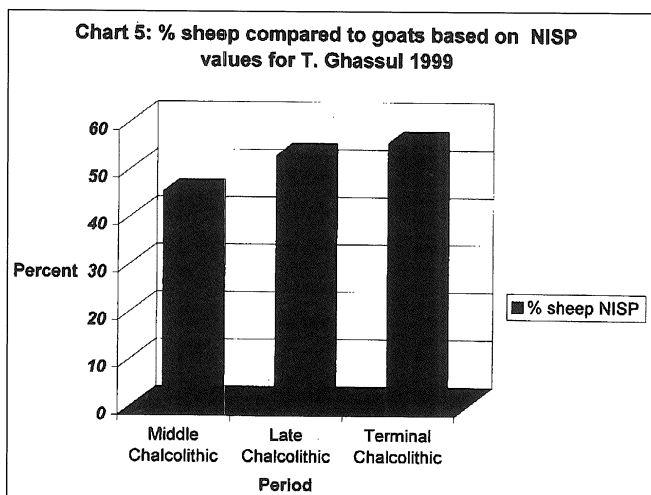
Middle Chalcolithic	A.XIII	6	2	11	4	35.3	33.3
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al. 2000: 77) a change in husbandry practices from the middle of the Chalcolithic. These featured a decline in neonatal deaths coinciding with a resurgence in the relative importance of sheep and goats, more animals kept to maturity, but few kept into a relatively unproductive old age, a trend which might be indicative of secondary product exploitation. These alterations in sheep and goat husbandry patterns tally well with botanical studies that indicate a dramatic switch to agricultural field systems and intensified fruit cropping (Meadows 2005). As goat numbers remain relatively stable throughout the

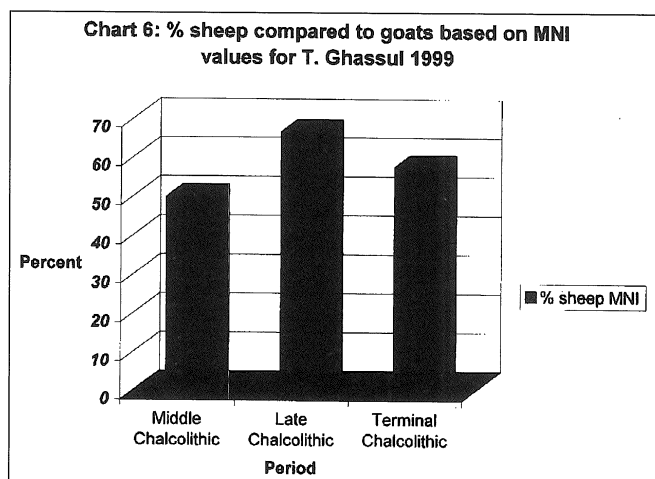
occupational span, they provide no support (as via increasing goat numbers) for any suggested climatic change to a drier regime. Indeed, the continued (and perhaps growing) heavy reliance on cattle does not favour a severe change towards arid conditions (see **Figs. 39, 40; Table 6**).

4. ARCHAEOBOTANY (JM)

Small archaeobotanical assemblages from earlier excavations at Tulaylāt al-Ghassūl were analysed by Zohary and Spiegel-Roy (1975), Hallam (Hennessy 1989), and Neef (1990), but



39. Chart 5. Sheep Percentages Compared to Goats. NISP Values. 1999.



40. Chart 6. Sheep Percentages Compared to Goats. MNI Values. 1999.

archaeobotany only became a key research tool under the renewed University of Sydney excavations. Samples from the 1994 and 1995 seasons were studied by Hoppè (1996 unpublished; Bourke 1997), and samples from the 1997 season were analysed by this writer (Meadows 1998 unpublished; Bourke *et al.* 2000). The fine fractions (<1mm diameter) of 1994-97 samples have not yet been studied.

The data discussed here are from 76 samples collected during the 1999 season, analysed as part of the writer's doctoral research (Meadows 2005). The normal sample volume was reduced from 50L to a notional 20L of sediment, on the basis of the 1994-97 results. All securely-strati-

fied occupational contexts were sampled, although not all samples have been sorted. Large midden deposits in trenches QI and NIII were sub-sampled in 10cm spits, whereas the fills of some smaller features (eg postholes, hearths) were sampled in full. All the mudbrick buildings were regarded as domestic in function (other than the Sanctuary Area E), and no destruction levels were identified. There are no obvious taphonomic differences between samples from different trenches, therefore.

Identification and Quantification

The samples were processed at Pella (Ṭabaqat Fahl) using flotation machinery from the Council for British Research in the Levant, with 1.0mm and 0.3mm mesh geological sieves. Both coarse and fine flot fractions were analysed. Plant remains were sorted under a stereoscopic microscope (x7-x40 magnification) at La Trobe University, Melbourne. Only carbonised remains were regarded as ancient; uncharred specimens were deemed to be modern. Wood charcoal and plant vegetative organs (leaves, stems, and roots) were not identified. Preliminary identifications of seeds, fruits, nutshells, and cereal chaff were based on previous experience with Jordanian material (Meadows 2001a) and published illustrations of archaeobotanical remains, by Colledge (1998), Kislev (1987, 1997), van Zeist and Bakker-Heeres (1982, 1984a, 1984b), and Willcox (1996). Identifications were confirmed using comparative collections of modern material at the University of Sheffield and the Institute of Archaeology, University College London, and an archaeobotanical collection at the German Archaeological Institute, Berlin.⁴ Examples of all wild/weed taxa are illustrated in the larger Doctoral study (Meadows 2005).

The results are summarised in Table 7. Some specimens were identified to a more specific taxonomic level than indicated here (Meadows 2005). The table does not include rare taxa (<10 identifications) or taxa that could not be identified to at least the family level. The table records the minimum number of whole organs represented (eg seeds, grains, or chaff elements).

4. JM would like to acknowledge the assistance of Dr. Sue Colledge (UCL) and Dr. Reinder Neef (DAI), and the Near Eastern Archaeology Foundation of the Univer-

sity of Sydney, which funded his study trip to Europe through the 1999 Catherine Southwell-Keely travel grant.

Table 6: Chi Squared Tests: 94-97 Seasons and 99 Season.

94-97 Seasons				
	Neolithic		Expected	
	NISP	%NISP	NISP	%NISP
Ovicaprine	215	86.7	185.5	74.7
Bos	20	8.1	24.3	9.8
Sus	10	4	17.1	6.9
Cervid	1	0.4	8.6	3.5
Gazella	2	0.8	12.1	4.9
Equid			0.5	0.2
Total NISP	248		248.1	100

Chi test Neolithic 9.84296E-05

94-97 Seasons				99 Season	
	Early Chalcolithic	Exp %NISP	Expected	Early Chalcolithic	Expected
Ovicaprine	271	74.7	267.4	62	59.8
Bos	45	9.8	35.1	11	7.8
Sus	27	6.9	24.7	0	5.5
Cervid	10	3.5	12.5	6	2.8
Gazella	5	4.9	17.6	1	3.9
Equid		0.2	0.7	0	0.2
Total NISP	358	100	358	80	80

Chi test Early Chalco 0.013548065

Chi test Early Chalco '99 0.02426303

94-97 Seasons				99 Season	
	Mid Chalcolithic	Exp %NISP	Expected	Mid Chalcolithic	Expected
Ovicaprine	814	74.7	782.11	217	235.3
Bos	77	9.8	102.61	25	30.9
Sus	82	6.9	72.24	15	21.8
Cervid	50	3.5	36.65	48	11
Gazella	16	4.9	51.30	9	15.4
Equid	8	0.2	2.09	1	0.6
Total NISP	1047	100	1047.00	315	315

Chi test Middle Chalco 1.3844E-10

Chi test Middle Chalco '99 8.73116E-27

94-97 Seasons				99 Season	
	Late Chalcolithic	Exp %NISP	Expected	Late Chalcolithic	Expected
Ovicaprine	887	74.7	893.4	47	71.1
Bos	137	9.8	117.2	17	9.3
Sus	120	6.9	82.5	1	6.5
Cervid	18	3.5	41.9	15	3.3
Gazella	34	4.9	58.6	15	4.6
Equid		0.2	2.4		0.2
Total NISP	1196	100	1196	95	95

Chi test Late Chalco 5.30859E-09

Chi test Late Chalco '99 1.11137E-16

94-97 Seasons				99 Season	
	V. Late Chalcolithic	Exp %NISP	Expected	V. Late Chalcolithic	Expected
Ovicaprine	1624	74.7	1677.7	584	623
Bos	218	9.8	220.1	109	81.7
Sus	114	6.9	155	15	57.6
Cervid	97	3.5	78.6	93	29.2
Gazella	192	4.9	110.1	33	40.9
Equid	1	0.2	4.5		1.6
Total NISP	2246	100	2246	834	834

Chi test V. Late Chalco 5.05697E-16

Chi test V. Late Chalco '99 7.50227E-38

The number of olive stones, which are usually crushed during oil extraction, was estimated by measuring the surface area of olive stone fragments (a complete olive stone has a surface area of approximately 1cm²).

The assemblage reflects the plant economy (the exploitation of plants for food, fuel, fodder, building materials, textiles, and industrial, medicinal, and ritual uses) and natural vegetation around the site. Its composition is also affected by the selective pre- and post-depositional attrition of plant remains, and by the methods by which archaeologists recover, identify, and quantify those remains. Detailed statistical analysis of the 1994 - 99 data (Meadows 2005) has helped to identify these effects, allowing a plausible environmental and economic reconstruction.

Spatial Patterns

Some intra-site patterns in sample composition apparently reflect the location of routine crop-processing and food-preparation activities. Naturally, these patterns are most evident in later Chalcolithic levels, which were sampled in more excavation areas. It is also possible that some spatial patterns are merely due to taphonomy — in particular, to the distribution of different context types. Few of the samples analysed were from primary contexts (hearths or burnt patches), and these were restricted to early and middle Chalcolithic horizons in Areas A and N. Samples from secondary contexts described as middens or rubbish pits were only sorted from Area Q (Late Chalcolithic), whereas samples from installations or storage pits came mainly from middle Chalcolithic horizons in Area A. Occupation deposits ('surfaces') were sampled in all areas and phases.

The early Chalcolithic samples from Areas A and N represented 26 contexts, including a firepit, eight 'installations' (sometimes interpreted as storage pits), and ten 'surfaces'. The taxa associated with Area A samples were glume bases and spikelet forks, and straw products (culm nodes and straw fragments). All other taxa were apparently associated with Area N samples, which were apparently more diverse. There was no intelligible association between context type and sample composition.

In 1999, the middle Chalcolithic contexts

were sampled only in Trenches A XI and A XIII. The samples represented 25 contexts, including firepits, a burnt area, 'installations' (stone- or plaster-lined pits), and 'surfaces'. All the 'installations' were in A XIII, and the burnt patch and three of the four firepits were in A XI. The composition of 'surface' samples from A XIII, however, was more like that of A XIII 'installation' samples than like the composition of 'surface' samples in A XI, which in turn had more in common with the A XI 'firepit' samples than with 'surface' samples in A XIII.

There were no obvious differences in sample composition between context types, but there are consistent differences in sample composition between trenches. Some mixing of plant remains in adjacent contexts was expected (McCorriston and Weisberg 2002), but it is interesting that adjoining trenches produced consistently different samples. The differences appear to reflect where different stages of crop processing took place. There was consistently more fine chaff of wheat and barley in the A XIII samples, and more grain (of cereals and pulses) in the A XI samples.

Samples were sorted from 25 later Chalcolithic contexts, including surfaces, pits, and other features. Five contexts were from trench E XXIV, three from E XXVII, five from G IV, five from N III, five from Q I, and two were from Q III. As in the middle Chalcolithic, there were consistent differences in sample composition between trenches, whether data from all context types or only 'surfaces' were compared. Again, this seems to be mainly due to the location of different crop-processing activities. Area G samples were rich in the by-products of threshing and winnowing, whereas Areas N and Q tended to contain more pulses.

Area E

One of the questions posed in 1999 was whether there was a post-Ghassulian, non-sedentary phase of occupation in Area E; that is, whether the sanctuary complex postdated the abandonment of the site as a settlement. Archaeobotanical samples taken in 1997 within the sanctuary (Trench E XXV) were essentially sterile, perhaps because the area was kept clean when in use.

The 1999 Area E samples yielded at least 7 or 8 identifications/L of sediment, only a third to

Table 7: Summary of Archaeobotanical remains (seeds unless specified): 1999 Season.

Area Phase	A early	N early	A middle	E late	G late	N late	Q late
glume wheat grain	21	41	186	48	12	50	38
glume wheat spikelet fork	107	99	764	179	103	68	157
terminal spikelet fork	12	8	98	10	9	4	10
wheat glume base	345	304	2160	330	152	176	329
free-threshing wheat grain	1	6	2	8	1	1	1
free-threshing wheat rachis	2	1	16	0	3	0	0
wheat grain indet.	6	10	44	7	3	6	21
wild barley grain	2	11	49	5	7	11	5
wild/cult. barley grain	18	30	94	31	12	24	33
cult. hulled barley grain	20	60	167	66	28	50	53
wild barley rachis	4	9	12	18	17	1	3
2-row cult. barley rachis	4	13	41	20	32	10	15
6-row cult. barley rachis	0	2	8	10	28	7	27
cult. barley rachis indet.	18	61	120	95	89	55	108
cereal grain indet.	36	76	286	52	25	61	49
cereal culm node	2	8	38	7	20	12	14
cereal culm base	10	5	93	13	52	7	19
lentil	12	26	83	10	10	25	23
other cult. legumes	0	9	37	2	4	32	16
flax (linseed)	0	5	14	1	3	1	23
Pistacia nutshell	1	0	1	1	1	1	5
fig seed	1	2	36	2	1	7	24
olive stone	11	6	121	10	14	14	48
Aizoon sp.	4	9	20	6	5	1	2
all Apiaceae	0	2	4	0	1	3	10
all Asteraceae	1	2	10	0	13	2	5
Heliotropium sp.	1	0	9	0	1	0	2
Arnebia sp.	1	6	4	2	0	2	1
all Caryophyllaceae	0	3	5	0	2	1	2
Chenopodium sp.	3	10	15	1	8	3	12
Atriplex bract	1	0	4	1	3	2	1
Suaeda sp.	0	2	5	2	0	0	12
Chenopodiaceae indet.	5	13	56	11	8	8	23
Carex sp.	3	2	29	1	1	2	0
Fimbristylis sp.	2	17	57	1	0	7	0
Scirpus sp.	0	9	1	1	0	0	0
Scirpus kernel	3	19	20	12	8	1	3
Scorpiurus sp.	23	57	209	72	29	191	124
Medicago type	26	76	89	19	16	20	35
Astragalus type	5	8	21	10	4	10	4
Trigonella astroites type	5	2	7	7	2	1	1
Fabaceae indet.	17	19	78	25	21	64	27
Bellevalia type	1	4	3	1	0	6	5
Ornithogalum type	0	1	4	3	4	14	66
Malva sp.	9	17	52	6	0	3	3
Plantago sp.	2	7	3	1	0	0	1
Avena sp.	1	4	8	1	3	2	5
Bromus sp.	3	7	35	5	7	14	30
small grass seeds	2	35	239	22	22	9	2
Lolium sp.	33	60	128	14	19	6	19
Phalaris sp.	1	5	15	5	8	5	4
grass indet.	34	45	152	32	17	28	4

a half of the incidence of plant remains in later Chalcolithic samples from Areas G, N, and Q. Half the middle Chalcolithic Area A samples had an even lower incidence of plant remains, however. The 'background noise' at Tulaylāt al-Ghassūl appears to be 1 or 2 identifications/L, suggesting that most plant remains in Area E were not residual from earlier occupation phases.

The range of species in Area E samples was essentially the same as that in samples from other areas of the site. Some rare taxa were absent, presumably because the Area E assemblage was relatively small. All the food plants were found in Area E samples, and each stage of crop processing was represented. Threshing and winnowing by-products (straw and barley rachis internodes), which normally indicate local cereal cultivation, are associated with the Very Late Chalcolithic Area E samples. Area E samples contained twice as many snail shells per litre as later Chalcolithic samples from Areas G, N, and Q, and there appeared to be an inverse relationship between the incidence of snails and the incidence of archaeobotanical remains. The population density of snails at an arid site probably depends on the density of surface vegetation. Denser vegetation cover could also cause more soil disturbance. Post-depositional taphonomy may, in part, account for the lower incidence of identifiable plant remains in Area E.

Diachronic Patterns

The 1999 data demonstrate subtle but consistent differences in sample composition between the earlier and later Chalcolithic. These changes are difficult to separate from spatial patterning, because earlier and later Chalcolithic strata were sampled in different excavation areas in 1999. Consistent trends were identified, however, and confirmed by comparison of data from all seasons in the excavation areas with full vertical sequences (A, G, and N). These trends include:

- Pulses other than lentils (pea/bitter vetch and chickpea) became more prominent over time, increasing from less than a quarter of all pulses in the Early Chalcolithic to about half in the Very Late Chalcolithic.
- Six-row barley partly replaced the two-row variety, particularly during the Late Chalcolithic and particularly in Areas G, N, and Q. In Areas

- A and E, however, two-row barley remained as important as six-row barley.
- The relative abundance of rye grass (*Lolium*) decreased in every phase, although it was partly replaced by brome grass (*Bromus*).
- *Scorpiurus* increased sharply, and from the middle Chalcolithic onwards there were samples dominated by this taxon, which may have been primarily a weed of pulse crops. Other small-seeded legumes, however, tended to dwindle.
- Plantain (*Plantago*) and mallow (*Malva*) steadily declined over time, and sedges (*Cyperaceae*) probably declined after the middle Chalcolithic phases, if not earlier.
- The Liliaceae taxa (*Bellevalia* and *Ornithogalum* types) increased slightly in middle Chalcolithic horizons and dramatically in the later Chalcolithic phases.

Olive Cultivation

Zohary and Spiegel-Roy (1975) argued that olives from Late Chalcolithic levels at Tulaylāt al-Ghassūl must represent cultivation, as the site was outside the natural habitat of wild olive trees. Neef (1990) identified olive wood charcoal at Tulaylāt al-Ghassūl, and suggested that olive trees were cultivated locally, as firewood would not have been carried very far. Measurements of olive stones recovered in the 1994-97 seasons also imply that olives may have been domesticated during the Chalcolithic (Meadows 2001b).

New olive stone measurements reinforce the patterns observed in the 1994-97 material. The 1999 season more than doubled the number of measurable olive stones from Neolithic-middle Chalcolithic contexts, to 75, compared to 76 olive stones from later Chalcolithic levels. The latter were collected during the 1994-97 seasons; a much larger late Chalcolithic assemblage would have been obtained had the 1999 samples from pits in trench NIII been sorted. The measured olive stones were from many contexts, in every excavation area, which means that the assemblages do not represent single events (which might, for example, relate to particularly good or bad seasons). Some of the olive stones from later Chalcolithic samples may have been reworked from earlier contexts; this may have blurred the evidence of morphological changes

at the population level.

When olive stone measurements are plotted (see Fig. 41), the earlier stones are clearly more variable in size. Nearly a quarter are over 11.0mm long, against only two such stones from later Chalcolithic contexts. The longer of these is clearly an outlier among the later Chalcolithic stones, and may well be residual from earlier strata. Summary statistics of olive stone dimensions at other sites can be deduced from Kislev (1994-95), Liphschitz *et al.* (1996), and Neef (1990). These show no trend in mean length, but suggest that throughout the region, from the Late Chalcolithic onwards, olive stones are less variable in length than in the earlier assemblage at Tulaylāt al-Ghassūl. The latter are as variable in length as olive stones from the submerged Wādī Rabāḥ site of Kfar Samir, which Kislev (1994-95) attributed to foraging from wild olive trees. The later Chalcolithic assemblage at al-Ghassūl, however, is not significantly more variable than an assemblage from Late Bronze Age Tall Jrisha.

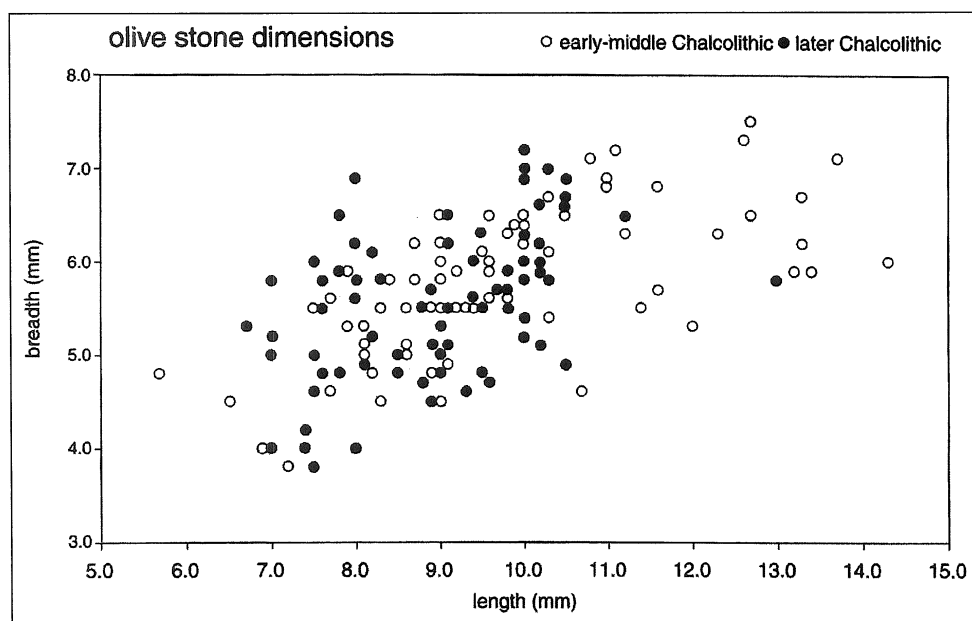
The reduction in variance during the Chalcolithic is probably due to olive domestication, either because cultivated trees grew under a narrower range of conditions than wild trees, or because cultivation was associated with a loss of genetic diversity. The answer is necessarily speculative, because there are no true wild olive trees left; 'wild' olive trees are either feral cultivars, or products of cross-pollination with domestic olive trees (Kislev 1994-95). Modern

'wild' olives are thus genetically more 'domestic' than the earliest cultivated olives. For various reasons, there may have been a significant time lag between the start of cultivation and its expression in the archaeobotanical record. It is thus more likely that the Late Neolithic-Early Chalcolithic olives at al-Ghassūl and Kfar Samir were from cultivated trees than it is that olives were not domesticated by the late Chalcolithic (Meadows 2005). It is also possible that the earlier assemblages contain both wild and cultivated olives, but that foraging for olives ceased during the Chalcolithic.

Economic Development

The cultivated plants identified were olives and the Neolithic field crops (wheat, barley, lentils, peas, beans, chickpeas, bitter vetch and flax). There was no overall trend in the incidence of fig seeds, which is comparable to that at much older sites, and probably reflects the occasional use of wild resources (as do occasional finds of *Pistacia* nutshell). The absence of grape, and the near-absence of date, suggest that these species were not domesticated before the fourth millennium. Grape remains are common at Early Bronze Age sites (Cartwright 2002; Fall *et al.* 2002; Bourke *et al.* 2003), and rare in Neolithic and Chalcolithic contexts, where they presumably represent gathered wild fruit.

The economic implications of olive cultivation are significant. Olive remains were identified in under half the early Chalcolithic



41. Scattergram. Olive Stone Dimensions. Early/Middle and Late Chalcolithic.

samples, but in nearly all the later Chalcolithic samples, suggesting that the importance of olives increased over time. Olive trees need at least seven years to become productive, and at al-Ghassūl may have been irrigated for much of that time. Compared to growing annual crops and breeding domestic animals, therefore, olive cultivation represents a considerable investment and a delayed return. Olive cultivation thus requires secure land tenure, and would have encouraged sedentism and territorial demarcation. It also produced a tradeable commodity, perhaps contributing to the growth of other industries (Bourke 2001, 2002).

Other than olive domestication, however, economic changes during the Chalcolithic consisted of changes of emphasis in the production of existing crops. Earlier Chalcolithic farming was based on emmer wheat, two-row barley, and lentils, with other pulses, free-threshing wheat, and six-row barley as secondary crops. Later Chalcolithic farming still relied on emmer, but six-row barley was as important as the two-row variety, and other pulses were as important as lentils. Nevertheless, the development of arboriculture during the Chalcolithic, and perhaps of plough cultivation and seasonally-transhumant pastoralism, provided new means of storage and risk mitigation, and may have improved labour scheduling, as well as opening a new niche in the ecosystem, as rain-fed agriculture and arboriculture on upland *terra rossa* soils became viable.

Environmental Change

Some changes in the wild/weed assemblage during the Chalcolithic can be interpreted as signals of environmental change. Some taxa that declined over time (the Cyperaceae and *Lolium*) are adapted to relatively damp fields, and are common at sites in the north Jordan Valley, such as Pella (Meadows 2005) and Tall Abū al-Kharaz (Fischer 1997). The *Bromus* type that increased sharply in the later Chalcolithic was the most common wild grass at Wādī Fidān 4, in the Wādī ‘Araba (Meadows 2001a). Other things being equal, these trends suggest a shift towards a more arid environment, but there were no clear

trends in the Chenopodiaceae taxa and *Aizoon*, which are typical of arid conditions.

It is possible that the Early Chalcolithic wild/weed assemblage reflects cultivation of relatively damp areas of the wadi bed, whereas the Late Chalcolithic assemblage represents an extension of agriculture into more marginal land. As rainfall at al-Ghassūl was almost certainly insufficient to support agriculture, however, this expansion would have been limited to areas that could have been irrigated, perhaps using floodwater farming techniques, as proposed at Chalcolithic sites in the Negev (Levy 1983, 1992). The later Chalcolithic assemblage could thus represent the weed flora of fields with a less predictable water supply than the earlier garden plots.

Al-Ghassul’s position made it vulnerable to deforestation and overgrazing in the uplands. Natural vegetation cover facilitates the infiltration of rainfall, increasing spring flows and reducing the risk of flash-flooding (Harlan 1982, 1985). In the late fifth and early fourth millennia, the population of the upper wadis and the Jordanian plateau increased rapidly, after several centuries of relatively sparse population (Bourke 2001), which may suggest why Tulaylāt al-Ghassūl was eventually abandoned: either farming became unproductive (as spring flow decreased, the water table fell, and the area of naturally damp alluvial soil decreased), or the frequency and severity of flash-flooding increased, until it was no longer worth maintaining the floodwater farming check dams.

5. RADIOCARBON DATING (SJB) ⁵

Another twelve C14 AMS dates were processed at the ANSTO AMS facility over 2001/2002. These are additional to the ten dates presented previously (Bourke *et al.* 2000: 84-85). The twelve new dates include six from al-Ghassūl Phase A, drawn from four widely separated areas (two each from Areas E and Q, and one each from Areas H and N) across the site. Three samples come from slightly earlier (Phase B-C) horizons (two from Area E and one from Area G). The final three samples derive from

5. The twelve new AMS dates were processed under ANSE Grants 01/196 and 02/199. SJB would like to thank ANSE for these grants, particularly Drs. Ugo Zoppi

and Quan Hua, and all other members of the AMS dating facility at ANSTO (Lucas Heights, Sydney) for their assistance in the preparation of the new dates.

significantly earlier horizons (one from each of Areas A, H and N) (see **Table 8**).

Discussion

All six of the latest (Phase A) C14 results are broadly comparable, and suggest that significant occupation across the site came to an end by 3900/3800 cal BC at the very latest. The three earlier (Phase B-D) assays are stratigraphically coherent in relation to Phase A determinations. The relatively early date of OZF418 was unexpected, suggesting some of the cereal grains making up this sample were residual in the assemblage.

Comparative archaeobotanical analysis has suggested that the Area E assemblage in general contains rather more material residual from earlier horizons than in other areas of the site, perhaps a function of part-time or special-purpose activities in much of this area. This may go some way towards accounting for the consistently earlier dating of Late Chalcolithic assemblages from Area E, when compared with identical assemblages from other areas of the site.

The radiometric position of OZG250 is internally coherent with the four previous assays from Area G (Bourke *et al.* 2000: 84). Together

Table 8: Twelve new AMS dates from Tulaylāt al-Ghassūl.

ANSTO Code	Material	Graphite Mass (mg C)	d13 C (PDB)	Radiocarbon Age [BP]	2s Calibrated Age [BC]	Stratigraphic Context and Site Phase
OZF417	cereal grain	1.85	-25.1	5450 ± 40	4355-4227 cal BC	EXXV 2.13 Phase A
OZF418	cereal grain	2.25	-24.5	5750 ± 40	4698-4496 cal BC	EXXV 4.9 Phase B/C
OZF419	cereal grain	0.66	-21.9	5490 ± 40	4369-4248 cal BC	EXXIV 12.12 Phase A
OZF420	cereal grain	2.29	-23.2	5395 ± 40	4337-4219 cal BC	HIII 2.10 Phase A
OZF421	cereal grain	2.02	-25.0	5870 ± 40	4808-4667 cal BC	HII 3.31 Phase F/G
OZF422	cereal grain	2.04	-22.2	5505 ± 40	4403-4320 cal BC	NI 15.11 Phase E/F
OZF423	cereal grain	2.37	-24.2	5370 ± 40	4202-4048 cal BC	QI 17.18 Phase A
OZG248	olive stone	1.09	-26.2	5510 ± 40	4405-4321 cal BC	AXIII 1.5 Phase D/E
OZG249	olive stone	1.33	-26.4	5475 ± 40	4369-4237 cal BC	EXXVII 2.40 Phase B/C
OZG250	olive stone	1.58	-23.9	5445 ± 40	4355-4227 cal BC	GIV 30.43 Phase C/D
OZG251	olive stone	1.46	-23.3	5110 ± 45	3982-3792 cal BC	QIII 7.3 Phase A
OZG252	olive stone	1.98	-23.5	5335 ± 60	4260-4037 cal BC	NIII 3.1 Phase A

the five recent AMS dates provide a reliable chronology for the occupational history of Tulayl 3 for the first time. This area was extensively excavated by Pontifical Biblical Institute (PBI) archaeologists in the 1930s (Lee 1973).

The early samples from Areas A, H and N are broadly in line with stratigraphic positioning. In Area H, the early date of OZF421 may suggest the presence of early materials residual in the mixed wash deposits at the base of the H II sondage. The similarity between A XIII Phase E OZG248 and N I post-Phase F OZF422 would imply a relatively short-life for the post-Phase F 'campfloor' horizon, which intervened between the built architecture of Phases E and F.

6. GENERAL CONCLUSION (SJB)

The fourth season of renewed excavations continued with two main aims, limited-area deep stratigraphic soundings across the site to gain some idea of settlement size over time, and wide area clearance of the latest horizons of occupation (Bourke *et al.* 2000: 85), to further study the circumstances surrounding the end of occupation at the site.

One full-sequence stratigraphic sounding was taken down to sterile in 1999 (trench N I), and the excavation of the last in a series of small step-trenches (G IV) through Tulayl 3 completed the Area G sequence. In Area A the existence of Hennessy's relatively broad coverage (Hennessy 1982, 1989) allowed for something of a compromise between wide coverage and narrow soundings, with the excavation of two larger trenches (A XI and A XIII) facilitating the sampling of a wider range of pre-Ghassulian Early Chalcolithic contexts than was possible in the more restricted deep soundages.

The second aim of wide area sampling progressed well, with significant expansion in Areas E, N and Q. The investigation of key areas linking the two sanctuary buildings together (E XXIV), and Sanctuary B with the northern temenos wall (E XXVII) clarified constructional history and site function within the northern region of the Sanctuary precinct. In Area Q, the near complete exposure of one large multi-phase building complex (Q I) and the detection of a second unit to the west (Q III), represents a significant advance in our understanding of the settlement layout in this eastern region of the

site. A similar exercise in Area N (N III) recovered most of a large mudbrick structure partly excavated in 1995, and provided significant new information on the last phase of so-called 'squatter occupation' (Hennessy 1969: 7) in the north-central region of the site.

Continued intensive sampling strategies of ecofactual (Mairs and Meadows) and artefactual (Lovell) data are slowly coming to fruition. The accumulation of large samples from all main horizons across the site facilitates both chronological and spatial comparative analysis. These are producing assemblages that become ever more clearly differentiated spatially and functionally over time. These statistically robust differences in artefactual and ecofactual assemblages provide strong evidence for the economic transformation of a relatively undifferentiated Early Chalcolithic society into one displaying considerable economic and craft specialisation, along with an incipient social and political stratification by the end of the Late Chalcolithic period.

Ghassulian society never achieved state-level complexity, but it was arguably on a trajectory towards such organisational sophistication. A satisfactory account of the final years of Ghassulian prehistory still needs to be written, but we are assembling the materials required for such an effort. Although all scenarios will remain little more than speculation for the time being, we continue to believe that the increasingly stressed environment ultimately set limits beyond which the socio-economic technology available at the time could not progress.

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