# Central Zagros Archaeological Project

## Excavations at Bestansur and Shimshara, Sulaimaniyah Province, Kurdistan Regional Government, Republic of Iraq

18th August – 27th September 2012

## Survey in Zarzi Region

January 2013

Archive Report

Excavations in Trench 7, Bestansur, looking southeast.

## Preface

A second season of excavations at the site of Bestansur took place in summer 2012 as part of the Central Zagros Archaeological Project, co-directed by Roger Matthews, Kamal Rasheed Raheem and Wendy Matthews. The project operates under a Memorandum of Understanding issued by the Sulaimaniyah and Erbil Directorates of Antiquities and Heritage, with agreement from the State Board of Antiquities and Heritage, Baghdad, and is funded by a grant from the UK Arts and Humanities Research Council with the project title 'Sedentism and Resource Management in the Neolithic of the Central Zagros'. A short period of work also took place at Shimshara on the Rania Plain and there was a winter season of survey in the Zarzi region, all reported on here.

We are extremely grateful to all our colleagues at Sulaimaniyah Directorate of Antiquities and Heritage, in particular its Director Kamal Rasheed Raheem, who made the project possible and provided vital support at every stage, as well as all the support staff and drivers. We also thank our colleagues at Erbil Directorate of Antiquities and Heritage, in particular its Director, Abubakir O. Zainadin (Mala Awat), for their ongoing support. We are very appreciative also of the considerable assistance provided by the staff of Sulaimaniyah Museum, led by its Director, Hashim Hama. Our government representative, Kamal Rouf Aziz, gave support and advice in a great many ways as well as serving as a key team member. We also thank the villagers of Bestansur who worked with us on site and looked after us in the Expedition House.

The summer 2012 team comprised:

| | | |
|---|---|---|
| Roger Matthews | University of Reading | Project Co-Director, lithics, excavation |
| Wendy Matthews | University of Reading | Project Co-Director, micromorphology, excavation |
| Kamal Rasheed Raheem | Sulaimaniyah Antiquities | Co-Director |
| Kamal Rouf Aziz | Sulaimaniyah Antiquities | Representative, excavation, ceramics |
| Hero Salih Ahmad | Sulaimaniyah Antiquities | Excavation |
| Halala Salih Ahmad | Sulaimaniyah Antiquities | Excavation |
| Robin Bendrey | University of Reading | Archaeozoology, excavation |
| Amy Richardson | University of Reading | Finds, data-base, excavation, pXRF |
| Sarah Elliott | University of Reading | Micromorphology, excavation, pXRF |
| Jade Whitlam | University of Reading | Archaeobotany |
| Ingrid Iversen | University of Reading | Micro-archaeology, excavation |
| Zoe Robinson | Oxford Brookes University | Excavation, lithics |
| David Thornley | University of Reading | Geophysics |
| Nick Harper | University of Reading | Excavation, molluscs |
| Will Owen | University of Reading | Excavation, burial |

The January 2013 Zarzi survey team comprised:

| | | |
|---|---|---|
| Roger Matthews | University of Reading | Project Co-Director, lithics |
| Wendy Matthews | University of Reading | Project Co-Director |
| Kamal Rasheed Raheem | Sulaimaniyah Antiquities | Co-Director |
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| Robin Bendrey | University of Reading | Survey |
| Amy Richardson | University of Reading | Survey, finds |
| Sarah Elliott | University of Reading | Survey |
| Dominik Fleitmann | University of Reading | Cave survey |

The following report is a preliminary, provisional account of the results from the summer 2012 season, produced for distribution to the Sulaimaniyah, Erbil and Baghdad Directorates of Antiquities and Heritage, and is not intended for publication.

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# Chapter One: Research Issues, Strategy, Methods

Roger Matthews, Wendy Matthews, Kamal Rasheed Raheem

## Aims, objectives, issues

The aims and objectives of the project are:

1. To investigate issues in the transition from hunter-forager to villager-farmer in the central Zagros region by the application of a full range of modern scientific and humanities-based approaches to Early Neolithic societies of the eastern Fertile Crescent.

2. To address the imbalance in our knowledge and understanding of the Neolithic transition in Southwest Asia through fieldwork and research in the eastern Fertile Crescent, and through widespread dissemination of results and interpretations within academe and beyond.

3. In collaboration with colleagues, to produce high-quality outputs that maximise the outreach and impact of the project's achievements.

The project research questions are:

1. Sedentism, society and ritual
Did early settlements develop from seasonal and temporary to year-round and permanent?
How were these early settlements constructed and socialised?
How significant was ritual in social transformations in the Zagros Neolithic?

2. Resource management
What were Early Neolithic economic practices and do they suggest a 'broad spectrum revolution'?
How best do we investigate hunting, management, and domestication of wild goat?

3. Chronology of change
What is the chronology of change in the Zagros Neolithic? How does high-resolution evidence develop our understanding of sedentism and resource management in Southwest Asia?

## Methods

The main approach is three seasons of excavation at the Neolithic sites of Bestansur and Shimshara, to investigate socio-economic and cultural strategies through the Early Neolithic. Recording and processing are managed through the web-based Integrated Archaeological Data-Base (IADB). Excavation is being conducted, employing trenches for diachronic investigation and open-area trenches to examine buildings, external areas, middens and streets/corridors. Excavated deposits are quantified, sieved, floated, sampled, and processed for recovery of lithics, ground-stone, clay tokens, figurines, faunal and botanical remains (macro and micro), phytoliths, molluscs, and architectural materials.

Additionally, intensive field survey was conducted during 2013 in the vicinity of Zarzi cave, in the Iraqi Central Zagros, in order to investigate the Neolithic settlement of this fertile region. Further seasons of intensive field survey are planned for the Zarzi region.

# Chapter Two: Fluxgate Gradiometry Survey at Bestansur

David Thornley

A geophysical survey at Bestansur was undertaken by David Thornley and William Owen over a period of six days starting on 27th August 2012. A Bartington Grad 601-2 dual fluxgate gradiometer was used to conduct the survey. Fluxgate gradiometry is a technique that records small magnetic anomalies associated with both natural and man-made features beneath the ground surface. The depth of investigation for the Bartington gradiometer is generally considered to be up to 1.5 metres.

Features such as clay brick or mud brick walls, pits, ditches, kilns and materials such as ceramics and metals all have magnetic fields of different strengths which create distortions in the earth's magnetic field just above the surface of the ground. The magnitude of these distortions can be measured using the gradiometer and are seen as a contrast in magnetic signature between the feature or material and its surrounding matrix ie the soil of the land. Stone or limestone walls may also be recognised as they often have a magnetic signature that is often less that the surrounding matrix. Areas of burning caused by lighting of camp fires can have an enhanced magnetic signature (Schmidt 2007).

The main aim of the project was to detect the mud walls of Neolithic building structures and any pits or rubbish pits (middens) that may be associated with past human activity.

## Laying out the grid system

The gradiometry was carried out using a system of 30m by 30m grids and partial grids. The whole area to be surveyed was then laid out by triangulating the position of the 30m by 30m grid corners using tapes and marking these with tent pegs.

A full survey was made by Ahmed Rasheed Raheem of the grid corners. This has enabled us to correctly position the results of the fluxgate gradiometry survey on to a map of the site, which in turn will be extremely useful to target areas for future excavation.

## Survey method, data collection and processing

Firstly the instrument was adjusted to give a reading of 0nT at a fixed location to the north west of the survey area, where very low readings of magnetic signature were encountered.

The data was collected in zig-zag fashion, starting in the north-east corner of each grid. The first traverse was made by walking in a southerly direction then turning at the end of the traverse and walking in a northerly direction and so on. The traverse intervals were 0.5 m with the sample intervals along each traverse being 0.25m.

Subsequent data processing was performed using Geoscan research "Geoplot" software. The The grey-scale images of the gradiometry are in the range -5nt white to +5nt black and are accurately overlain onto a map of the site. The post processing techniques used were destagger, zero mean traverse, interpolation and low pass filter.

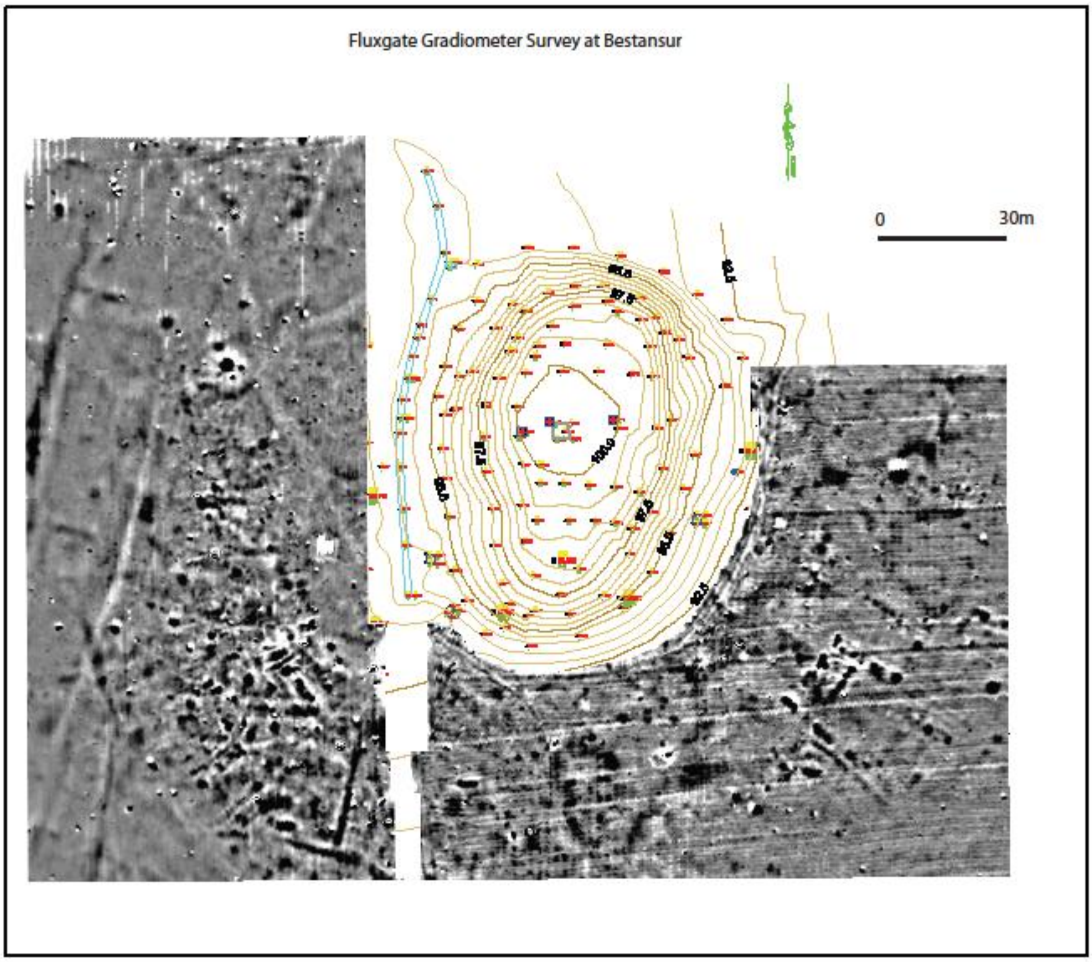


Figure 2.1. Results of fluxgate gradiometer survey at Bestansur

## Interpretation

### *Plough lines*

The field to the west of the mound has faint plough lines that are orientated north-south direction. These show up weakly on the gradiometry survey. However, in the field to the south and east of the mound, the plough marks are much more visible. These are very obvious on the gradiometry survey as a series of closely spaced lines orientated in a west-east direction, giving readings of +1 to -1 nT.

### *Settlement to the south-west of the mound with wall or ditch enclosures*

There are a series of buildings to the south west of the mound that occupy an area of approximately 100 x 60 metres. There are many dark areas of high magnetic signature (50nT) that are possibly the floor of a building that are surrounded by lighter areas of lower magnetic signature (-10nT) that are possibly stone wall or foundation. The magnetic appearance of these buildings is very similar to a set of soldiers barracks seen in a Roman fort (Schmitt 2007, fig. 5). These are most likely to be buildings of an Assyrian settlement. There are indications of linear walls that partially enclose the settlement

### *A building to the south east of the mound*

A large almost rectilinear building that occupies an area of approximately 60 x 60 metres is located to the south east of the mound. It possibly has a courtyard within its interior. The darker lines which give readings of 50nT are possibly the location of the main entrance which looks out in a north westerly direction towards the mound. This high magnetic signature would indicate that the structure is possibly made of brick. The magnetic signature gets steadily weaker towards the south east but the outline of the building is clearly visible. These are most likely to be buildings of the Assyrian or Sassanian period.

***Rubbish pits or middens***

Darker areas of 5 to 10nT that are not surrounded by white halo of negative readings may be rubbish pits or middens.

***Other features***

There are many other features such as the long slightly curving lines of negative intensity (-5nT) that seem to converge on a circular feature to the north-west. There are also large, semi-circular rings of high magnetic signature that are not associated with any negative readings. It is more difficult to interpret these features.

# Chapter Three: Excavations in Trench 7

Roger Matthews, Wendy Matthews, Kamal Rouf Aziz and the CZAP team

## Introduction

Excavations at Bestansur in spring 2012, involving the excavation of ten trenches (see Archive Report, *Excavations at Bestansur, Spring 2012*), recovered evidence for a range of activities within the 2 x 2m area of Trench 7, including pisé architecture, an open area with multiple surfaces, *in-situ* grindstones, flint knapping and substantial quantities of edible land snail in discrete clusters. In view of this rich evidence for multiple Early Neolithic activities, in summer 2012 we decided to expand the 2 x 2m excavation area of Trench 7 into a 6 x 6m area excavation, with the 2 x 2m area at its centre. Trench 7 is located *ca*. 15m west of the southwest edge of the mound at Bestansur, in the large arable field that runs along the west and southwest sides of the mound (Fig. 3.1). Excavation began by removal of back-fill from the 2 x 2m trench and continued with stratigraphic removal of deposits from topsoil down.

Figure 3.1. Excavations underway in Trench 7, looking southwest.

The following account discusses the deposits of Trench 7 in their true sequence of deposition; that is in reverse order to their sequence of excavation. The lowermost deposits were reached in the base of the 2 x 2m area. The architecture in the 2 x 2m area aligned well with that exposed across the 6 x 6m area and we believe that the deposits and surfaces excavated in the 2 x2m area represent earlier phases of the same building as excavated across the whole trench (Fig. 3.2). A full matrix of Trench 7 is shown in Fig. 3.3.

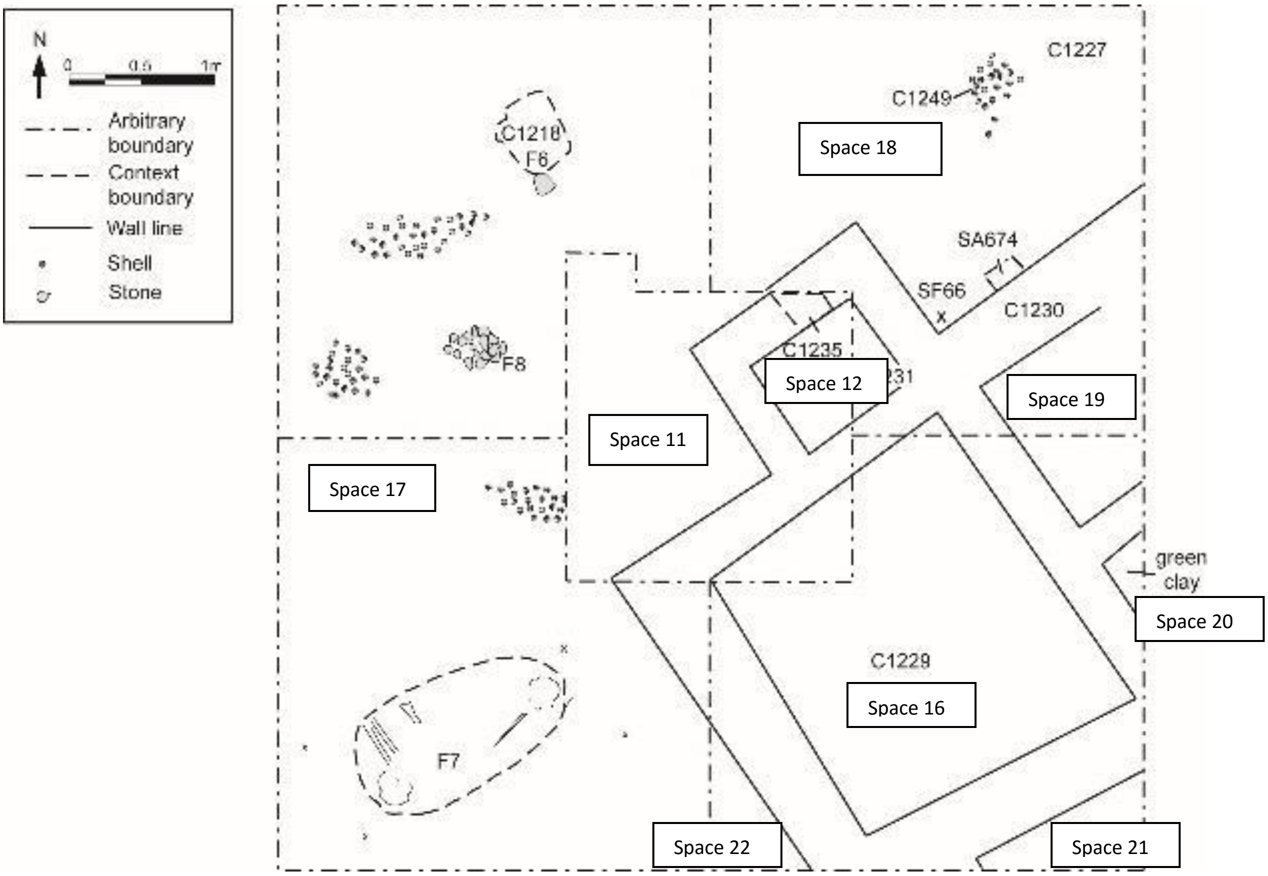


Figure 3.2. Composite plan of architecture and major features of Trench 7, showing all Space numbers.

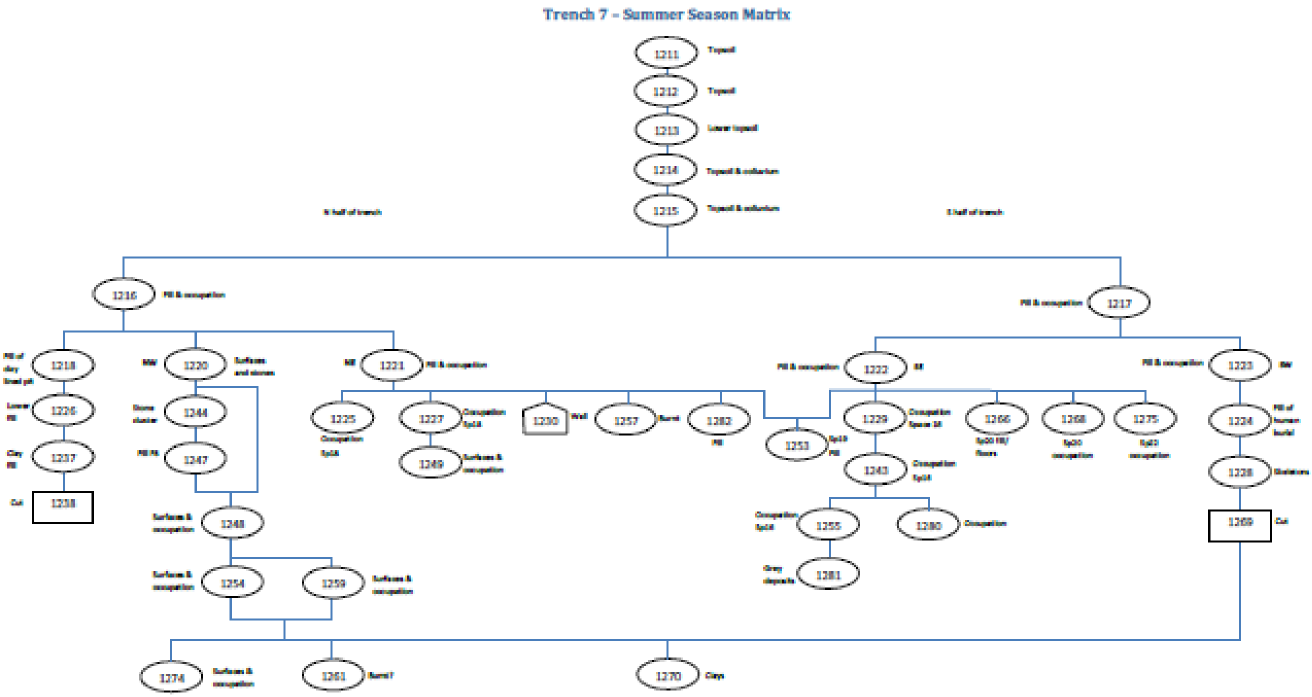


Figure 3.3. Matrix of excavated deposits in Trench 7.

## Deposits in the 2 x 2m trench in the centre of Trench 7

In the base of the 2 x2m area in Sp11, deposits were excavated as C1273, a silty clay loam with almost no inclusions (Fig. 3.4). Originally interpreted as natural, subsequent analysis (Chapter 8) suggests that these deposits are anthropogenic. Overlying C1273, deposits excavated as C1264 contained the transition to richer anthropogenic deposits, with sparse shell and white aggregates and a single bone fragment in the upper lenses. Walls of the rectilinear structure comprising Sp9/12, Sp10 and Sp11 were the earliest features to be constructed. These walls were extremely difficult to articulate, being unplastered, but consisted of lumps of reddish clay with white inclusions.

Figure 3.4. West section of 2 x 2m sounding in centre of Trench 7, with C1273 at base.

Sequential occupation deposits within Sp11, C1262, C1260 and C1256, contained a patch of charred lentils, bone fragments, including a large cattle rib (Fig. 3.5), and chipped stone debris on fugitive undulating surfaces. Space 11 is an external area, part of the larger open area identified as Sp17 on the 6 x 6m plan (Fig. 3.2).

Figure 3.5. Cattle rib lying on surface, C1260, in Sp11, Trench 7.

In the adjacent Sp9/12, a rectilinear room *ca*. 80 x 75cm in area, a laid stone surface was excavated as C1272, composed of flat, thin stones. Occupation deposits, C1252, had accumulated on top of the flat stones, with one lithic artefact lying flat on a surface. Fill and building make-up, C1251 and C1231, overlay the occupation deposits, and a lens of unidentified blackish material, C1235, was excavated along the northern wall of Sp9/12. Finally, removal of backfill from the spring 2012 excavations, C1210, represented the uppermost deposits in this part of the trench.

## Deposits in the 6 x 6m extent of Trench 7

Walls of the exposed building, defining Sp9-Sp12 and Sp17-Sp21 (Fig. 3.2), were the earliest constructed features across the 6 x 6m trench. All walls were constructed with shapeless lumps of reddish clay or pisé with fine white inclusions and without any plaster on external or internal faces. The walls were extremely difficult to identify, the presence of white inclusions being one guide to their articulation. Excavations in the 6 x 6m trench were broadly conducted in four quadrants (NW, SW, NE, SE), with some overlap from one quadrant to another. Stratigraphic relationships are portrayed in the matrix (Fig. 3.3), and deposits are here discussed according to Space number (Fig. 3.2).

### *Excavations in Space 17*

The lowermost excavated deposits were in the SW quadrant, comprising reddish clayey lenses with sparse shell and small stone inclusions, C1270. Contemporary deposits in the NW quadrant, C1274, comprised sequences of finely stratified, highly fugitive surfaces with discrete clusters of shells, stones, and lithic items (Fig. 3.6), interbedded with patches of red/brown material that may have been packing between surfaces. This context was intensively sampled for flotation and all finds of chipped stone and bone were 3D located on each surface. Context 1261, dark grey/black lenses with interbedded grey/brown material represents further intensive activity in the NW quadrant of Trench 7.

Within Sp17 and overlying C1261, C1259 consisted of mixed deposits including reddish bricky material that may have been a platform, make-up or slumped wall to the north of Sp9/12. Context 1254 continued the pattern of C1274, which it directly overlay, with multiple fugitive .surfaces on which discrete clusters of shells and stones were situated (Fig. 3.7). Patches of charred lentils (Fig. 3.8) were separately collected and multiple flotation and shell samples taken. Further accumulations of surfaces and *in-situ* clusters of shells and stones were excavated in the NW quadrant as C1248. A dense cluster of small, fist-sized stones, C1244 (Fig. 3.9), lay directly on a charred surface, C1247, overlying the surfaces of C1248. These stones are likely to have been used as fire-stones in cooking or heating in some way. More sequences of surfaces with clusters of shells and small stones, generally unaligned, were excavated as C1220 and intensively sampled.

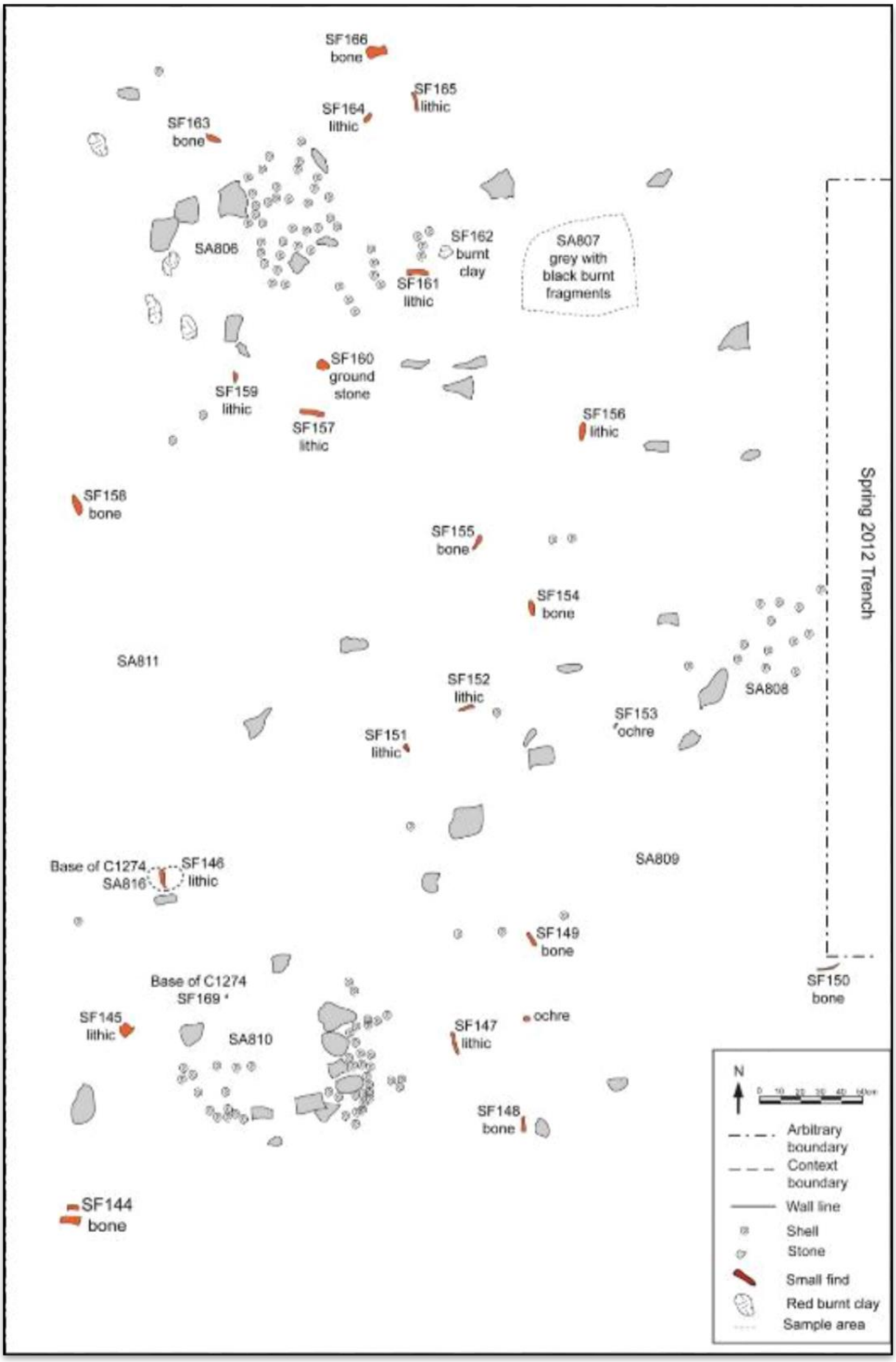


Figure 3.6. Plan of C1274, Sp17, showing clusters of objects and artefacts on surfaces.

Figure 3.7. View of C1254, showing shells and stone debris, Sp17.

Figure 3.8. Deposit of lentils in C1254, Sp17.

Figure 3.9. Cluster of small stones, C1244, lying on charred surface in Sp17.

In the NW quadrant a cut, C1238, was made into the underlying deposits in order to situate a small pit, *ca*. 50 x 40 cm, which was lined on the base and sides with clay, C1237 (Fig. 3.10). The clay was fire-hardened from cooking within the pit. Fill within the pit, C1226 and C1218, comprised a dense cluster of land snail shells, presumably cooked within the pit through heating by fired stones, as well as broken chert tools.

Figure 3.10. Burnt clay-lined pit, C1237, Sp17.

In the SE quadrant of Trench 7, in the south of Sp17, a double human burial had been made (see Chapter 5). The cut for this burial, C1269, was made into the lower deposits, C1270, but may well have been cut from an upper layer and not detected. Indeed the cut for the burial was not clearly visible at any point, in plan or in section. Lying within the cut were two human skeletons, C1228, one adult male and one adult female lying head to toe (Fig. 3.11). Fill of the burial was excavated as C1224. Overlying this fill, and possibly mixed with it in part (the deposits were extremely hard to differentiate), were lenses of possible surfaces and shell scatters excavated as C1223 across the SE quadrant of the trench.

Figure 3.11. Skull of adult male in double human burial, C1228.

In sum, the deposits in Sp 17 attest repeated activity in a large open area. To the east, Sp17 is bounded by the walls of Sp 9/12 and Sp16, but to the north, west and south we do not yet know how extensive Sp17 might have been. To the north-east it merges into Sp11 and Sp18. The excavated evidence suggests repeated revisits to this open area, perhaps seasonally over significant periods of time. Radiocarbon dates are awaited and should give some indication of the duration of use of this area but the recurrent presence of edible land snail shells, almost entirely *Helix salomonica*, in discrete clusters, suggests at least spring-time visits to the site, the only time when snail collecting on the large scale attested here would have been feasible. The frequent presence also of groups of small stones, clumps of lentils, broken tools of chert and obsidian and fragmented animal bones suggests that cooking and eating activities were taking place episodically here, with rapid disposal of discarded food debris close to the place of preparation and consumption. If so, we can envisage that each discrete cluster of discarded snail shells represents the debris from meals eaten by individuals sitting or squatting in small groups on sequences of roughly trampled surfaces. The deposition of a double human burial may have been made significantly later in the sequence from a now eroded level but the stratigraphy is not clear enough to be sure on this point.

***Excavations in Space 18***

Space 18 is the extension of open area Sp17 in the NE quadrant of Trench 7 (Fig. 3.2). The lowermost deposits excavated here, C1249, comprise further lenses of shells and small stones lying on fugitive surfaces. The red clayey nature of the deposits in this region differentiates them from contemporary deposits to the west in

Sp17. Subsequent lenses of snail shells and occupation deposits in Sp18 were excavated as C1227 and C1225. A distinctive cache of obsidian knapping debris, with joining fragments of debitage, was found in C1221/1225, further evidence for chipped stone tool working in this external area (Chapter 12). Black, possibly burnt, deposits in a limited area of Sp18 were excavated as C1257. Forming the southern limit to C1225, the pisé wall separating Sp18 from Sp19 was designated as C1230 but not excavated. Finally, C1221 included removal of uppermost unclear Neolithic deposits across the NE quadrant of Trench 17.

***Excavations in Space 16***

Space 16 is a well-defined rectilinear room, *ca*. 2.5 x 2.4m in area (Fig. 3.2). The earliest features here are the pisé walls which were not excavated. Lower fill of this space was excavated as C1282, above which greyish occupation deposits had accumulated, containing some shell (C1281 and C1280). Large quantities of ground-stone artefacts were then placed on the surface of this room in quite discrete clusters. The function of so many ground-stone objects in such a small space remains to be established and could not yet be ascertained from the associated deposits. It may be that the stones were being stored in this space rather than being used. The deposits around and over the stones were excavated in a grid of 9 squares in order to detect patterns in micro-debris (Chapter 6). Two levels of occupation material around the stones were excavated as C1255 and C1243 with multiple flotation samples taken. Chert tools occurred in direct association with some ground stone clusters (Fig. 3.12). Further occupation deposits including trample and sparse shells and charred remains had accumulated in the upper level of Sp16 (C1229). Eroded and disturbed Neolithic levels across the SE quadrant of Trench 7 were excavated as C1222.

Figure 3.12. Chert serrated blade in association with ground-stone tools, Sp16.

***Excavations in Spaces 19, 20, 21 and 22***

Exploratory investigations were made of the suite of rooms along the eastern side of Trench 7, Sp19, Sp20, Sp21 and Sp22 (Fig. 3.2). The pisé walls are the earliest features here, but were not excavated. In Sp19 a small sample of clayey deposits was excavated (C1253) without reaching clear floors or surfaces. In the limited available segment of Sp20, deposits with distinctive greenish clay patches and with some shell inclusions had accumulated (C1266), perhaps including floors. To the south of Sp16, occupation deposits in Sp21 were excavated as C1268, and in Sp22, to the west of Sp16, further occupation deposits with shell inclusions (C1275) had accumulated as part of the overall pattern of use of the open area dominating the western half of Trench 7. All these deposits were overlain by the mixed fill and occupation debris excavated over the SE quadrant of Trench 7 as C1222.

***Excavation of uppermost deposits in Trench 7***

Overlying C1220, C1221 and C1218, C1216 was excavated across the northern half of the 6 x 6m trench, consisting of the transition from Neolithic deposits, highly disturbed, into more amorphous fill. Context 1217 comprised similar deposits in the southern half of Trench 7, overlying C1222 and C1223. Succeeding C1216 and C1217 colluvium and disturbed deposits were excavated across the whole 6 x 6m trench as C1215 and C1214, overlain by three arbitrary spits of topsoil, C1213, C1212 and C1211.

## Summary of excavations in Trench 7

Excavations in Trench 7 have revealed and investigated a wide range of activity-specific contexts in a relatively well-defined area. In the eastern half of the trench a substantial pisé building with multiple rooms was excavated. In these rooms the deposits were relatively clean and surfaces (of floors and walls) hard to articulate. The presence of large quantities of ground-stone items in Sp16 may indicate long-term or seasonal storage rather than *in-situ* activity. By contrast, the external area to the west and north of the pisé building is full of material evidence for repeated human activity, attested by clusters of land snail shells, scatters of small stones, shattered fragments of animal bones, discarded chert and obsidian tools and debitage, occasional clumps of charred lentils, and a double human burial. These traces are found on sequences of trampled surfaces through a considerable depth of occupation, up to *ca.* 75cm according to the section of the 2 x 2m sounding in the centre of Trench 7, and may thus represent long-term, but seasonal, visits to the site by groups of humans taking advantage of spring-time availability of land snails and the many other natural resources of the region in the Early Neolithic.

# Chapter Four: Architecture, Activities, Site Formation Processes

Wendy Matthews

## Introduction: Research rationale and aims and objectives

This chapter presents a brief overview and reflection on the architecture, traces of activities and site formation processes at Bestansur and Shimshara. The aim in studying these is to examine local and regional variation in:

- architecture in order to investigate continuity and change in sedentism, social boundaries and relations and technology
- traces of activities to study the nature and periodicity of occupation and the ecological and social strategies of these communities and implications for environment
- the nature of site formation processes at these contrasting sites to study the pre-depositional, depositional and post-depositional histories of artifacts and deposits at a) a predominantly flat extended site at Bestansur and b) a tell site at Shimshara. These two types of sites are present much more widely in the Near East and Mediterranean and co-occur in regions such as Greece, for example.

## Methodology

The principal techniques and methods include field observations of architectural materials and technology and portable XRF, micromorphology, clay mineralogy (X-ray diffraction XRD) and particle size analysis to study their microstratigraphy, microstructure and geochemical chararacteristics. These techniques are reported on in the first CZAP Archive Report from excavations at Bestansur in spring 2012 (W Matthews 2012). Spot samples for phytolith and geochemical analyses for comparison to micromorphological analyses are collected in the field and in the laboratory from the blocks prior to impregnation.

Micromorphological block samples are prepared by resin-impregnation of samples and cutting, grinding and polishing samples to manufacture large thin-sections of microstratigraphic sequences and architectural materials 14 x 7 cm in size, of standard geological thickness (25-30µm). These are analysed with reference to internationally standardised methods of description (Bullock *et al.* 2005; Courty *et al.* 1989; Stoops 2003) at magnifications of x25-400 using a Leica DMLP polarising microscope for analysis in plane polarized light, cross-polarised light, oblique incident light and fluorescent light (Hg gas discharge lamp 50W, Filter systems: AS wavelength excitation 340-360/380nm, dichromatic mirror 400nm; N2.1S: 515-560nm, transmitting > 590 nm).

The Spring Report discussed results from micromorphology, particle size and pH analyses of deposits and architectural materails at Bestansur. This report briefly discusses results from: field analysis at Bestansur and Shimshara; analysis of clay mineralogy of deposits and architectural materials from Bestansur conducted by Mike Andrews, QUEST, University of Reading; and preliminary micromorphological analyses of deposits and architectural materials from Shimshara.

## Bestansur Architecture

The walls at Bestansur were constructed from rammed earth (pisé/tauf) using dense compacted reddish brown silty clay-silty clay loam with white calcareous aggregates, with few or nor plasters (Matthews 2012a). In the hot weather of August and September (>4-47°C) the trench was covered each day with large sheets of plastic to reduce the drying out of sediments. A shelter with a white roof and adjustable sides was also constructed to reduce the impact of the sun and heat and to improve the visiblity of deposits and features by creating shade. Walls, nevertheless were difficult to detect across the site, like those at Jarmo (Braidwood 1983, 162, 169).

The explanation for some difficulty in articulating walls at Bestansur lies partly in: the absence of wall plasters; the similarity of the wall material with the infill; and the high percentage of expandable clays which through successive wetting and drying have bonded fill deposits to wall faces. XRD analysis has established that expandable clays represent 42-59% of wall construction materials and 47-52% of floor and ashy deposits. These expandable clays include smectite. Of the mass percentages of mineral phases, calcite represents 50-65% and quartz 27-39%. The remaining <12% include kaolinite, albite, potassium feldspar, dolomite and haematite.

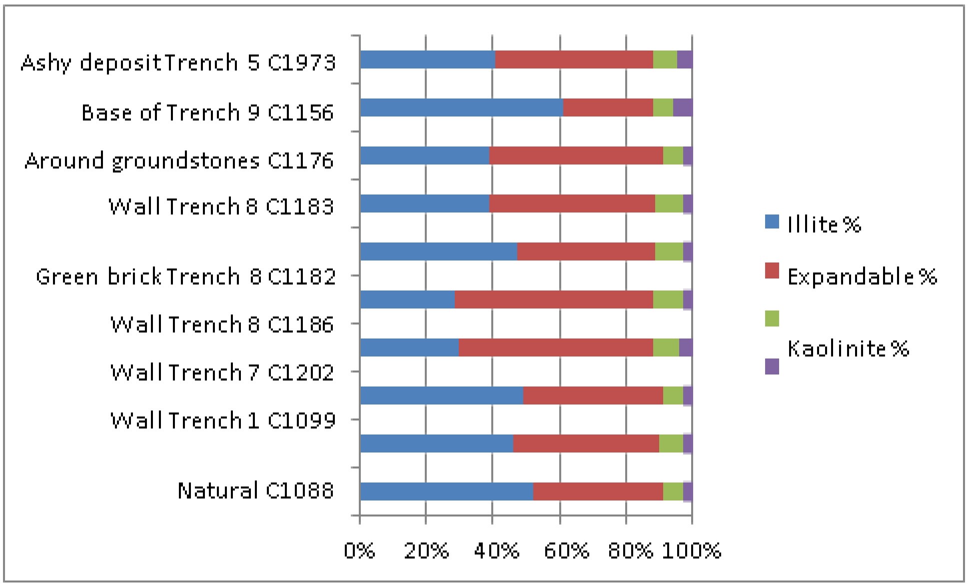


Figure 4.1 Clay mineralogy (XRD) of architectural materials and deposits at Bestansur.

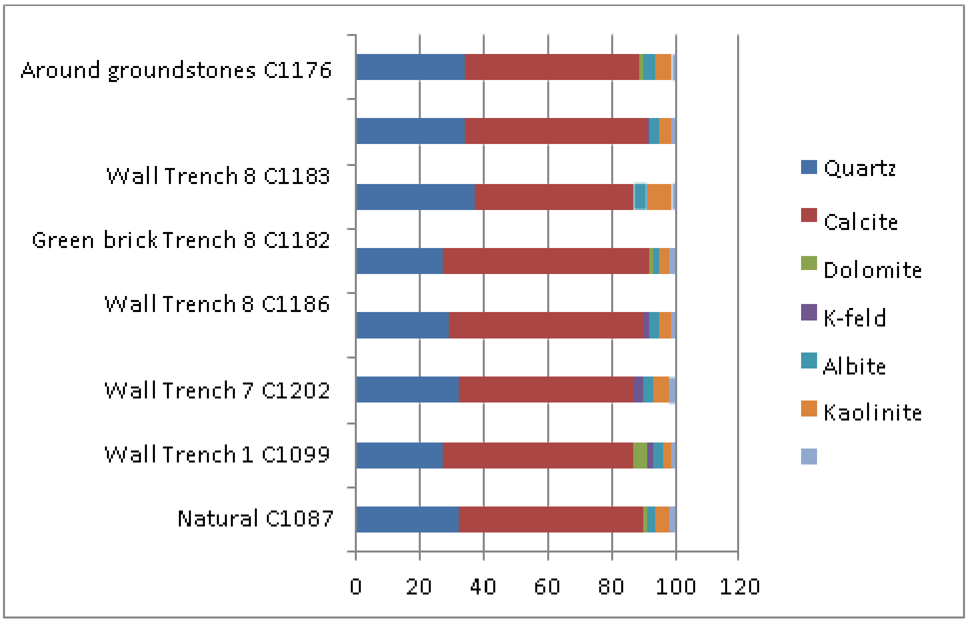


Figure 4.2 Mass percentages of mineral phases (XRD) of architectural materials and deposits at Bestansur.

Walls were articulated where possible in plan by brisk brushing to differentiate between the reddish-brown silty clay loam with white aggregates from infill which included aggregates of wall material in some cases, and greyish surfaces and accumulated deposits with shell, lithic and sparse charred plant and bone inclusions. The infill of Space Sp9 Trench 7 included reddish aggregates, perhaps from wall plaster fragments/burnt aggregates, to be examined in micromorphology sample SA819. The infill of Sp20 Trench 7 included green silty clay aggregates, similar to the 'brick' excavated in Trench 8 (C1182 S454), and will be investigated in micromorphology sample SA817, which is currently being prepared. These wall materials are being compared to the plaster that lined pit/fire-installation F6, C1218, in micromorphology sample SA612 to study the range of technological materials and choices at Bestansur.

***Bestansur Site formation processes***

One question arising during excavation and on receipt of two radiocarbon dates for two discrete patches of lentils is: why do these clusters occur in the NW quadrant of Trench 7? In the field, these patches are <6-13cm in diameter, and <5-10mm thick and the edges are well-defined (Fig. 4.3-5; Fig. 10.1-2). These two patches were uncovered during excavation of 1) C1254 in Sp17 (SA740 and directly beneath but not continuous with it SA746) and 2) C1262 in Sp11 (SA803).


Figure 4.3. Well-defined patch of lentils uncovered during excavation of C1254 (SA740 above SA746 Fig. 4.4). Scale = 5cm.

Figure 4.4. Patch of lentils uncovered during excavation of C1254 (SA746, below SA740 Fig. 4.3). Scale = 10cm.

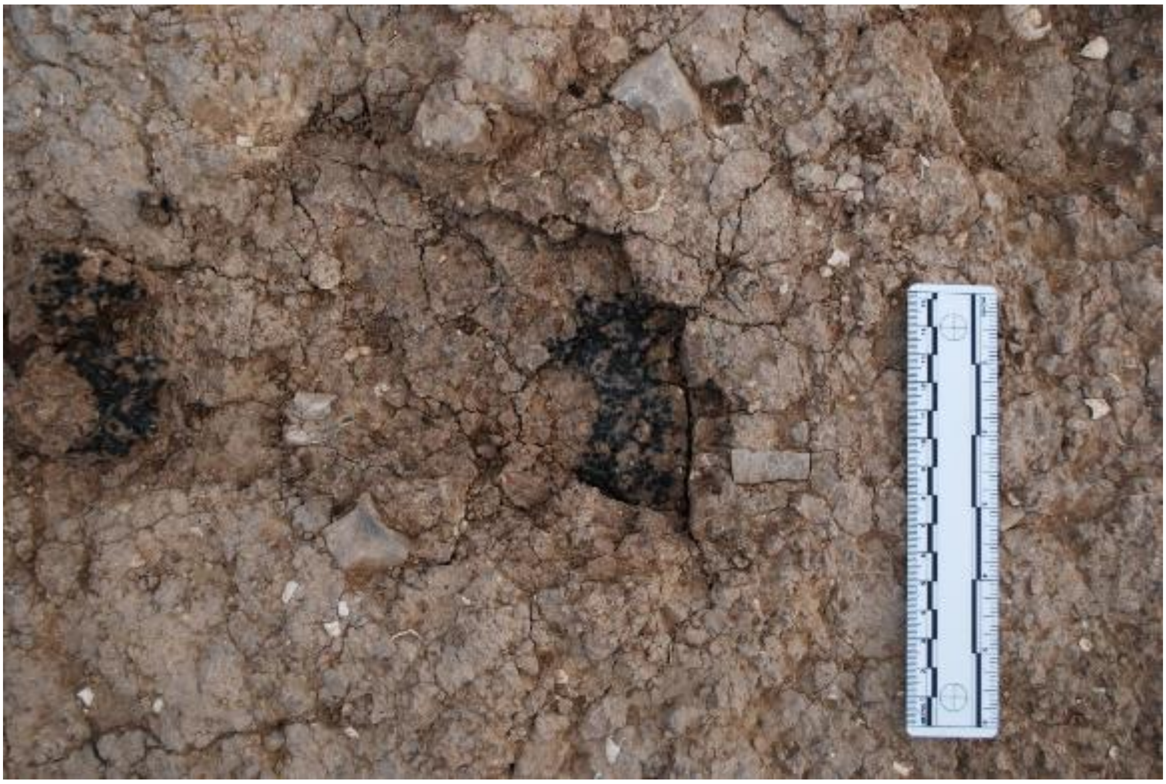

Figure 4.5. Patch of lentils C1254 (centre) and aggregate lifted off the top of these with lentils adhering to it (left), Trench 7 in deposits with animal bone and shell. Scale = 15cm.

Figure 4.6. Patch of lentils C1262 (centre) Trench 7 in otherwise comparatively sterile deposits.

One suggestion was that they were initially preserved below stones which had prevented them from otherwise being blown away or eroded by trampling by humans or animals. Ethnoarchaeological research by Mallol et al. (2007) has shown that unless hearths and burnt deposits are covered quickly by subsequent deposits, they are susceptible to erosion by wind, water and disturbance by humans and animals. Even after only ten days, few extant traces may remain. In all three cases, however, no stones were remaining on these lentils.

The return of two consistent radiocarbon dates on two separate lentils, however, raises the possibility that they may have been introduced by postdepositional agencies and processes, as these dates are in the early first millennium BC, at least 6,000 years later than expected. The date returned for SA740 (C1254) is 1000-840 cal. BC at 2 sigma (95% probability), 970-960 and 930-900 cal BC at 1 sigma (68% probablity), intercept 910 cal. BC (Beta-342482). The date for SA803 is 970-960 and 930-820 cal BC at 2 sigma (95% probability) and 910-840 cal BC at 1 sigma (68% probability), intercept 900 cal. BC.

By contrast, the radiocarbon date from spring 2012 on one shell in an extensive layer of shell C1078 with interbedded Neolithic lithics in the adjacent trench, Trench 5, gives a conventional radiocarbon age of 9570±40 BP (Beta-326883). This date calibrates with 95% probability at 2 Sigma to 9160-8780 cal BC. Whilst old carbon effects may reduce the age of this date by *ca*. 1,000-1,500n years, in all trenches excavated the complete absence of pottery below *ca*. 40cm and the typology of the chert and obsidian lithics and artefacts including the perforated disks and pendants and thick stone bowl are all indisputably Neolithic in date, and at least *ca*. 8000 cal BC pending further dates. We have designed a programme of intensive $^{14}C$ dating and our application to Oxford for dates has been invited for re-submission.

That the patches of charred lentils may be intrusive is supported by very clear observations and discussion on the habits and effects of subsurface and surface soil foragers, by Schiffer (1987, 208-9) and by Reed (1958) at Neolithic Jarmo, *ca.* 65km to the northeast. Reed's discussion focuses on a mole-like mammal *Spalax leucodon* but his observations on burrowing mammals are relevant more widely. He cautions that "in this part of the world Spalax obtrudes itself upon the archeologist's consciousness, for the rodent is usually a prior excavator in the archeologist's site and has often been mixing things up for thousands of years, to the exasperation of man [*sic*], who thus finds small cultural artifacts displaced vertically (not always downward) and out of stratigraphic sequence. In addition, *this same type of displacement of materials is always a potential source of error in collecting charcoal to be used for radiocarbon (C14) dating*" (1958, 386; *italics author's emphasis*). He observed active burrowing to a depth of *ca*. 75cm below the surface.

Schiffer (1987, 207-8) similarly observes:

1) with regard to subsurface foragers such as gophers and earthworms that after sustained action "pavements of larger particles – those not deposited on the surface- will form near the bottom of their activity zones. The cobble features creadted by gophers, for example, strikingly mimic cutural constructions (Bocek 1986)"
2) that, in contrast to subsurface foragers, surface foragers such as prarie dogs, rabbits, foxes, ants, termites, and many rodents, create well-defined tunnels and burrows which when infilled are classified as krotovinas. "The distinctive fill of krotovinas, which derives from surface materials and adjacent parts of the deposit, is introduced by wind, water, and other depositional processes". He also records that many mammals do not burrow below a depth of *ca.* 1m. As these surface foragers are predated above ground, their bones are rarely found in these tunnels.

On the basis of Reed (1958) and Schiffer (1987) therefore, it is possible that 1) the action of subsurface foragers may have created some of the cobble layers rich in pottery observed at the interface of later Iron Age deposits and the underlying acermic Neolithic deposits. It is also possible that (2) the well-defined patches of lentils represent Iron Age surface materials that have been introduced by wind, water, gravity and other agencies down into open burrows, following a burning event(s) that may have charred a field or stores of lentils. That these lentils may be intrusive deposits within Iron Age burrows into earlier Neolithic levels is suggested by:

- the very discrete distribution of the lentil clusters, at <6-13cm, and *ca.* <0.5mm thick. Notably:
    - this size range is similar to that of small mammal burrows.
    - the outline shape of C1254 SA 740 is ovoid, like a burrow. The edge of C1262 SA803 is also slightly curving like a burrow edge, and includes a central circular raised 'dimple' not unlike those illustrated by Schiffer (1987, fig. 8.5) at the base of well-defined burrows in a mound in Arizona .
    - the horizontal distribution within these clusters is not uncommon in many stretches of burrows and at their base, as also evident in the examples of krotovinas from Arizona (Schiffer 1987, Ffg. 8.5).
    - the edges of these clusters are generally well-defined, suggesting that the clusters were constrained, perhaps within a burrow, and had not been kicked about nor trampled on a surface.
- the sparsity of any other charred remains in the massive yellowish brown deposits C1262 (Fig. 4.6) which marks the exceptional character of their occurrence in otherwise alsmot sterile deposits
- the depth of the burrows is consistent the distance from the Iron Age land surface, which is likely to have been eroded.

The burning of these lentils, speculatively, may have been related to natural or accidental fires sparked by lightening for example, intensified agriculture and burning of any 'stubble', or unrest in the region. These dates, *ca.* 900 cal BC correspond with the expansion of Adad-Nirari II and his son Tulkulti-Ninurta II's domains.

## Shimshara architectural materials and occupation sequences

### *Introduction and sampling strategy*

The architecture and occupation at Shimshara spans *ca.* 7300-6000 BC and is contemporary with a range of key sites, including Çatalhöyük in Central Anatolia, Jarmo in the Iraqi Zagros and Tepe Guran and Ali Kosh in western Iran, as discussed in Chapter 16.

In the *ca.* 15m long, 2-2.5m high, field section analysed we identified a range of levelled and laid surfaces, as well as a line of stones that probably represents stone footings/foundations for a mud-brick/pisé wall. These stone foundations are similar to those found in later levels at Shimshara by Mortensen (1970, figs 11-12), Levels 15 and 14. The cessation of a series of surfaces at the eroded and sloping juncture of the W-E and N-S sections, and the presence of massive pale brown deposits may suggest the presence of a rammed earth (pisé/tauf) wall. The presence of this wall(s), however, needs to be confirmed by future excavation.

Of the six micromorphological block samples collected from these two field sections, three samples were selected in order to analyse site preservation, architectural materials and occupation sequences, and a fourth to study probable natural deposits (Table 4.1). These thin-sections were prepared by Sarah Elliott along with 2 others from Shimshara and additional samples from Bestansur and will also be analysed by her for traces of dung, dung fuel and indicators of ecology and early animal management (Chapter 8).

Table 4.1. List of micromorphology samples collected for analysis of architectural materials and traces of activities at Shimshara

| Sample No. | Context No. | Section | Deposit type |
|---|---|---|---|
| 753 | n/a | W-E section | Surfaces, charred lenses and white plaster |
| 758 | n/a | N-S section | Upper lens of stones and white aggregates |
| 763 | 1277 | W-E section | Surface and thick layer of phytoliths |
| 756 | n/a | N-S section | Natural and overlying yellow deposit |

This report briefly reviews preliminary analyses of samples SA753, SA756 and SA758.

### *SA753, W-E Section: Surfaces, charred lenses and white plaster*

Sample SA753 was selected to analyse a sequence of thick surfaces with overlying charred lenses, ash and white plaster (Fig. 4.7; Chapter 16, Fig. 16.5). Of particular note is the remarkable layer of white plaster (Fig.

4.7 [1]) which was made from re-used aggregates of multiple sequences of white-wash/plaster that had been applied elsewhere, either earlier in this building, or on another buildings. The thin white washes/plasters are less than 20-100µm thick (0.02-0.1mm). Some are coated in dark brown-black soot. They closely resemble sequences of annual and intra-annual plasters and white-wash applied to walls at the Neolithic site of Çatalhöyük, Turkey (Fig. 4.7; Matthews 2005, Fig. 19.8-19.9) as discussed below.

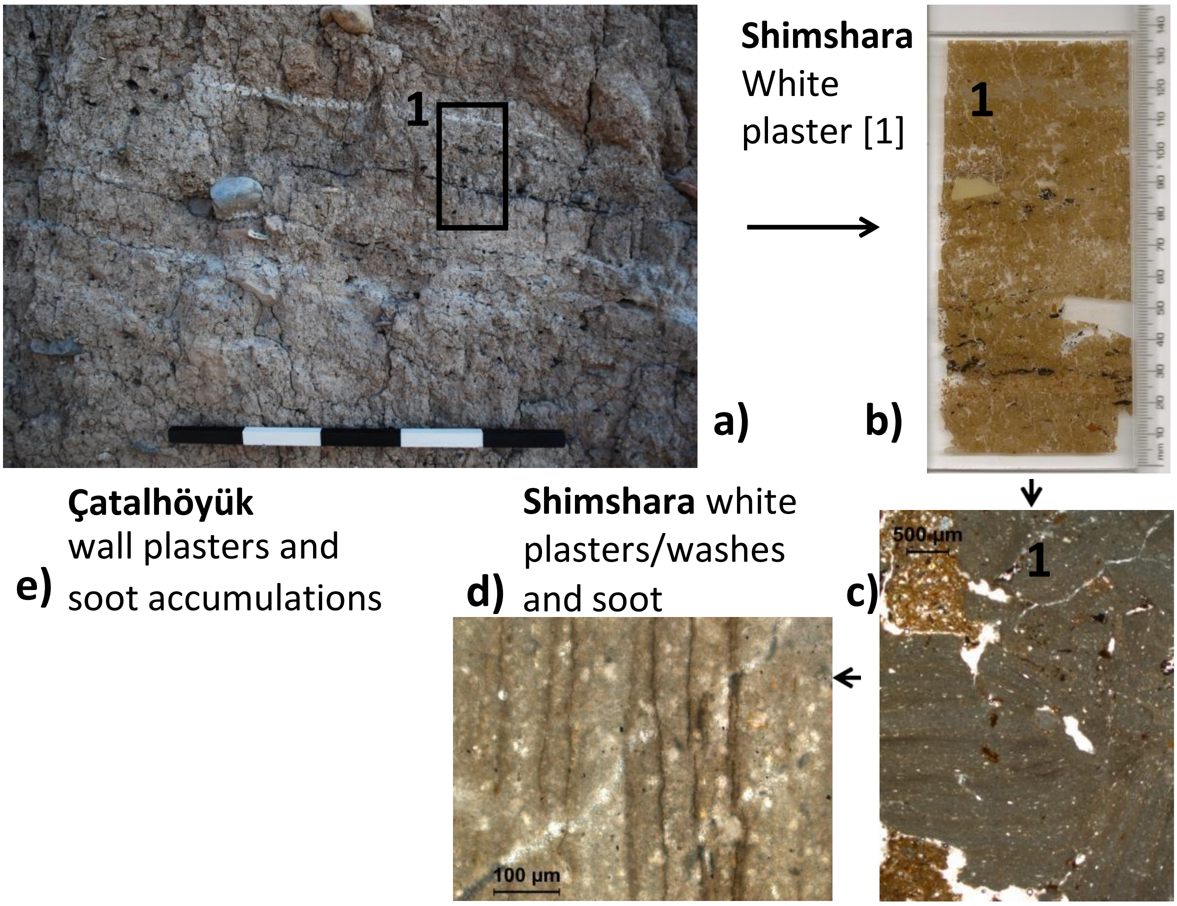


Figure 4.7. a) Field section and b) micromorphological thin-section of Sample SA753, W-E Section, comprising thick surfaces and overlying lenses of charred remains, ash and white plaster [1]. c-d) The white plaster [1] is made from re-used aggregates of multiple lenses of white plasters/wash, some with traces of dark brown soot accumulation (d). The white plasters/washes and soot accumulations resemble those from Neolithic Çatalhöyük, Turkey (e).

***SA756, W-E Section. Thick surface overlain by burnt plant remains and phytoliths.***

A burnt surface with well-preserved plant remains was sampled in micromorphological block SA 756 to examine the nature of the burning and traces of activities in this sequence at the west edge of the W-E section (Fig. 4.8; Chapter 16, Fig. 16.4). In the field burnt bone and a bone pendant (SF117) were also detected on this surface and classified as small-finds for zooarchaeological and specialist analysis (Chapters 8 and 14). In thin-section, it is evident that the plant remains had been burnt in-situ as the underlying floor surface was burnt (Fig. 4.8 [1]). This surface was overlain by discontinuous amorphous organic aggregates [2] and a thick layer of remarkably well-preserved and articulated phytoliths and charred plant remains (Fig. [3] and d)-e)). The plant remains were examined in fluorescent light and autofluoresce (Fig. 4.8 e)), attesting excellent preservation and the presence of some organic matter.

We are also integrating micromorphological analysis of bone with zooarchaeological analyses to assess: bone preservation and taphonomy and the potential for isotopic and biomolecular studies, as well as bone fragments as indicators of activities and ecological and social strategies. The bone at Shimshara also autofluoresces, suggesting moderate-good preservation (Fig. 4.9)

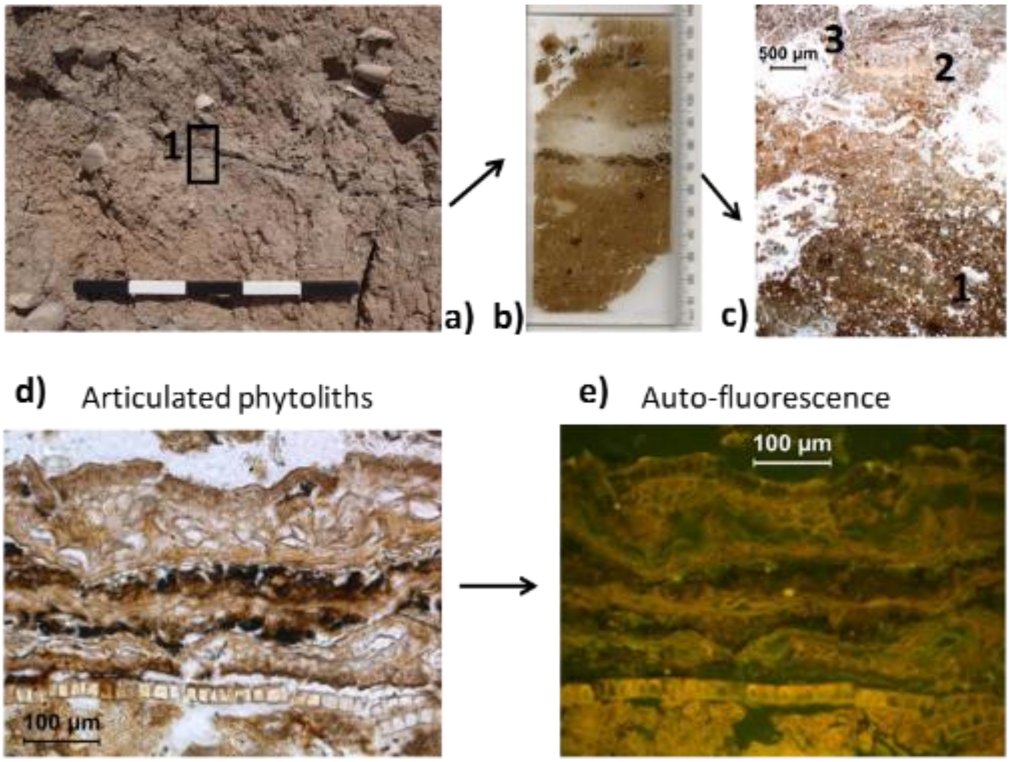


Figure 4.8. Burnt surface and well-articulated phytoliths, SA756, W-E Section, Shimshara. a) Field-section; b) micromorphology thin-section (scale = 14cm); c) burnt surfaces [1] overlying organic lens [2] and articulated burnt plant remains and phytoliths [3] (PPL); d) articulated phytoliths (PPL), which are e) autofluorescent.

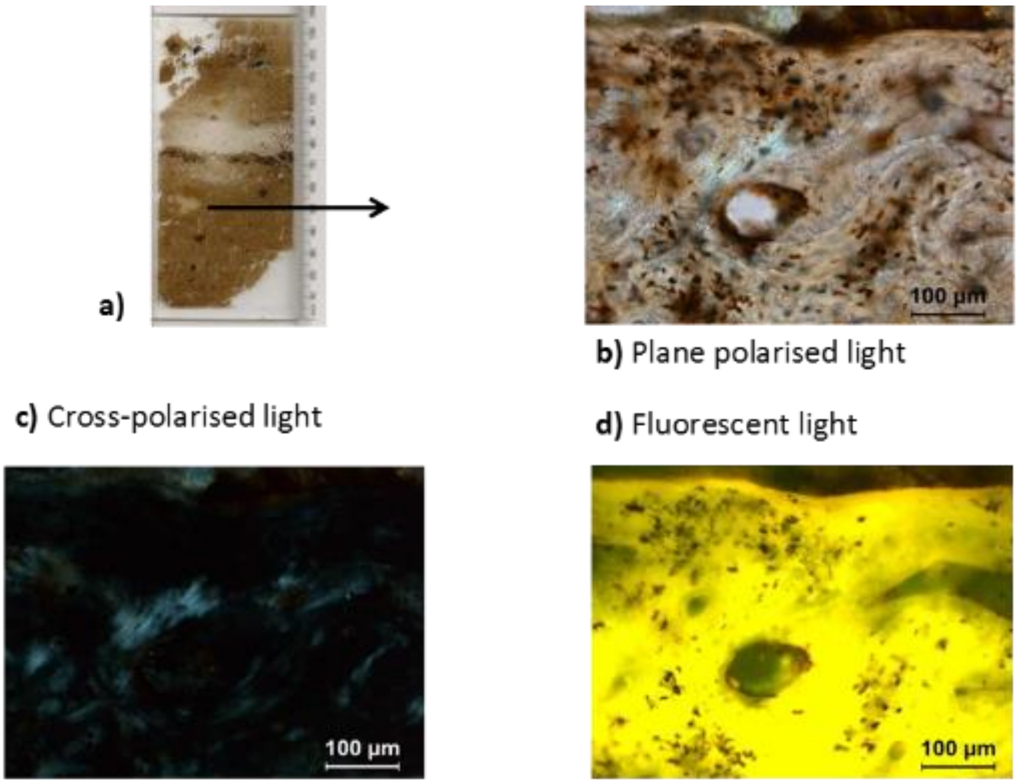


Figure 4.9. Non burnt bone in a) thin-section in b) plane polarised light, c) cross-polarised light and d) fluorescent light. SA 756, W-E Section, Shimshara.

***Discussion***

### *Site preservation*

The preservation of deposit components and microstratigraphic sequences at is very good, despite submergence for many years as well as seasonally by dam flood waters. It is comparable to other semi-arid sites such as Tell Brak in Syria. There is little or no translocation of fine materials within pore spaces, as might be expected from submergence. Nor is there extensive reprecipitation of gypsum salts. There is some bioturbation, generally clearly defined by channels and chambers.

Phytoliths and charred plant remains are exceptionally well-preserved, visible in lenses and as charred wood fragments up to 1.5-2cm in size in the field. In thin-section SA756, the phytoliths visible in the field, are excellently preserved in thin-section. The anatomy of the plant remains is exceptionally well-preserved and articulated, as well as auto-fluorescent suggesting extant preservation of organic materials (Fig. 4.8). These lenses include well-preserved reeds and grasses. The underlying surface has been burnt, perhaps suggesting in-situ burning of these (Fig. 4.8). Mortensen (1970) noted that there at least two levels, Levels 16 and 13, were destroyed by fire.

Bone preservation and diagenesis in-thin-section are currently being analysed and will be integrated with other zooarchaeological indicators of this, particularly with a view to the potential for isotopic and biomolecular analyses. Preliminary thin-section analysis indicates that bone is relatively well preserved as well as autofluorescent (Fig. 4.9).

### *Architectural materials*

Of particular note is the striking resemblance to Catahoyuk wall plasters of the reworked aggregates of multiple lenses of white-wash and soot in the white plaster in SA753. These aggregates were carefully collected from another building elsewhere and puddled and mixed to form a new plaster mix that was applied on a thick mud packed surface. Such re-use of building materials, particularly white wall plasters is well attested at Çatalhöyük, and may have been practiced to extend the use of otherwise difficult to obtain materials and/or, more speculatively, to incorporate the history and symbolism of other places and people into new structures (Matthews 2005). That white silty clays were naturally available is suggested by the presence of non-reworked aggregates in SA758, from the N-S section (Fig. 16.6).

Whatever the significance of this re-use of materials, the presence of such repeated white-washes suggest the existence of elaborate, long-lived buildings at this site or one with which the inhabitants at Shimshara were associated. This has important implications for our understanding of sedentism and increasing focus on interior spaces within buildings as major social arenas (Matthews 2012b). If these white-washed architectural surfaces derive from buildings at Shimshara, it suggests that there may have been significant contact or networks between the Zagros and Central Anatolia, along which such practices may have been communicated. If the clear obsidian at Bestansur proves to be of central Anatolian origin (Chapter 13), it would lend further support to the existence of long distance networks spanning these regions.

### *Traces of activities*

The wide range of micro- and macro-artefactual and bioarchaeological remains at Shimshara point to excellent potential for study of interior and exterior activities and investigation of local and regional variation in ecological and social strategies at this key site on range of important routeways.

## Chapter Five: Human Burial in Trench 7

Will Owen and Robin Bendrey

### Introduction

Two human burials were located in the south-west corner of Trench 7 (see Figure 3.2 in the Trench 7 excavation chapter). Human bones were noted during excavation at the base of C1223. Upon identification of the human bones a new context number (C1224) was assigned which corresponds to the cleaning and exposure of the extent of the burials (without removing any bones). The skeletons themselves were assigned to C1228. The remains were exposed and excavated using a set of dental tools. Following excavation, they were cleaned in the laboratory at the dig house using dental tools and dry-brushing, and weighed and recorded onto an excel datasheet. Any additional observations beyond those recorded in the field were noted at this stage.

#### *Preservation*

The burials were located *ca*.50cm below the current land surface, within the area of the ploughed field to the west of the mound. The shallow location of the skeletons meant that the burials may have been affected by temperature fluctuations and agricultural activity at the site. Consequently the skeletal remains were friable and highly fragmented. It was rarely possible to remove elements without them completing fragmenting, due to the preservation. Each bone was lifted separately, bagged and assigned a unique number, with the exclusion of the highly fragmented parts of the axial skeleton.

#### *Context, extent and orientation of the human burials*

The extent of the burial cut was not identifiable, but the burials themselves covered an extent of approximately one metre east-west, and slightly over half a metre north-south. The burials were shallow with a total depth of *ca*.30cms. Two skeletons were identified: Skeleton 1 was assigned to the individual whose head was to the east, and Skeleton 2 assigned to the individual whose head was to the west (Fig. 5.1).

Figure 5.1. The two human burials (C1228): the skull of Skeleton 1 is to the right of the image, that of Skeleton 2 to the left.

#### Skeleton 1

Skeleton 1 was lying on its left side, tightly flexed and fully articulated. The spine ran on an east-west axis.

#### Skeleton 2

Due to the conditions of preservation it was difficult to fully define the position of the complete skeleton of Skeleton 2. The body appears to have been tightly bound, as it holds as anatomically unlikely position if soft tissue remained on the bones at deposition. Some pre- or post-depositional movement and disarticulation may have occurred, as suggested by some bones found slightly to the east of the main group.

Figure 5.2. Arrowhead discovered lying directly on surface of skull of Skeleton 1.

In addition, an arrowhead (Fig. 5.2) was found in close association with the skull of skeleton 2. Some mollusc remains and flint débitage were found amongst the burials, but as the concentration of these artefacts never significantly increased to a noticeable level above contexts immediately adjacent to the burials, it is interpreted that this is merely background noise, and simply part of the grave fill.

## Preliminary analysis of the skeletal remains

As far as possible, measurements were taken during excavation as the bones were fragmenting as they were lifted.

### ***Skeleton 1***

Despite the fragmentation of remains making it difficult to perform most methods of sexing, Skeleton 1 was identified as probably female due to its wide sciatic notch and a less-defined supraorbital ridge (White and Folkens, 2005). While these two results alone are far from conclusive, they provide a good indication that Skeleton 1 was female.

The teeth of Skeleton 1 were in remarkably good condition, allowing a good estimation of age to be made. Due to the fact that Skeleton 1's wisdom teeth had fully erupted, the individual must have been over 21 (ibid), but the degree of wear on the teeth indicated that the individual was less than 24 years of age at death (Lovejoy, 1985). Therefore, an estimation of *ca.*21-24 years of age is proposed for Skeleton 1.

Stature for Skeleton 1 was calculated using Trotter's (1970) formulae for the right femur and fibula. These returned an average of 63.95", suggesting Skeleton 1 was around 5'4" at death.

During excavation, possible cut marks were observed on the left temporal, suggesting some degree of post-mortem manipulation (Fig. 5.3).

Figure 5.3. Left temporal of skull of Skeleton 1 showing possible cut marks.

***Skeleton 2***

Skeleton 2 is identified as a male, based on a very narrow sciatic notch and a much more defined supraorbital ridge. Again, a lack of sexing methods available due to preservation means that this is conclusion must be treated with caution and understood within the context of the caveats described.

The age of Skeleton 2 is also difficult to determine due to poor preservation. Despite the teeth being well-preserved, much like that of Skeleton 1, the skeleton of individual 2 presents dental pathology indicative of accelerated attrition. Due to all the mandibular molars and wisdom teeth being lost much earlier in life, Skeleton 2 would not have been able to use their maxillary molars and wisdom teeth for chewing, and as a result overuse of the mesial teeth may have accelerated the attrition on the crowns of these teeth, which therefore makes any estimation of age from dentition extremely inaccurate. Therefore, it is difficult to age Skeleton 2, but the individual was certainly older than Skeleton 1 as it would have taken some time for the loss of the mandibular teeth to heal completely.

The stature of Skeleton 2 could only be measured from the left femur using the same formula (Trotter 1970), which gave the results that the individual was 5’6” at death.

Figure 5.4. Right mandible and maxilla of Skeleton 2 showing loss of lower molars.

Post-cranial pathology was extremely difficult to identify on Skeleton 2 again due to poor preservation, but upon exposure of the jaw it was obvious that Skeleton 2 had lost both sets of mandibular molars and wisdom teeth in earlier life (see Fig. 5. 4). Furthermore, the jaw bone had completely healed where the roots had once been, suggesting this had occurred a significant time before the individual's death and burial.

## Discussion, interpretation and further study

The close association of the two individuals indicates that they were deposited at the same time. They were found in close proximity to domestic architecture (in the east of Trench 7) and domestic activity areas (west of Trench 7) suggesting that the individuals may have been inhabitants of the site.

The positioning of the post-cranial elements of skeleton 2 suggests that this individual may have been bound. This may be associated with a mobile lifestyle, if the death occurred at a seasonal site used some distance from Bestansur. This will be the subject of further investigation: both through comparison to other contemporaneous sites (Owen *in prep.*) and via isotopic analyses of dental enamel. The cut marks on Skeleton 1 are unlikely to be related to any kind of defleshing or scalping as the marks are so parallel and deeply incised, though they are unlikely to be post depositional. The morphology of the marks are not suggestive of post-depositional modification, and although the skeleton was positioned close to the current land surface it was lying on its left side, with the left hand side of its skull facing down away from the surface, making it therefore relatively protected.

There is no evidence for causes of death, although the fragmentary nature of the skeletons precludes detailed assessment of trauma or pathology.

Full analysis of the remains is on-going and will be reported and contextualised within the literature (Owen in prep). Selected elements from the skeletons have been transported to the UK for scientific analysis. It is aimed that radiocarbon dating and stable isotope analyses will be undertaken on sections of the femora of each skeleton. The fragment of the left temporal bearing cut marks will be examined under a variable pressure SEM to assess the nature and morphology of the possible cut marks. A sample of teeth from each skeleton was also transported. Strontium analyses are planned on the enamel of the teeth to explore questions of mobility, in relation to local biosphere values (see Bendrey et al. 2012). In addition, we will be investigating the possibilities of aDNA analysis and dental micro wear studies. Soils samples were also taken from the hands/wrists of both skeletons to look for phytoliths as possible evidence of bindings.

# Chapter Six: Microarchaeology

Ingrid Iversen

## Introduction: research aims and objectives

The aim of this research is to understand the 'role' of early households ('domestic' groups)and is based on the premise that the household represents a 'great intensity of social relations, practices, choices and decisions' making it the ideal place to address questions relating to economic and social networks at a range of scales (Souvatzi 2008, 2).

In the Neolithic, the house became central to the organisation of economic and social life. The location of production shifted to the household with implications for greater specialisation and a division of labour which in turn would have shaped social relationships, within the house and the community as a whole. Facilities, such as hearths, are often to be found within houses rather than in the shared community spaces suggesting strong identification with the household and a move towards greater privacy (Banning and Byrd 1987; Byrd 1994). Houses have also produced evidence for their symbolic role with below floor burials, increasing elaboration and rebuilding in the same spot. In sum, the house is seen as key to all aspects of life – 'material, social and ritual' and it is through observing all the aspects of the house that we can begin to understand Neolithic society (Hodder 2006, 109; Kuijt 2000).

A number of methods will be employed in examining, measuring and analysing social space using artefacts and architecture. Analysis of artefacts, their variability and distribution can assist in determining activities and the use of different spaces (Allison 1999; Roaf 1989). While processual archaeology does not provide a fully satisfactory framework within which to answer questions of how people lived and interacted, many of the methods inspired by this approach are extremely useful (Wilk and Rathje 1982). Understanding how activities were distributed is a key line of enquiry and can just as well be used to answer questions about practices and social relationships as the economic functions of households.

## Research context and rationale

Examination of micro-artefacts promises to produce the most reliable picture of past activities as they are more likely to represent 'primary' deposits, having been trampled into floor surfaces or swept into corners during cleaning. Larger artefacts will often have been subject to different site formation processes (e.g. discarded, scavenged or curated) and thus are frequently found away from the area of primary use; at best they can only reflect the immediate pre-abandonment situation (LaMotta and Schiffer 1999; Rainville 2005). The artefacts to be collected and analysed will be those less than 1cm but larger than 1mm in size and will include ceramics, bone, shell, chipped stone and beads. Some of these are rarely picked up by traditional excavation methods and the 'abundance' of material and the patterns of distribution can also vary from those shown by macroartefacts.

### *Theoretical context: activity and practice*

Questions relating to the social and economic relationships within and between prehistoric households can be examined by studying the interaction between people and objects. People are both shaped by and shape their material world; the practices of daily life, which are frequently social, work to produce and maintain social structure (Bourdieu 1990; Giddens 1984). To gain an understanding of social networks and structure, it is necessary, in the language of processual archaeology, to 'bridge the gap' between the social and the material and using structuration and practice theory can achieve this.

The daily routines and practices of eating, sleeping and moving around domestic space can be viewed as shaping and maintaining social structures and have proved to be an interesting and valuable approach in the understanding of Neolithic life (Verhoeven 1999). The house has been viewed as the material manifestation of social structuring and acts as 'an instrument of thought and metaphor' (Verhoeven 2004, 222).

Microarchaeology enhances the potential for identifying repetitive practices, which is of interest in the analyses of household or industrial activities, in contrast to larger artefacts which at best indicate only the most recent use of a space. Activity areas within rooms and additional functions of rooms or buildings can be identified by examining microdebris (Rainville 2003). The technique has also been successful in identifying changes in the use of space over time and changes in the way activities were undertaken (Parker *et al*. 2009).

Distributions of microdebris can confirm conclusions suggested by architecture and/or macroartefacts, such as defining outdoor and indoor space and how it was used, but also produces new information; for example, understanding spaces where there is no architecture. In addition, living practices may not be at all obvious from the architectural remains as inside floors were often swept clean of evidence of activities. Outdoor spaces may well give a better picture of primary deposits. Microarchaeology has been useful in explicitly addressing this potential gap in archaeological data .The absence of microartefacts can also convey information such as a lack of activity or greater cleaning.

***Abundance, scale and variability***

The numbers of items collected using micro-sieving are typically much greater and are likely to show variability which is not evident from larger artefacts. Their 'abundance' lends itself to different (and potentially more robust) statistical analysis of densities and distributions. The small size of the items allows us to reduce the scale of the analysis, e.g. from identifying the find spot to a room to an area *within* a room. Certain types of artefacts are very rarely picked up by traditional excavation methods such as beads, shells, fish scales and small mammal bones.

## Methodology: microarchaeological techniques

***Sampling strategy***

Sampling is based on a scheme of systematic *random* sampling and *strategic* sampling. The sampling was a collaborative process with discussions between excavators and other specialists determining the outcome, and was fully integrated with the flotation procedures. At least one whole-earth sample of 50 litres was collected by the excavator from each context – a *random* sample. Contexts with features, such as architecture or groundstone, or evidence for activity, such as concentrations of artefacts or debris (e.g. flint debitage, burning) were subject to the collection of a number of samples which in some cases resulted in the complete context being sampled – *strategic* samples. In some cases sub-samples were taken to ensure a finer spatial resolution, e.g. areas around and/or under features and next to walls, and some areas were sampled using a grid.

In total, of the 109 samples processed 74 were strategic and 35 random. Samples are deemed to be strategic when the excavator has indicated a specific reason for the sample. The locations of these samples are typically indicated on the relevant plan. During the Spring season while a similar number of samples were processed (116) the split between random and strategic samples was reversed with 76 random samples and 40 strategic. This reflects the different emphasis of the excavation with a large number of smaller areas being excavated in the Spring in contrast to just a couple of larger trenches being explored during the Summer season. The Spring samples included more samples taken from topsoil and fewer determined by specific features.

The total volume of the 35 random samples was 1,613l, an average size of 46l while the 74 strategic samples averaged 18l and totalled 1,317l. The difference in the average size of the samples reflects the different purpose of the types of sampling.

***Processing: sorting and recording***
The sample to be analysed is first floated, which removes loose soil and allows the collection of plants and other light material – the *light fraction.* The samples are then dried and the unsorted *heavy residue* is weighed before being sieved through a 1cm sieve. This removes all the large items, including stones. At this stage any artefacts are picked out by hand and recorded as artefacts larger than 1cm but remain associated with the sample.

The remaining residue is put through a nest of sieves which sorts it by size: <1cm>4mm, 4mm-2mm and 2mm-1mm. The size fractions are weighed and the decision on the proportion to be sorted is made. The size fractions are divided accordingly using a riffle box and are then are sorted by type of material, such as pottery, bone, shell, lithics, etc. The sorted material is weighed and counted and these data recorded. For further description (and illustrations) please see the Bestansur Spring 2012 Report (CZAP 2012, 77).

## Summer season activity
The 109 new samples which were processed during the season aggregated 2,930 l of sediment floated and the total weight of heavy residue was 356kg. The average sample size was 27 l, ranging from 98l to 150 ml. The size of strategic samples varied according to context, presence of a grid and deposit thickness (from around 250ml) while random samples were typically around 50l. Small areas obviously produce smaller sample sizes. The 109 samples were taken from 47 different contexts (see Table 6.2).

| | |
|---|---|
| **Samples processed** | 109 |
| Random | 35 |
| Strategic | 74 |
| | |
| Volume of sediment (litres) | 2,930 |
| | |
| **Heavy residue (kg)** | 356 |
| By size | |
| <1cm>4mm | 38 |
| 2mm-4mm | 42 |
| 1mm-2mm | 22 |
| | |
| **Spring season samples processed** | 17 |
| Volume of sediment (litres) | 818 |
| Heavy residue (kg) | 45 |

Table 6.1. Summary of activity

| Context | Samples # | Litres floated | Heavy residue (g) | % sorted |
|---|---|---|---|---|
| 1212 | 1 | 55 | 1,700 | 53 |
| 1213 | 1 | 55 | 3,000 | 50 |
| 1214 | 1 | *50* | 6,130 | 41 |
| 1215 | 1 | 51 | 6,260 | 46 |
| 1216 | 1 | 60 | 3,550 | 61 |
| 1217 | 1 | 50 | 4,720 | 48 |
| 1218 | 1 | 20 | 2,120 | 50 |
| 1220 | 4 | 174 | 24,873 | 56 |
| 1221 | 1 | 49 | 4,650 | 46 |
| 1222 | 2 | 83 | 11,000 | 37 |
| 1223 | 1 | 50 | 5,960 | 41 |
| 1224 | 2 | 160 | 16,880 | 43 |
| 1225 | 2 | 60 | 13,040 | 62 |
| 1226 | 2 | 32 | 2,400 | 72 |
| 1227 | 1 | 54 | 11,420 | 43 |
| 1228 | 8 | 662 | 90,223 | 2 |
| 1229 | 1 | 49 | 5,910 | 42 |
| 1231 | 1 | 28 | 2,560 | 0 |
| 1239 | 1 | 50 | 6,640 | 0 |
| 1242 | 1 | 47 | 4,190 | 0 |
| 1243 | 30 | 441 | 48,862 | 57 |
| 1246 | 1 | 50 | 7,030 | 0 |
| 1247 | 2 | 16 | 2,140 | 83 |
| 1248 | 4 | 140 | 20,530 | 49 |
| 1249 | 2 | 62 | 7,220 | 46 |
| 1250 | 1 | 48 | 7,380 | 0 |
| 1253 | 1 | 50 | 5,070 | 0 |
| 1254 | 9 | 162 | 30,848 | 64 |
| 1255 | 4 | 59 | 6,726 | 57 |
| 1256 | 1 | 44 | 7,310 | 45 |
| 1259 | 1 | 62 | 8,140 | 39 |
| 1261 | 1 | 63 | 8,910 | 42 |
| 1262 | 2 | 70 | 6,760 | 47 |
| 1263 | 1 | 50 | 7,120 | 49 |
| 1264 | 1 | 42 | 2,290 | 35 |
| 1266 | 1 | 17 | 1,610 | 0 |
| 1268 | 1 | 49 | 3,150 | 0 |
| 1270 | 1 | 48 | 5,840 | 43 |
| 1273 | 1 | 48 | 1,010 | 20 |
| 1274 | 6 | 51 | 12,668 | 62 |
| 1275 | 1 | 51 | 5,470 | 0 |
| 1280 | 1 | 3 | 187 | 100 |
| Shimshara | 2 | 37 | 11,500 | 55 |
| **Total** | **109** | **1838** | **237,071** | **40** |

Table 6.2. Samples by context

***Samples: volume and weight***
Figure 6.1 shows the overall distribution of sample sizes with a cluster around 50l (mainly systematic samples) and then two clusters of strategic samples. The smallest samples were collected around and under a specific feature while the samples in the 10-20l range were samples typically taken to help define an area.

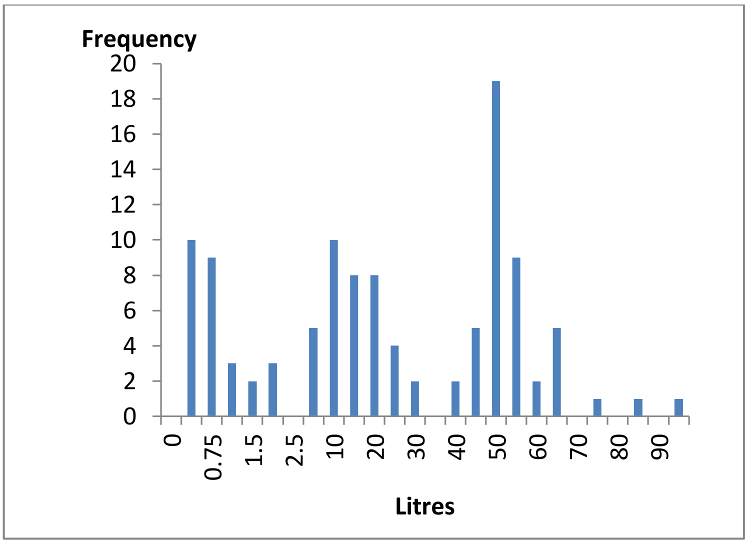


Figure 6.1. Sample size by volume

The heaviest samples frequently included large items such as stones or a large proportion of molluscs and so the material to be sorted after the larger than 1cm items were handpicked, was much less. Once the heavy residue was sieved through a 1cm sieve the total heavy residue to be sorted weighed 102kg.

The average weight of heavy residue samples was 3.3kg but a majority of the samples weighed less than 3kg with a distinct skew towards 100g or less (41 samples) (see Fig. 6.2). This reflects the emphasis on strategic sampling which is more likely to limit the sample size.

While there is some clustering of samples in the range of 4.5kg to 6.5kg this is not as distinct as seen when samples are measured by volume (see Fig. 6.1). The volume is determined by the excavator when the sample is collected while the weight will vary according to the mix of soil, stone and other material which is part of the whole-earth.

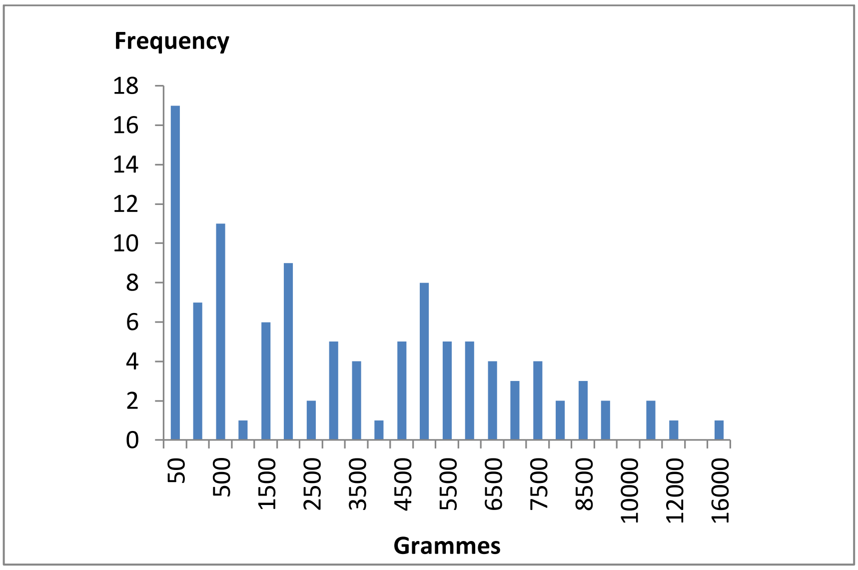


Figure 6.2. Sample size by weight

The density of material is recorded both relative to the weight of the heavy residue and the volume of the original sample. There is a correlation between sample size and the weight of heavy residue as shown in Fig. 6.3. The relationship between the volume of a sample and the weight of the residue once floated is broadly consistent across all samples, at an average of 118 g of heavy residue per litre floated but ranging from 21g to over 500g. The variation across samples reflects a number of factors with the presence of stones and very silty clay having an impact of the heavy residue weight. The smaller the sample, the lighter the heavy residue. The explanation for this lies in the reason for sampling as while all samples are taken as 'whole earth' the smaller samples are typically taken to examine the presence or absence of material relating to a feature, e.g. below and around groundstones and areas with evidence of burning. To illustrate this further, the 'lightest' sample at 21g per litre is a 48 litre sample appeared very clean and designated as possible 'natural ?' by the excavator (WM) and the implication is that the bulk of the volume was silt and soil, with few stones, which are removed in the process of floatation. At the other extreme, the 'heaviest' was relatively small in terms of volume (8 litres) but contained a lot of stones and complete mollusc shells. The different results produced by looking at volume and weight argue for both to be recorded and the most useful measure to be used according to the analysis being undertaken.

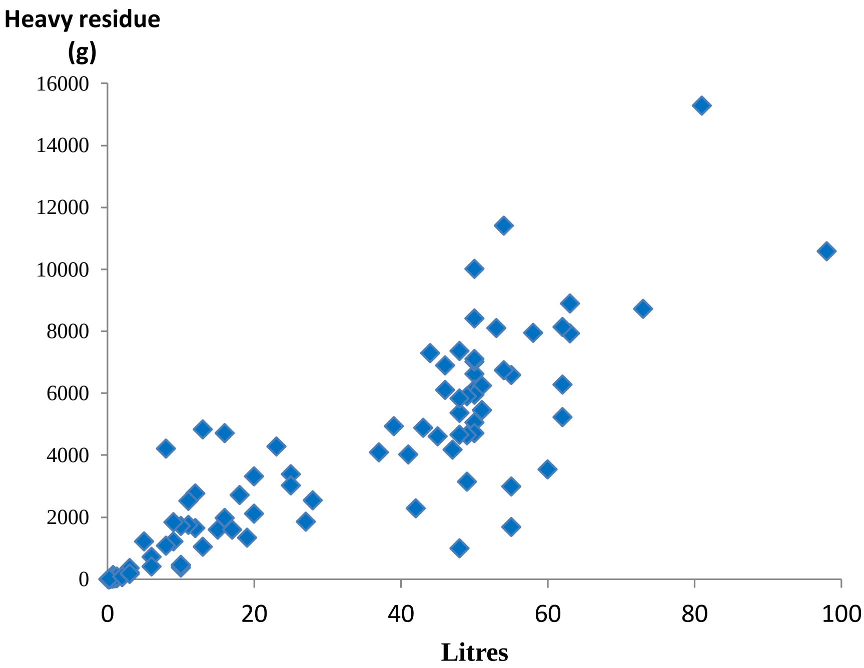


Figure 6.3. Flotation samples: volume and weight of heavy residue

***Heavy residue sorting***

All the samples were weighed and sorted by size although 18 remained unrecorded by material. The decision to leave these 18 samples unrecorded was driven by a lack of time in the field and the samples have been stored and can be fully processed at a later date. The first few days of the excavation does not produce heavy residue for the sorting team (as the samples have to be collected, floated and dried before the heavy residue can be sorted which can take 2-3 days) and this time can be used to deal with the previous season's backlog. Unprocessed samples from the Spring season were completed during the summer season (see below).

Of the 18 partially processed samples, 7 were associated with the human burials as, based on the results from the samples from this context which were fully sorted, the decision was made that there would be little added information to be gleaned and that these samples were low priority given the time constraints. In the process of sieving and sorting the samples by size it is possible to visually estimate the composition of a sample and they looked very similar to the already sorted samples. A further 4 samples came from Trench 11 and were deemed to be of lower priority.

The majority (91 samples) were sorted by size and then by material. The 4 millimetre fraction was sorted in its entirety in every sample while in some cases with the smaller size fractions a proportion was left unsorted. Overall 40% of all heavy residue was sorted; 4 mm 100%, 2mm 25% and 1mm 8%. The small proportion of the 1 mm fraction which was sorted is a reflection of the decision taken part-way through the season to leave this fraction unsorted. The results from samples which had been sorted suggested that little was being gained from sorting this size of residue and as it takes longer than the larger sizes after discussion among the team this size has been left unsorted. In all cases, the unsorted heavy residue is labelled and stored and can be accessed in the future.

In addition to the sorting of new samples taken during the season, further processing of last season's samples was undertaken. At the end of the season there was a backlog of 17 samples; 818 litres produced 45 kg of heavy residue which was sorted and the data input. A number of the partially sorted samples (around 30) were revisited and in all that were designated as high priority the 4mm size fraction is now fully sorted for all material. This also provided the opportunity to examine the validity of proportioning the sample and the results were broadly in line the results from the previously sorted proportion.

***Storage***

All unsorted heavy residue is stored and a record is kept of the location for easy access. The residue left after sorting, 'rubbish', is also kept for future reference. This allows it to be checked for other material (e.g. otoliths) and poor sorting and may prove useful if the results from samples look 'strange'.

## The results

***Density of material***

The density of material is useful in highlighting the different uses of space and possible activities horizontally but also vertically. The results from all the samples are summarised in Tables 6.3, 6.4, 6.5 and 6.6**,** using a variety of measures.

Table 6.3 shows the density of all types of material by context (contexts with more than one sample are averages) and the densities have been ranked, using colour; low densities are shaded red and high densities green. The first four contexts are top soil (C1212, C1213, C1214, C1215) and are included in the table but are not part of the average values. The data from Shimshara are not included in the averages either.

Table 6.4 presents the data for all material and is useful in giving an initial indication for the relative cleanliness of the different samples (Cessford and Mitrovic 2005).

Table 6.5 and Table 6.6 show the results in terms of numbers of pieces of the different material and also allows a comparison between the different measures (see Table 6.6).

The results have been analysed further with the objective of reaching a better understanding of spaces highlighted as of potential interest during excavation, and therefore sampled strategically. The detailed analysis can be found at the end of the section (Tables 6.7 and 6.8).

| Context | g per 100g Bone | Mollusc | Chipped stone | Pottery | Fired clay | g per litre Bone | Mollusc | Chipped stone | Pottery | Fired clay |
|---|---|---|---|---|---|---|---|---|---|---|
| 1212 | 0.48 | 0.27 | 0.43 | 1.52 | 0.86 | 0.08 | 0.04 | 0.07 | 0.25 | 0.14 |
| 1213 | 0.17 | 4.88 | 0.06 | 0.67 | 0.33 | 0.02 | 0.75 | 0.01 | 0.08 | 0.04 |
| 1214 | 0.31 | 4.27 | 0.15 | 0.00 | 0.00 | 0.04 | 0.72 | 0.02 | 0.00 | 0.00 |
| 1215 | 0.58 | 4.74 | 0.14 | 0.00 | 0.23 | 0.08 | 0.78 | 0.02 | 0.00 | 0.04 |
| 1216 | 0.70 | 4.37 | 0.08 | 0.00 | 0.61 | 0.10 | 0.74 | 0.01 | 0.00 | 0.09 |
| 1217 | 0.28 | 6.34 | 0.37 | 0.00 | 0.16 | 0.04 | 0.92 | 0.05 | 0.00 | 0.02 |
| 1218 | 0.25 | 26.06 | 0.00 | 0.00 | 0.00 | 0.04 | 4.31 | 0.00 | 0.00 | 0.00 |
| 1220 | 0.41 | 12.26 | 0.15 | 0.00 | 0.26 | 0.06 | 1.99 | 0.02 | 0.00 | 0.04 |
| 1221 | 0.60 | 9.94 | 0.02 | 0.00 | 0.12 | 0.06 | 1.19 | 0.00 | 0.00 | 0.01 |
| 1222 | 0.00 | 2.26 | 0.03 | 0.00 | 0.30 | 0.00 | 0.39 | 0.00 | 0.00 | 0.03 |
| 1223 | 1.40 | 12.19 | 0.45 | 0.00 | 0.00 | 0.10 | 0.93 | 0.03 | 0.00 | 0.00 |
| 1225 | 0.65 | 9.62 | 0.80 | 0.00 | 0.29 | 0.29 | 2.87 | 0.17 | 0.00 | 0.13 |
| 1226 | 1.06 | 14.05 | 0.00 | 0.00 | 0.28 | 0.07 | 1.05 | 0.00 | 0.00 | 0.02 |
| 1227 | 0.87 | 2.83 | 0.12 | 0.00 | 0.00 | 0.12 | 0.41 | 0.02 | 0.00 | 0.00 |
| 1229 | 0.53 | 10.33 | 0.35 | 0.00 | 0.06 | 0.04 | 0.99 | 0.03 | 0.00 | 0.00 |
| 1243 | 0.14 | 3.65 | 0.03 | 0.00 | 0.00 | 0.03 | 0.86 | 0.00 | 0.00 | 0.00 |
| 1247 | 0.12 | 23.01 | 0.20 | 0.00 | 0.00 | 0.01 | 1.59 | 0.03 | 0.00 | 0.00 |
| 1248 | 0.44 | 13.55 | 0.22 | 0.00 | 0.06 | 0.07 | 2.08 | 0.04 | 0.00 | 0.01 |
| 1249 | 1.19 | 44.43 | 0.07 | 0.00 | 0.00 | 0.15 | 5.54 | 0.01 | 0.00 | 0.00 |
| 1254 | 0.83 | 32.24 | 0.17 | 0.00 | 0.03 | 0.19 | 6.57 | 0.04 | 0.00 | 0.01 |
| 1255 | 0.25 | 5.84 | 0.25 | 0.00 | 0.04 | 0.06 | 1.20 | 0.04 | 0.00 | 0.01 |
| 1256 | 5.16 | 12.62 | 0.00 | 0.00 | 0.00 | 0.51 | 1.32 | 0.00 | 0.00 | 0.00 |
| 1259 | 3.69 | 2.60 | 0.23 | 0.00 | 0.00 | 0.35 | 0.30 | 0.02 | 0.00 | 0.00 |
| 1261 | 3.39 | 4.62 | 0.68 | 0.00 | 0.00 | 0.40 | 0.67 | 0.08 | 0.00 | 0.00 |
| 1262 | 1.52 | 13.71 | 0.54 | 0.00 | 0.00 | 0.19 | 1.41 | 0.07 | 0.00 | 0.00 |
| 1263 | 0.22 | 17.54 | 0.87 | 0.00 | 0.00 | 0.04 | 3.38 | 0.16 | 0.00 | 0.00 |
| 1264 | 1.14 | 10.92 | 1.06 | 0.00 | 0.00 | 0.04 | 0.53 | 0.03 | 0.00 | 0.00 |
| 1270 | 0.43 | 15.54 | 0.10 | 0.00 | 0.05 | 0.07 | 2.65 | 0.02 | 0.00 | 0.01 |
| 1273 | 0.00 | 5.43 | 0.16 | 0.00 | 0.31 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 |
| 1274 | 1.68 | 35.46 | 0.38 | 0.00 | 0.00 | 0.33 | 6.55 | 0.06 | 0.00 | 0.00 |
| 1280 | 0.00 | 2.74 | 0.00 | 0.00 | 0.00 | 0.00 | 0.97 | 0.00 | 0.00 | 0.00 |
| **Averages** | 0.72 | 13.73 | 0.21 | 0.00 | 0.05 | 0.11 | 2.31 | 0.03 | 0.00 | 0.01 |
| SHIM | 2.95 | 0.05 | 0.13 | 0.00 | 0.00 | 0.70 | 0.01 | 0.03 | 0.00 | 0.00 |
| SHIM | 6.44 | 1.21 | 0.37 | 0.00 | 2.42 | 1.34 | 0.20 | 0.08 | 0.00 | 0.35 |

Table 6.3. Material density by context

| Context | All material | | excluding mollusc | | Comments |
|---|---|---|---|---|---|
| | g per 100g | g per litre | g per 100g | g per litre | |
| 1216 | 5.76 | 0.94 | 1.39 | 0.21 | |
| 1217 | 7.15 | 1.03 | 0.81 | 0.11 | |
| 1218 | 26.30 | 4.35 | 0.25 | 0.04 | Below average density but with concentration of mollusc |
| 1220 | 13.07 | 2.10 | 0.81 | 0.12 | |
| 1221 | 10.68 | 1.27 | 0.74 | 0.08 | |
| 1222 | 2.60 | 0.42 | 0.34 | 0.03 | Below average density for all material |
| 1223 | 14.04 | 1.06 | 1.85 | 0.13 | |
| 1225 | 11.36 | 3.46 | 1.74 | 0.59 | Slightly above average material density. Possible outdoor area |
| 1226 | 15.39 | 1.14 | 1.34 | 0.09 | |
| 1227 | 3.82 | 0.55 | 0.99 | 0.14 | |
| 1229 | 11.38 | 1.07 | 1.05 | 0.08 | |
| 1243 | 3.83 | 0.89 | 0.18 | 0.03 | Below average material density, many samples (see Table 2) |
| 1247 | 23.33 | 1.63 | 0.31 | 0.03 | |
| 1248 | 14.27 | 2.20 | 0.72 | 0.12 | |
| 1249 | 45.69 | 5.70 | 1.26 | 0.16 | High density of mollusc but overall average density of material |
| 1254 | 33.27 | 6.80 | 1.03 | 0.23 | |
| 1255 | 6.39 | 1.31 | 0.55 | 0.11 | |
| 1256 | 17.78 | 1.83 | 5.16 | 0.51 | |
| 1259 | 6.52 | 0.66 | 3.92 | 0.37 | Above average density. External area |
| 1261 | 8.69 | 1.15 | 4.07 | 0.48 | Above average density. External area |
| 1262 | 15.78 | 1.67 | 2.07 | 0.26 | |
| 1263 | 18.63 | 3.59 | 1.10 | 0.20 | |
| 1264 | 13.12 | 0.61 | 2.20 | 0.07 | |
| 1270 | 16.11 | 2.75 | 0.57 | 0.10 | |
| 1273 | 5.90 | 0.18 | 0.47 | 0.01 | |
| 1274 | 37.52 | 6.95 | 2.06 | 0.40 | Slightly above average density. Multiple samples (see Table 2) |
| 1280 | 2.74 | 0.97 | 0.00 | 0.00 | |
| | | | | | |
| Averages | 14.49 | 2.08 | 1.37 | 0.17 | |
| | | | | | |
| SHIM | 3.13 | 0.75 | 3.08 | 0.74 | Above average density |
| SHIM | 10.58 | 2.00 | 9.37 | 1.80 | Well above average density |

Table 6.4. Density of all material

| Context | # per litre<br>Bone | Chipped stone | Fired clay |
|---|---|---|---|
| 1216 | 2.72 | 0.11 | 0.09 |
| 1217 | 0.30 | 0.52 | 0.25 |
| 1218 | 0.50 | 0.00 | 0.00 |
| 1220 | 0.96 | 0.41 | 0.02 |
| 1221 | 0.18 | 0.00 | 0.33 |
| 1222 | 0.22 | 0.00 | 0.03 |
| 1223 | 1.14 | 0.11 | 0.00 |
| 1225 | 0.53 | 0.28 | 0.04 |
| 1226 | 1.12 | 0.00 | 0.63 |
| 1227 | 0.13 | 0.02 | 0.00 |
| 1229 | 0.16 | 0.18 | 0.00 |
| 1243 | 1.00 | 0.05 | 0.00 |
| 1247 | 0.80 | 0.08 | 0.00 |
| 1248 | 0.57 | 0.08 | 0.01 |
| 1249 | 2.08 | 0.01 | 0.00 |
| 1254 | 1.06 | 0.10 | 0.50 |
| 1255 | 0.67 | 0.26 | 0.01 |
| 1256 | 0.00 | 0.00 | 0.00 |
| 1259 | 3.02 | 0.02 | 0.00 |
| 1261 | 1.27 | 0.08 | 0.00 |
| 1262 | 2.06 | 0.21 | 0.00 |
| 1263 | 2.30 | 0.99 | 0.00 |
| 1264 | 0.48 | 0.03 | 0.00 |
| 1270 | 0.77 | 0.02 | 0.01 |
| 1273 | 0.00 | 0.00 | 0.00 |
| 1274 | 2.16 | 0.31 | 0.00 |
| 1280 | 0.00 | 0.00 | 0.00 |
| **Average** | 1.10 | 0.13 | 0.09 |
| SHIM | 4.71 | 0.79 | 0.00 |
| SHIM | 14.94 | 1.46 | 5.68 |

Table 6.5. Material density: counts

| per litre | Bone | | Chipped stone | |
|---|---|---|---|---|
| Context | g | # | g | # |
| 1216 | 0.10 | 2.72 | 0.01 | 0.11 |
| 1217 | 0.04 | 0.30 | 0.05 | 0.52 |
| 1218 | 0.04 | 0.50 | 0.00 | 0.00 |
| 1220 | 0.06 | 0.96 | 0.02 | 0.41 |
| 1221 | 0.06 | 0.18 | 0.00 | 0.00 |
| 1222 | 0.00 | 0.22 | 0.00 | 0.00 |
| 1223 | 0.10 | 1.14 | 0.03 | 0.11 |
| 1225 | 0.29 | 0.53 | 0.17 | 0.28 |
| 1226 | 0.07 | 1.12 | 0.00 | 0.00 |
| 1227 | 0.12 | 0.13 | 0.02 | 0.02 |
| 1229 | 0.04 | 0.16 | 0.03 | 0.18 |
| 1243 | 0.03 | 1.00 | 0.00 | 0.05 |
| 1247 | 0.01 | 0.80 | 0.03 | 0.08 |
| 1248 | 0.07 | 0.57 | 0.04 | 0.08 |
| 1249 | 0.15 | 2.08 | 0.01 | 0.01 |
| 1254 | 0.19 | 1.06 | 0.04 | 0.10 |
| 1255 | 0.06 | 0.67 | 0.04 | 0.26 |
| 1256 | 0.51 | 0.00 | 0.00 | 0.00 |
| 1259 | 0.35 | 3.02 | 0.02 | 0.02 |
| 1261 | 0.40 | 1.27 | 0.08 | 0.08 |
| 1262 | 0.19 | 2.06 | 0.07 | 0.21 |
| 1263 | 0.04 | 2.30 | 0.16 | 0.99 |
| 1264 | 0.04 | 0.48 | 0.03 | 0.03 |
| 1270 | 0.07 | 0.77 | 0.02 | 0.02 |
| 1273 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1274 | 0.33 | 2.16 | 0.06 | 0.31 |
| 1280 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Averages** | 0.11 | 1.10 | 0.03 | 0.13 |
| SHIM | 0.70 | 4.71 | 0.03 | 0.79 |
| SHIM | 1.34 | 14.94 | 0.08 | 1.46 |

Table 6.6. Material density: weight and count

## Analysis and interpretation

***Space 16***

An area within a possible room which had a large number of groundstones placed in discrete clusters (see Excavations in Trench 7, Chapter 3) was sampled in its entirety in two contexts (C1243 and C1255). The space was gridded (see Fig. 6.4) and samples were taken for each square and in addition sub-samples were taken from around and under stones.

Figure 6.4. Sp16 gridded for sampling

The bulk of the stones were in C1243 (see Fig. 6.5) where 30 samples were collected and processed; a total of 441 litres with the resulting heavy residue weighing 49kg. The samples averaged around 15l but 19 were small at 1l or less. The context immediately below this (C1255) was only excavated in parts of the grid and so fewer samples were taken (4 samples averaging 15 l). The context overlying (C1229) is shown here for comparison and was sampled systematically with one sample of 49l taken.

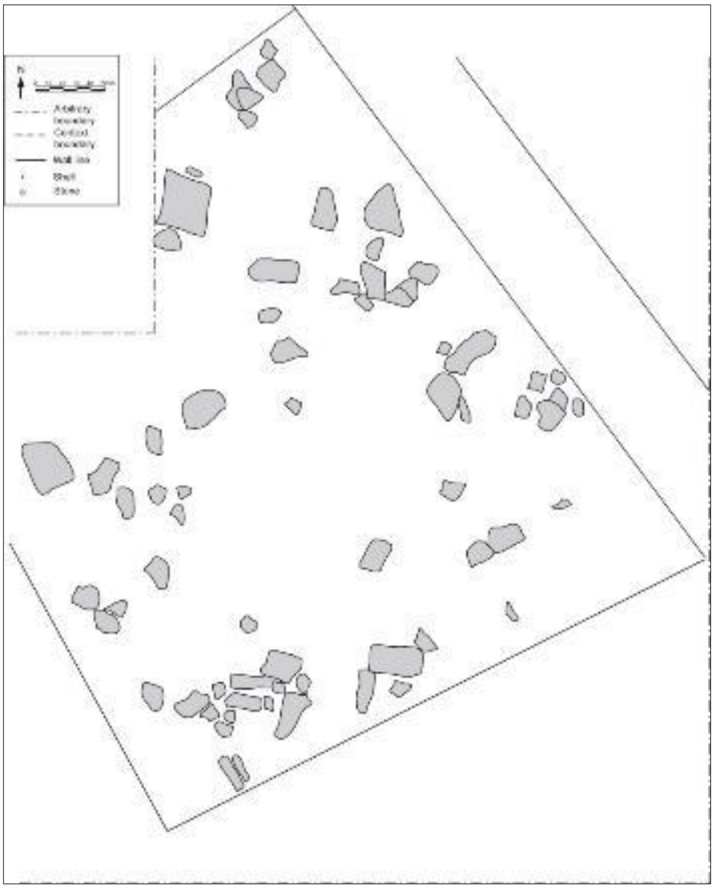

Figure 6.5. Sp16: Groundstone clusters

In each of the contexts, the presence of micro-artefacts is well below the average with the context with the most groundstones the ‘cleanest’ (see Table 6.7). The slight increase from C1243 to C1255 is not great enough to be able to draw any conclusions although the greater presence of chipped stone may suggest some change in use or cleaning between the two levels.

| | Totals | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | g per 100g | | | | g per litre | | | |
| Context | Bone | Mollusc | Chipped stone | Fired clay | Bone | Mollusc | Chipped stone | Fired clay |
| 1229 | 0.53 | 10.33 | 0.35 | 0.06 | 0.04 | 0.99 | 0.03 | 0.00 |
| 1243 | 0.14 | 3.65 | 0.03 | 0.00 | 0.03 | 0.86 | 0.00 | 0.00 |
| 1255 | 0.25 | 5.84 | 0.25 | 0.04 | 0.06 | 1.20 | 0.04 | 0.01 |
| **Averages** | 0.72 | 13.73 | 0.21 | 0.05 | 0.11 | 2.31 | 0.03 | 0.01 |

Table 6.7. Density of material in Sp16: ‘storage area’

***Space 17***

Within Sp17 an area with fugitive surfaces and clusters of shells and stones was extensively sampled (see Fig. 6.6). 4 samples were taken from the upper level (C1248) totalling 140l and averaging 35l while the level below this (C1254) was more intensely sampled with 9 samples with an average of 18l each. Those samples were taken from areas with artefacts and features of interest such as layers of shell in discrete lenses and bone and lithics lying flat on fugitive surfaces. In addition, several samples were taken from an area with charred lentils, specifically for archaeobotanical examination. The context below this (C1274) was also sampled selectively with 6 samples, totalling 51l and 12.7 kg heavy residue collected and processed.

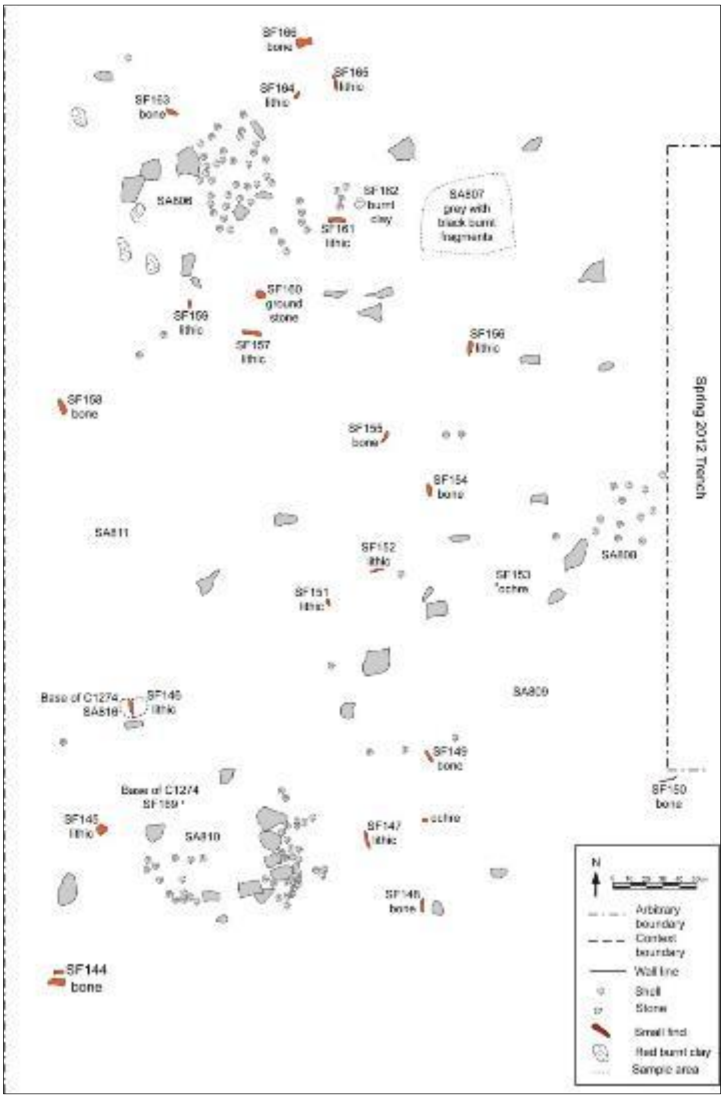


Figure 6.6. Sp17: 'external area'

All clearly visible artefacts were mapped onto the plan (see Fig. 6.6). The objective of both the accurate recording of artefacts and the sampling strategy is to produce a detailed spatial depiction of the area.

| | **g per 100g** | | | **g per litre** | | | **Total** | | **excl. mollusc** | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Context** | **Bone** | **Mollusc** | **Chipped stone** | **Bone** | **Mollusc** | **Chipped stone** | **g per 100g** | **g per litre** | **g per 100g** | **g per litre** |
| 1248 | 0.44 | 13.55 | 0.22 | 0.07 | 2.08 | 0.04 | 14.27 | 2.20 | 0.72 | 0.12 |
| 1254 | 0.83 | 32.24 | 0.17 | 0.19 | 6.57 | 0.04 | 33.27 | 6.81 | 1.03 | 0.23 |
| 1274 | 1.68 | 35.46 | 0.38 | 0.33 | 6.55 | 0.06 | 37.52 | 6.95 | 2.06 | 0.40 |
| **Average** | 0.72 | 13.73 | 0.21 | 0.11 | 2.31 | 0.03 | 14.49 | 2.08 | 1.37 | 0.17 |

Table 6.8. Density of material in Sp17: 'external area'

The data presented here are the averages of the samples taken from each context and present a vertical (chronological) picture of the space (see Table 6.8). The results show a clear change over time with the lowest level producing significantly greater density of artefacts. The area produced evidence for the cooking and eating of mollusc and this is reflected in the density being three times greater but bone also shows a similar increase in density. The upper level shows results similar to overall averages and so can be seen as a 'control'.

## Analysis and some initial conclusions

The samples from Sp16 and Sp17 produce very different results with the area with the clusters of groundstones containing very little anthropogenic material both relative to the overall average densities and in contrast to Sp17. The 'cleanliness' of Sp16 can be interpreted in a number of ways, e.g. it was little used, it was cleaned thoroughly and that it was an inside space (a room). Combining the evidence from microarchaeology with the presence of piles of groundstone in discrete clusters and indications of walls suggest the possibility that this was an area in which the stones were stored rather than used.

In contrast, the greater than average density of microarchaeological material in Sp17, combined with other artefacts indicates an external activity area.

## Cross-site comparisons

The two samples from Shimshara drew attention to the low density of microartefacts in the samples from Bestansur, prompting a broadening of the comparison to include other sites where microarchaeological techniques have been used and the results published. A wider set of results are summarised in Table 6.9. The comparative data need to be extremely cautiously interpreted as the methodology used will vary; sampling strategies, flotation methods, size screening and sorting all influence the final result. In addition, the contexts in which the samples are taken will vary widely as is illustrated by the differences shown in the density of material on floors compared with fill and outdoor areas. A robust comparison would require the same measurement of the data and truly comparable contexts but in most cases this is not possible. The data presented in the table should rather be seen as providing a range of values against which our data can be assessed.

The comparison with the results from Shimshara is not fraught with these methodological problems but as there are only two samples this is statistically troublesome. Further research, and sampling, is needed to be able to draw secure conclusions but a tentative interpretation of this comparative data is that the area excavated and sampled at Bestansur saw relatively low levels of activity over time. This may be because the site was being used as a seasonal site or that the areas of activity shifted across the site.

| (Count per litre) | | Bone | Chipped stone | Totals | Period |
|---|---|---|---|---|---|
| **Bestansur** | | 1.10 | 0.13 | 1.23 | Neolithic |
| **Shimshara** | | 9.80 | 1.10 | 10.90 | Neolithic |
| **Tol-e Baši** | | 8.11 | 0.60 | 8.71 | Neolithic |
| **Tell Kurdu** | | 97.78 | 5.20 | 102.98 | Halaf |
| **Kenan Tepe** | | 1.50 | 0.29 | 1.80 | Ubaid |
| | Earliest level | 4.079 | 0.391 | 4.47 | |
| | Latest level | 0.424 | 0.278 | 0.70 | |
| **Tell Brak** | | 5.80 | 0.21 | 6.00 | 4th millennium |
| **Ziyaret tepe** | | 13.44 | 0.48 | 13.92 | Iron age |
| | Floors | 7.63 | 0.25 | 7.88 | |
| | Outside | 28.75 | 1.08 | 29.83 | |
| | Fill | 3.94 | 0.11 | 4.05 | |
| **Average** | | **19.65** | **1.14** | **20.79** | |
| excl.Tell Kurdu | | 6.63 | 0.47 | 7.09 | |
| **(g per litre)** | | | | | |
| **Bestansur** | | 0.11 | 0.03 | 0.14 | |
| **Shimshara** | | 1.02 | 0.06 | 1.08 | |
| **Çatalhöyük** | | 1.27 | 0.89 | 2.16 | Neolithic |
| | Floors | 0.52 | 0.01 | 0.52 | |
| | Fill | 2.03 | 1.80 | 3.83 | |

Table 6.9. Density of material: some comparisons (Cessford 2003; Cessford and Mitrovic 2005; Hodder and Cessford 2004; Õzbal 2006; Parker *et al*. 2009; Rainville 2003; Saeedi 2010)

## Progress to date and future plans

The completion of two seasons of excavation at Bestansur has provided a significant quantity of data which is allowing some initial interpretation of the nature and distribution of activities. The sampling protocol is working well and the process of sorting and recording the results has been refined in order to achieve the aims of the research. Further seasons of excavation will build on this, providing more comparable data which should enhance our understanding of the existing results and provide new information.

There is still more work to be done on combining data already collected, both the heavy residue results from the first two seasons and analysing other information, e.g. results from dry-sieving, in conjunction with the results from microarchaeological techniques. This is already underway but not yet completed.

# Chapter Seven: Excavations in Trench 11

Amy Richardson and Kamal Rouf Aziz

## Introduction

Geophysical survey undertaken during the Summer 2012 field season by D. Thornley (Chapter 2) highlighted a necessity to investigate and identify the distinction between Neolithic and Iron Age signatures in the results. Furthermore, in a bit to target midden deposits, an area of mixed signatures to the south of Trench 7 was targeted as a potentially rich source of information.

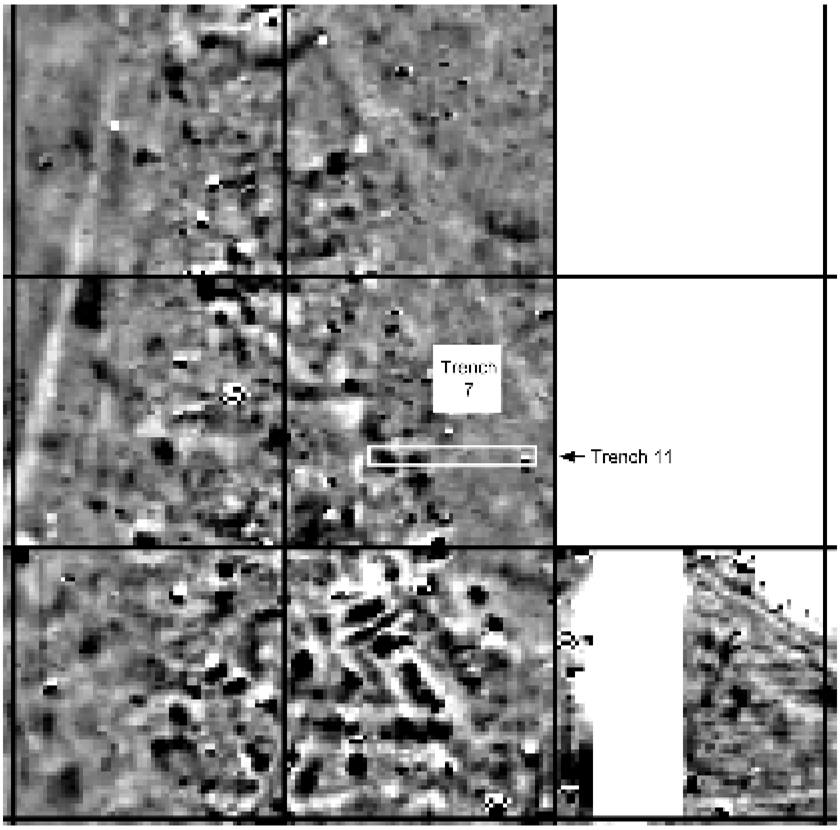


Figure 7.1. Location of Trench 11, south of Trench 7

## Methods of investigation

Initially, a five-by-two metre trench (West Sector) was laid out to intersect the apparently rounded features to the southwest of Trench 7, hypothesised to be midden deposits. The location was pinpointed from the position within the survey grid. Excavation was conducted with large picks and shovels. On the removal of 30cm of topsoil (C1236), those features identified on the survey results were revealed to be stone walls (Building 1). The excavated room fill (C1239) revealed the walls to be Iron Age in date and thus the trench was extended by five metres to the east (Central Sector) and a subsequent further five metres eastwards (East Sector), until it stretched 15m E-W and two metres N-S. The Central and East Sectors targeted linear features extending to the south of Trench 7. Excavation sampling procedures were conducted in accordance with standard project procedures, with 50 litres of each context below topsoil sent to flotation, 60 litres sent for dry-sieving and 0.25 litres retained for archive.

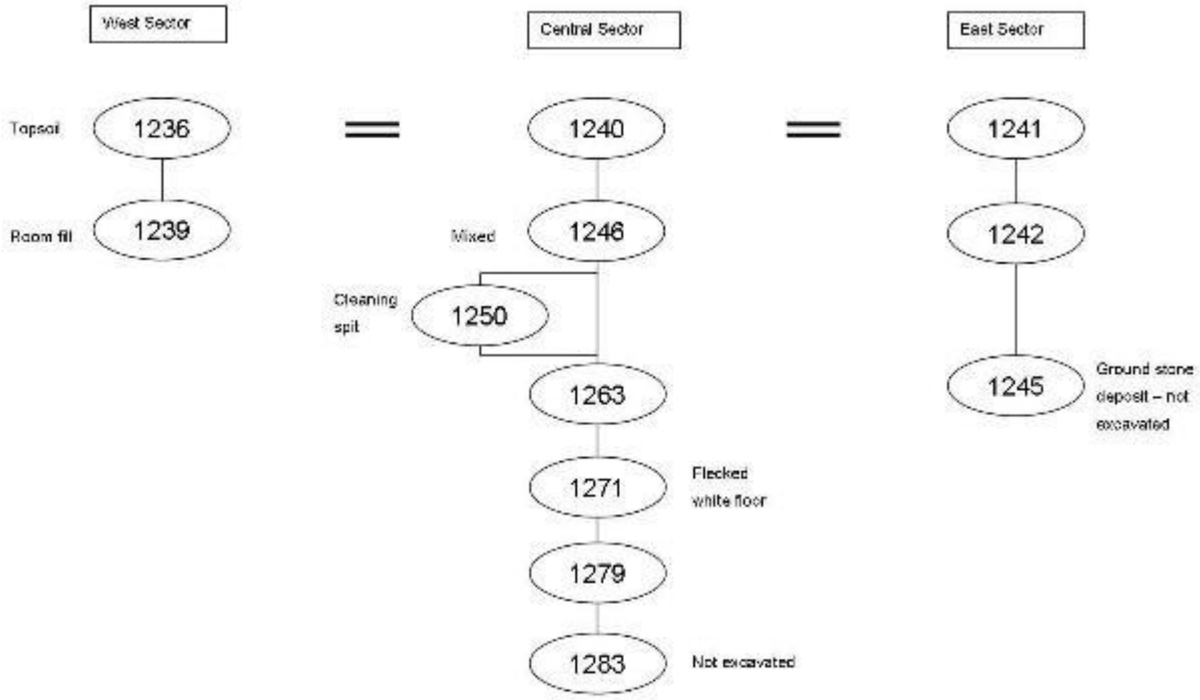


Figure 7.2. Trench 11 matrix

## Sequence of structures, deposits and features

The deepest deposits observed in Trench 11 (C1283) have not yet been excavated. Contexts 1283 and C1271 represent deliberately laid, gritty white surfaces, demonstrating linear distribution, with white flecks and sparse shell (Fig. 7.3). This possible sequence of floors and the massive bedding between has yielded very little archaeological material.

Figure 7.3. Flecked white surface (C1283)

However, C1263 overlying the later surface (C1271) was rich with groundstone (638g), bone (703g), chipped stone (340g) and molluscs (408g). This Central Sector deposit may be contemporary with an unexcavated East Sector deposit, C1245, which comprises a substantial ground stone deposit, with pestles and grinding stones visible (Fig. 7.4). These apparently intact deposits lie only 45cm below the ground level in the Eastern Sector, and 55cm in the Central Sector, mimicking the W-E slope towards the mound.

Figure 7.4. Ground stone deposit in Trench 11 (C1245), south of Trench 7

In the West Sector, immediately below 30cm of ploughed topsoil, stone walls (B1) and room fill containing fired clay and *ca.*600g of pottery overlie any earlier deposits. The wall foundations of B1, constructed from large stones and embedded with substantial fragments of ceramic material, outline two spaces, with an adjoining wall (Fig. 7.5). In the western space, a burnt clay feature abuts the adjoining wall. These walls correlate with the features initially identified through the geophysical survey.

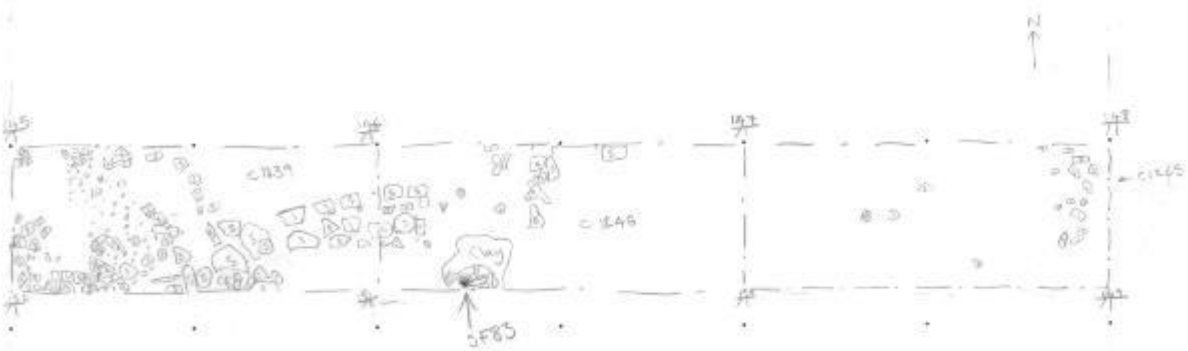


Figure 7.5. Composite plan of Trench 11, West, Central and East Sectors

## Discussion and interpretation

Trench 11 has successfully identified a clear differentiation in the representation of later stone architecture and earlier Neolithic features in the geophysical survey results. The clearly identifiable features visible in the survey to the south of Trench 7 represent part of a structure (B1) of likely Iron Age date (to be confirmed on the basis of the pottery). In the mixed deposit overlying the clay feature in the Central Sector, a single copper alloy arrowhead (SF83) may provide further evidence for the date. This arrowhead finds parallels with SF38, recovered during the Spring 2012 field season, from Trench 10, to the East of the mound, over 100m away, revealing the potential scale of occupation during this phase.

Figure 7.6. Excavation of Trench 11, south of Trench 7 and west of Bestansur mound

It is evident that the depths of both the later settlement in the West sector and the Neolithic areas of activity to the East are similar. The mixing of deposits in the Central Sector highlights the intersecting nature of deposits at Bestansur, as the later deposits appear to have cut into the earlier features, which may have been exposed.

The Neolithic activity areas and surfaces do not reveal a clear use of space, although the ground stone deposit (C1245) may be compared with the groupings of ground stones in C1243. Although it is not possible to clearly identify Neolithic features from the geophysical survey, it is evident that subtle differences in the resistivity, representing markedly different use of materials, can be used to determine areas of substantial later activity and areas likely to yield access to Neolithic levels.

# Chapter Eight: Investigating Early Animal Management, Diet and Ecology: Portable X-Ray Fluorescence, Spot-Sampling and Micromorphology Sampling

Sarah Elliott

## Introduction

This report will focus on expanding and implementing the field methodology which was introduced and explored during the spring 2012 season at Bestansur (see Spring 2012 Archive Report, Chapter 5). The full methodology was applied in Trench 7 at Bestansur on the Sharazor plane, while micromorphology sampling was the single aspect of the methodology which was able to be applied at the other CZAP site of Shimshara on the Ranya plane. This was due to logistical and time constraints at Shimshara during the summer 2012 field season. The full methodology was developed with the primary aim to identify archaeological dung deposits to study early animal management, diet and ecology.

## Research context, rationale, aims and objectives

The methodology applied at Bestansur was chosen in order to successfully locate, identify and sample ancient dung deposits using a range of analyses. Dung deposits are being analysed in order to investigate early animal management, diet and ecology.

Field methods comprised portable X-ray fluorescence (pXRF), spot-sampling/smear slide analysis and micromorphology sampling. The aim in using pXRF was to locate phosphorus rich deposits which may be indicative of dung which could then be spot-sampled for microscope analysis if the field. The aim of the field microscopic analysis was to identify calcareous spherulites from smear sides which were produced from the spot samples. Calcareous spherulites are formed in the gut of animals during digestion and pass through the digestive system into the dung and can be identified under crossed polarised light at high magnification (Canti 1999). The objective in the collection of micromorphology block samples in areas where dung had been successfully identified was to be able to carry out a range of analysis on the dung deposits back in the laboratory at the University of Reading. The analysis of micromorphological thin sections enables me to identify and analyse dung deposits in situ. Micro sub-samples taken from these deposits could then be selected from specific dung layers for further detailed analysis.

## Sampling and Preliminary results

***Portable X-ray fluorescence, spot-sampling and smear slide analysis***

#### *Portable X-Ray fluorescence*

In total 87 pXRF readings were taken during the summer 2012 field season. Of the total, 81 readings were taken from trench 7 at Bestansur. These readings were taken on targeted archaeological deposit in a range of contexts across the 6x6 metre trench. Two sub-samples from archaeological deposits at Shimshara were analysed using the pXRF back in the field laboratory and 4 modern dung samples were analysed in the field (see Chapter 11). The phosphorus readings from the pXRF results from Bestansur range from below the limit of detection to 4058ppm (parts per million). The two samples from Shimshara have phosphorus readings of 5723ppm and 11,119ppm. The modern dung samples range from 4589ppm to 16,490ppm. During the summer 2012 field season some comparative material was tested on the pXRF in order to place these readings into a wider context of archaeological phosphorus analysis. It is widely accepted that other anthropogenic signatures can be high in phosphorus. Therefore preliminary tests were run on burnt and non-burnt animal bones to give preliminary phosphorus readings for alternative anthropogenic material.

These readings for phosphorus taken directly on the animal bones were between 12,974ppm and 151,250ppm. These values are considerably higher than the sediment readings. For comparison of non-archaeological, non-anthropogenic material, five natural samples which were collected during the spring 2012 season in the vicinity of the Bestansur archaeological site (see Spring 2012 Archive Report, Chapter 8) have also been tested for the phosphorus content. The phosphorus readings for all of these samples were below the limit of detection. This provides a good control when you compare these results to sub-samples which have elevated phosphorus readings and faecal spherulites confirming the presence of animal dung. These readings lie between 866-4058ppm of phosphorus. Confirmed animal dung values at Shimshara come from only one sample, the phosphorus reading is 11,119ppm. To date no natural samples within the vicinity of Shimshara have been collected or analysed for their phosphorus content. A more intensive programme of chemical analysis will have to be carried out at Shimshara in order to analyse contextual variation between the two sites in the Zagros of Iraqi Kurdistan. The tests carried out on natural material collected from around the archaeological site of Bestansur, provides our pXRF readings from the archaeological site within the wider environmental context of the site. Full analysis of these samples will be carried out in the future (particle size, mineralogy, pH, magnetic susceptibility).

### *Spot-sampling and smear slide analysis*

Spot samples were routinely taken in the same location as the pXRF readings. In the laboratory a range of these were analysed by smear slide analysis in order to identify the presence of faecal spherulites and phytoliths. In 21 out of 22 cases where elevated phosphorus was identified from archaeological sediments faecal spherulites were also identified (Table 8.1). The full suite of results is still to be analysed, to date some of the results have proved inconclusive. Preliminary analysis of the data indicates that faecal spherulites were present in 15 of the samples but had a reading below the limit of detection for phosphorus (Table 8.1).

### *Micromorphology sampling programme*

Specific locations were selected for sampling of micromorphology blocks after consideration and analysis of the pXRF and spot sample results. Locations with high phosphorus, spherulite and phytolith content were targeted for further sampling. In addition to this other contexts were targeted for analysis of architectural materials and technology, natural sediments and activity areas. A total of 14 block samples were taken at Bestansur and 6 block samples taken at Shimshara (Table 8.2). To date a total of 15 thin sections have been impregnated, cut and ground to a standard thickness of 30-40 microns (Table 8.2). These samples are now ready for analysis and interpretation.

The location of the samples from Bestansur (collected by SE only) and purpose of collection will be discussed briefly with relation to the excavations in Trench 7. A brief note on deposits at Shimshara will be discussed. Some preliminary comments will be made about two of the samples: one sample from Bestansur (SA679) and one from Shimshara (SA763).

| | **Phosphorus (P) ppm** | **Spherulites (# observed)** | **Notes** |
|---|---|---|---|
| **(1216) <510>** | 2480 | 6 | P and spherulites |
| **(1217) <512>** | 2474 | 4 | P and spherulites |
| **(1220) <542>** | 1513 | 3 | P and spherulites |
| **(1220) <543>** | 1297 | 4 | P and spherulites |
| **(1220) <545>** | 866 | 11 | P and spherulites |
| **(1218) <527>** | 2604 | 11 | P and spherulites |
| **(1224) <530>** | 1881 | 2 | P and spherulites |
| **(1225) <523>** | 2386 | 1 | P and spherulites |
| **(1225) <549>** | 4058.98 | 22 | P and spherulites |
| **(1225) <546>** | 940.41 | 5 | P and spherulites |
| **(1227) <547>** | 1909 | 10 | P and spherulites |
| **(1225) <548>** | 1232.15 | 10 | P and spherulites |
| **SB A (1243) <570>** | 1437 | 1 | P and spherulites |
| **SB D (1243) <645>** | 924 | 3 | P and spherulites |
| **SB E (1243) <646>** | 1760 | 2 | P and spherulites |
| **SB H (1243) <649>** | 1589 | 3 | P and spherulites |
| **(1220) <558> K** | 2941 | 6 | P and spherulites |
| **(1220) <560> M** | 2261 | 11 | P and spherulites |
| **BO (1264) <670> 'natural'** | 1048.5 | 9 | P and spherulites |
| **SHIM <755>** | 11119.65 | 9 | P and spherulites |
| **(1218) <539>** | 903 | 0 | P only |
| **(1218) <536>** | 0 | 14 | Spherulites only |
| **(1218) <537>** | 0 | 2 | Spherulites only |
| **(1218) <538>** | 0 | 16 | Spherulites only |
| **(1220) <541>** | 0 | 7 | Spherulites only |
| **(1220) <544>** | 0 | 18 | Spherulites only |
| **(1230) <550>** | 0 | 8 | Spherulites only |
| **(1230) <551>** | 0 | 9 | Spherulites only |
| **(1231) <552>** | 0 | 5 | Spherulites only |
| **(1232) <553>** | 0 | 7 | Spherulites only |
| **(1228) <595>** | n/a | 6 | Spherulites only |
| **SB B (1243) <571>** | 0 | 8 | Spherulites only |
| **SB C (1243) <644>** | 0 | 2 | Spherulites only |
| **SB F (1243) <647>** | 0 | 4 | Spherulites only |
| **SB G (1243) <648>** | 0 | 2 | Spherulites only |
| **SB I (1243) <650>** | 0 | 8 | Spherulites only |

Table 8.1. Phosphorus readings and spherulites observed in a range of spot samples analysed in the field by smear slide analysis.

| Site | Sample No. | Context | Collected by |
|---|---|---|---|
| Best | 612 | Basal fill of clay lined feature | WM |
| Best | 651 | Occupation above stone surface | SE |
| Best | 652 | Charred layer | SE |
| Best | 656 | External occupation | SE |
| Best | 657 | External hearth/fire installation | SE |
| Best | 673 | Occupation within pise wall | SE |
| Best | 674 | Room fill, occupation deposits | WM |
| Best | 675 | Occupation in grinding stone 'room' | SE |
| Best | 676 | Early occupation deposits | WM |
| BEST | 678 | External occupation | SE |
| BEST | 679 | Lowest levels occupation (thought to be natural) | SE |
| Shim | 752 | Half yellow half ashy material | SE |
| Shim | 753 | Plaster layer and burning | WM |
| Shim | 756 | Natural? | WM |
| Shim | 757 | Lowest occupation burning and ash | SE |
| Shim | 758 | White aggregates, and upper layers of charred plants | WM |
| Shim | 763 | Ash, burning | WM |
| Best | 817 | Fill with green clay aggregates | WM |
| Best | 818 | Layers of charring | SE |
| Best | 819 | Fill with burnt building materials | WM |

Table 8.2. All micromorphology blocks collected at Bestansur and Shimshara during the Summer 2012 field season (By Sarah Elliott (SE) and Wendy Matthews (WM)). Samples already processed highlighted in blue.

***Bestansur***

***Deposits in 2 x 2m trench in the centre of Trench 7***

***Space 11***

In the base of the 2 x 2m area in Sp11 Sample 679 was taken through C1273 to elucidate the interpretation that 'natural' had been reached in the base of this 2 x 2m original Trench 7 (from the spring 2012 excavations) (Fig. 8.1). Above SA679, SA652 was removed; this sample is probably associated with C1170 (removed during the Spring 2012 season). This sample was taken through a charred layer to investigate the composition and nature of this burning layer (Fig.1).


Figure 8.1. Location of samples SA652 and SA679 from Sp11. Section 7. Scale = 50cm.

### *Space 12 (originally Space 9, Spring 2012)*

Above a laid stone surface C1272 (same as C1094) in Sp12 (originally allocated Sp9 in Spring 2012) SA651 was removed through C1252 (same as C1093). Context 1252 (same as C1093) is comprised of occupation deposits accumulated on top of this stone surface. Sample 651 was removed to investigate the nature of these occupation deposits (Fig. 8.2).

Figure 8.2. Location of SA652 from Sp12, Section 6. Scale = 25cm.

### *Deposits in 6 x 6m extent of Trench 7*

### *Space 17*

Space 17 has been interpreted as repeated activity in a large open external area. Five micromorphology blocks were taken during the summer 2012 season from this area of the excavation. Sample 657 was taken from a fire installation or external hearth C1247 Feature F8 (Fig. 8.3). This sample was taken for numerous reasons. Previous 'internal' hearth samples from the Spring 2012 season taken in Trench 9 have been proved to contain dung within the hearth material possibly used as a fuel. This fire installation is from an 'external' rather than 'internal' area and therefore will provide a comparative suite of analysis. In addition to this phosphorus readings taken near this fire installation/hearth were high at 2261ppm and the smear slide contained 11 spherulites (pXRF and smear slide analysis (1220) <560> M (see Table 8.1).

Figure 8.3. SA657, C1247, F8. Fire installation/hearth in 'external' open area. Scale = 25cm.

Sample 656 was taken through the deposit stratigraphically below Feature F8 (fire installation/external hearth) (Fig. 8.4). This sample will include a range of contexts perhaps including: C1248, C1254, C1274, C1261, C1270. Three of four locations across this area which was tested using the pXRF prior to sampling this deposit yielded elevated phosphorus levels between 2041 and 2941ppm. Two of these samples were analysed by smear slide analysis and were confirmed to contain faecal spherulites. This sample was taken to investigate the presence of animal dung in this area as well as the clusters of fugitive surfaces, shells and any other anthropogenic occupation debris. One objective was to examine whether these surfaces are any clearer in the micro stratigraphy.

Figure 8.4. Location of SA656. Taken into Sp17 (looking west). Section 15. Scale = 25cm.

Samples 678 and 818 were taken in the northern most extent of Sp17 into the northern (south facing) bulk of the main trench. Sample 678 contains C1220 and was taken in an area where there was high phosphorus, spherulites and a discarded articulating red deer foot was recovered which had signs of disease (see Chapter 9). This sample was taken to examine the activities in this area of the site (Fig. 8.5). Sample 818 was taken to the east of SA678 in the same bulk and contains C1257. This sample was taken through layers of charring in order to examine the composition of the charred material (Fig. 8.6).

Figure 8.5. Location of SA678. Section 16. Scale = 50cm.

Figure 8.6. Location of SA818. Charring visible in the bottom of the sample and on the deposit in from of the sample (in plan). Section 16. Scale = 50cm.

### *Space 18*

Sample 673 was taken through C1225 in Sp18 (Fig.7). Space 18 is an extension of open area Sp17. The location of sample 673 was chosen as this was the area with the highest phosphorus reading and highest number of spherulites identified in the smear slide for the whole of the Bestansur archaeological site (see Table 1 (1225) <549>).


Figure 8.7. Location of plinth where SA673 was taken. Photo taken facing towards Sp12 (with NE corner of trench behind). Horizontal scale = 25cm, vertical scale = 50cm.

### *Space 16*

Sample 675 was taken through C1255 in Sp16 (Fig. 8.8). This rectilinear room was divided into 9 grid squares for detailed micro analysis. Each square for both contexts excavated (C1255 and C1243) was tested with the pXRF and spot samples were taken. A plinth in the centre of this room was left in during excavation so that a micromorphology block could be taken at the end of the season. It was only possible to leave a plinth in the centre of this room (square E) due to the presence of numerous ground stones around the edges of this room (see Chapter 3). Both readings from square E contained elevated phosphorus 1083ppm in the lower deposit and 1760ppm in the upper deposit. Only the upper deposit was analysed by smear slide analysis. Faecal spherulites were positively identified in this spot sample (see Table 8.1: SB E (1243) <646>).

Figure 8.8. Location of plinth where SA675 was removed from square E. Photo taken looking NE. Scale = 25cm.

### ***Shimshara***

Sampling strategy at Shimshara was employed with a different approach, there was not enough time to carry out the chemical analysis with the pXRF and it was not possible to transport the microscope to the site to carry out smear slide analysis. The archaeological sediments were therefore assessed visually and areas targeted for sampling. There is an obvious contextual variation between the archaeological deposits at Shimshara and Bestansur. Stratigraphic variation through the deposits at Shimshara is clearly defined and there is obvious differentiation between various occupation activities. At Bestansur the deposits are more ephemeral and less clearly defined. I would speculate that occupation at Shimshara is more concentrated i.e. a more permanent occupation whereas at Bestansur perhaps occupation was more temporary and visits to this site were sporadic. I also hypothesise that the deposits are better preserved at Shimshara due to the fact that it is a tell site. In comparison the Neolithic occupation at Bestansur is on a flat area of the site. Sampling at Shimshara occurred over two days during the Summer 2012 field season. Obvious deposits such as burning, ash, plant/phytoliths, construction (such as plaster floors) and aggregated material were targeted for sampling.

## Discussion

***Preliminary Results: Bestansur (SA679) and Shimshara (SA763)***

*Bestansur (SA679) Space 11*

During excavation this deposit initially was interpreted as a natural deposit due to the difference in colour and texture, with high silt/soil content and few stones and the lack of apparent anthropogenic material. However, the phosphorus value for the base of this deposit where the excavation of the last deposit occurred is 1048.5ppm (see Table 8.1: BO (1264) <670> 'natural') and nine spherulites were identified in the smear slide analysis. From analysis carried out in natural samples from the ecological transect (see Spring Archive Report 2012, Chapter 8, and previous section 'portable X-ray fluorescence') it has already been deduced that the phosphorus content for natural deposits in the area is below the limit of detection for the five samples tested with the pXRF. The presence of faecal spherulites identified in the smear slide alone could not fully rule out that this was a natural deposit. Sample 679 was therefore taken in order to investigate this. This block was taken into 'natural' deposits above where the pXRF reading and smear slide analysis was carried out. While taking this block it was immediately highlighted that just 10cm further back into the section indications of anthropogenic activity was identified in the form of white and red aggregates, shell and possible charred particles (Fig. 8.9).

Figure 8.9. Visible white and red aggregates and shell behind SA679

Animal bone, shell, charred aggregates and charred plant material have subsequently been identified and confirmed in preliminary analysis in thin section (Fig. 8.10). This deposit is therefore either a deposit with anthropogenic material reworked into the natural, an earlier occupation level with either limited activity or infrequent use, or perhaps a pit cut into the natural further to the north of the trench. If a pit was cut into this deposit then this could explain the concentration of anthropogenic material further back in the section (Fig. 8.9). But in addition to preliminary results presented here, the results from the microarchaeology (see

Chapter 6) of C1273 and C1264 also indicate a presence of anthropogenic material, but in low concentrations. The flotation sample from C1273 produced just one piece of flint, however additional pieces of flint were recovered from the dry sieving. Context 1264 produced six bits of flint and some bone from the heavy residue. The evidence from the micromorphology, microarchaeology and the elevation in phosphorus and presence of faecal spherulites in these deposits still suggests that this material is in fact not natural. Detailed analysis of the micromorphological sample needs to be completed to confirm interpretation of these deposits.

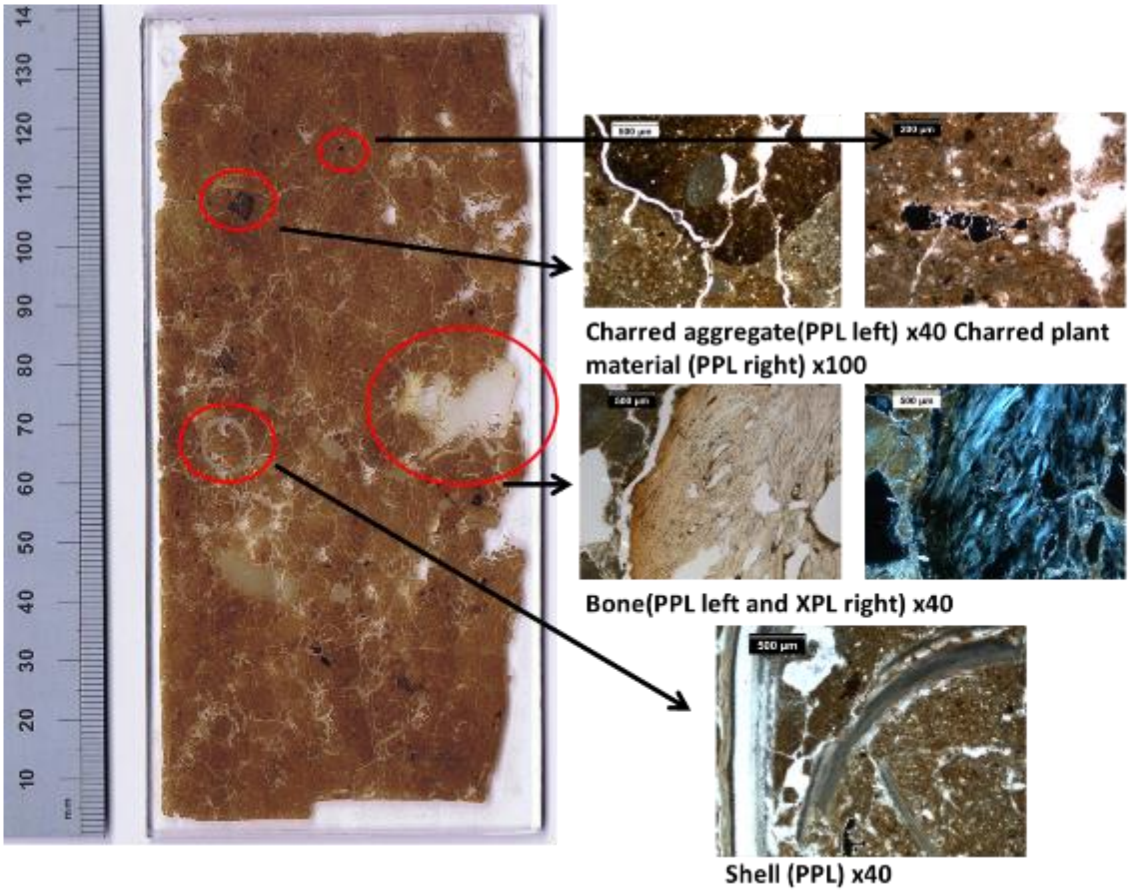


Figure 8.10. Anthropogenic material identified in SA679 from preliminary analysis

*Shimshara (SA763)*

Sample 763 from Shimshara was taken through possible ash and burning towards the eastern most extent of the section next to SF117, a bone pendant (Section 43). This sample has undergone preliminary analysis to assess the sample for faecal spherulite and phytolith content. Portable X-ray fluorescence, spot sampling and smear slide analysis was not able to be carried out at Shimshara due to logistical and time constraints at this site in the Summer 2012 season.

Faecal spherulites and phytoliths have now been identified in this sample from Shimshara. Confirming the presence of animal dung at this site and the preservation of plant silica phytoliths, specifically *phragmites* (reed) phytoliths (Fig. 8.11).

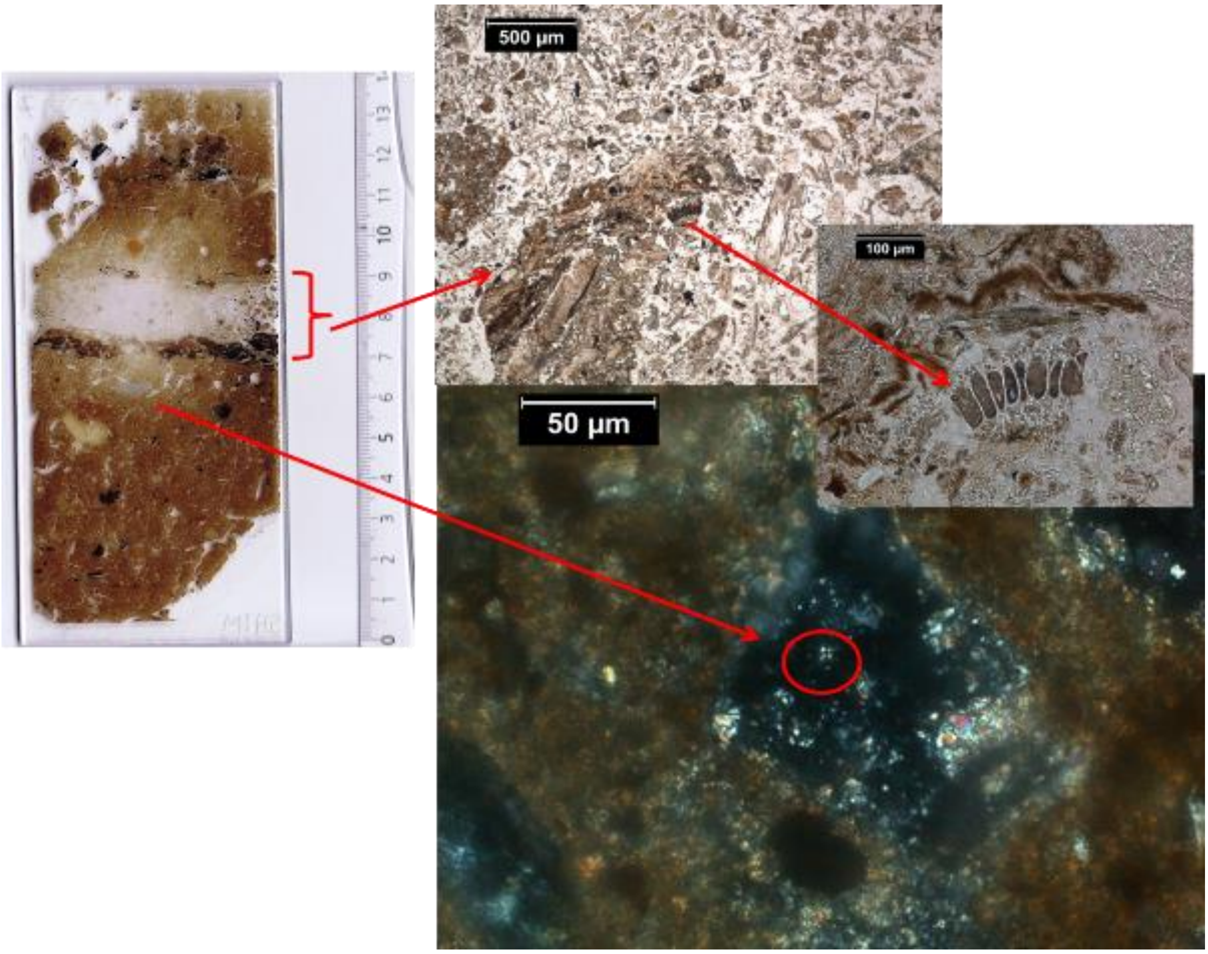


Figure 8.11. SA763 from Shimshara. Faecal spherulites identified (lower picture right hand side XPL x400) and stacked bulliform reed phytoliths (top picture middle x40 PPL and right hand side x200 PPL).

## Conclusion and future directions

The results presented here are very preliminary. Full analysis and integration of the portable x-ray fluorescence, spot sampling, smear slide analysis and micromorphological analysis/interpretation needs to be carried out on all of the samples collected from the Summer 2012 field season in order to formulate accurate interpretation of the archaeological deposits.

# Chapter Nine: Preliminary Assessment of the Zooarchaeological Assemblage

Robin Bendrey

## Introduction

This chapter briefly assesses the animal bone assemblages recovered from the CZAP excavations at Bestansur and Shimshara undertaken in summer 2012. This report provides basic quantifications of all recorded bones (divided into Neolithic and post-Neolithic), but only those remains from stratified Aceramic Neolithic deposits will be considered in detail. This zooarchaeological assessment does not include consideration of the material recovered from the top soil.

In total, from the summer excavations, the following quantities of material have been recorded: 2331 fragments of bones weighing 2.77 kg from Bestansur and 414 fragments weighing 2.57 kg from Shimshara. The following report lays out a brief assessment of the preservation, nature and composition of this material. Recovered material from our first excavation season at Bestansur (Bendrey 2012), for which there was insufficient time to record during the spring 2012 season, was recorded during the summer season and is incorporated into the material below.

## Academic context

The shift from reliance upon hunted wild populations to the control and exploitation of domestic animals is one of the great step changes in the human past (Harris 1996; Barker 2006). It is now argued that the early domestication of sheep, goat, pig and cattle, in possibly multiple centres of the Fertile Crescent in the Near East, appears to have developed as a gradual process, evolving from hunting strategies and the intensification of relationships between humans and wild animals into the management of, at first, morphologically unchanged animals, generally within their natural habitat (Zeder 2005; 2009; Conolly *et al*. 2011; Vigne et al. 2011). These evolving human-animal relationships were connected with a range of fundamental economic, social, and ritual transformations – especially those related to mobility, sedentarisation, and animal and plant use (Barker 2006; Vigne 2011).

The study area encompassed by the Central Zagros Archaeological Project is of particular interest in relation to the early processes of goat domestication in particular. Current evidence indicates that initial goat domestication, possibly occurring multiple times, arose between around 8700 and 7900 BC in the region stretching from the Zagros Mountains, in the eastern Fertile Crescent, to the highlands of southeastern Anatolia (Peters *et al*. 2005; Zeder 2008; Pereira and Amorim 2010). The Central Zagros region lies within the natural habitat of wild goats, and is a region of particular interest in the early history of goat management and domestication (Zeder 2005; Pereira and Amorim 2010). The earliest archaeological evidence for the presence of domestic goats from this region comes from Ganj Dareh, where the demographic profile indicates a managed population of goats dating to *ca*. 7900 BC that are morphologically unaltered from wild animals (Hesse 1978; Zeder and Hesse 2000; Zeder 2005; 2008) [see Peters *et al*. (2005) and Vigne *et al.* (2011) for early evidence from other regions]. Current evidence indicates that domestic sheep, however, appear in the Central Zagros only from *ca*. 7000 BC (Zeder 2008), whereas initial sheep domestication may have occurred in southeastern Anatolia during the 9$^{th}$ millennium BC (Peters *et al*. 2005). Predating the latter, evidence for the intensive exploitation of wild sheep, as at Körtik Tepe, Turkey, (10$^{th}$ millennium BC), may represent a highly selective hunting that was perhaps a precursor to strategies of herd management in the region (Arbuckle and Özkaya 2006). In the lower Zagros region, both domestic sheep and goat are present in the Ceramic Neolithic assemblage at Jarmo (Stampfli 1983; Zeder 2008).

## Research aims and objectives

Zooarchaeological analyses on the assemblages excavated within the CZAP research programme have the potential to contribute data and interpretations to a range of overlapping research themes that fall within the project aims (Matthews *et al*. in press). It is aimed that studies of the animal bones and teeth will be able to advancing knowledge in the following subject areas:

- processes of animal domestication
- human diet, economy and society
- wild animal resources
- ecology and environments
- sedentism and territorial use
- animal husbandry

The Zooarchaeological analyses will be fully integrated with the full range of research methods being applied by the CZAP team to investigate animal diet and management from GC/MS, micromorphological, phytoliths and archaeobotanical analyses (see other chapters).

## Methodology

### *Recovery methods*

Animal bones were collected by three different methods: hand-picking during excavation; dry sieving of the excavated sediments using a 4mm mesh; and wet sieving using a 1mm mesh (Tables 9.1-3). Material recovered from the integrated wet sieving and flotation programme typically consisted of, 50 litres of deposit per context processed by machine assisted water flotation (Chapters Six and Ten).

### *Identification and recording*

The recording system for the Bestansur zooarchaeological assemblage was based on the protocols used at Çatalhöyük by Russell and Martin (2005, 34-38). The bones were identified with the aid of standard published protocols (Boessneck 1969; Schmidt 1972; Prummel and Frisch 1986; Halstead and Collins 2002; Zeder and Lapham 2010; Zeder and Pilaar 2010). Bones not identified to species have been awarded an animal-size category, or labelled indeterminate. Material that could not be identified in the field has been exported to England for checking against modern osteological reference collections. Identifications reported in this assessment are provisional – some of these will change as further work is undertaken and specimens are compared to more comprehensive osteological reference collections (including the Natural History Museum collections in London and Tring).

***The animal bones from Bestansur***

### *Preservation and taphonomy*

The assemblage was scored for general conditions of preservation (excellent, good, fair, and poor) and broad taphonomic characteristics (battered, rounded, spikey, and variable) (O'Connor 1991, 234-235). The latter was assessed in order to distinguish between those contexts where bone fragments retained sharply angular margins to old breaks, those that exhibited a rolled/abraded appearance, and those that exhibited impact pitting/battering. As in the spring, generally the assemblage is well preserved, with most of the material exhibiting a good quality of preservation and a 'spikey' appearance.

## Zooarchaeological remains recovered during the summer 2012 season

The zooarchaeological assemblage analysed to date from those Aceramic Neolithic contexts excavated during the 2012 summer season is presented in Table 9.1. The following mammalian species have been positively identified from this assemblage: cattle, red deer, goat, sheep, pig, roe deer, and fox. In addition, a small number of remains of micro-mammals, birds, reptiles, fish and land crab were recovered - further identification needs to be undertaken on these remains (see above).

Small quantities of material come from post-Neolithic and mixed contexts from both trenches (Table 1. The identified taxa represented in this small quantity of faunal remains recovered are consistent with that recovered from the later levels during the spring excavations at the site (Bendrey 2012), and are dominated by sheep/goat remains (Table 9.1).

The identified taxa from Aceramic Neolithic contexts are also similar to those recovered from the spring season (Bendrey 2012), with the addition of land crab. In total 1736 fragments of bone, weighing, 1.71kg have been recorded from Neolithic contexts (Table 9.1). The quantities of bone recovered are relatively small, but this is related to the nature of the archaeological record under investigation, and the material has the potential to explore a range of questions in relation to the nature of the site. Although the quantities of metrical and age data will make it hard to interpret broader patterns of herd demographics and exploitation strategies of wild and domestic herds, what we can examine, in particular, is the nature of activities forming the complex interbedded sequence of seemingly ephemeral and episodic activity within the external area of the trench (Chapter 3). The remains attest to a range of practices and events, including the primary butchery of material, such as the bones of a red deer foot (C1220) found in articulation indicating that at it had been discarded with the soft tissue present, holding the separate elements together (Fig. 9.1a). Discrete collections of associated bones also indicate frequent evidence for marrow/grease processing of bones and also food preparation/cooking, such as a burnt fox femur from C1274 (Fig. 9.1c). There is also evidence for the processing of a range of resources, for example fish and crab (Fig. 9.1b and 9.1d).

| | period | Neolithic | Post-Neolithic/mixed | | |
|---|---|---|---|---|---|
| | **Trench** | **7** | **7** | **11** | **Total** |
| **Large-sized mammals** | *Bos* | 5 | - | 1 | 1 |
| | *Cervus elaphus* | 9 | - | 1 | 1 |
| | Large cervid | 4 | - | 1 | 1 |
| | Large-sized indet. | 100 | 2 | 17 | 19 |
| **Medium-sized mammals** | *Capra* | 2 | 1 | 3 | 4 |
| | *Ovis* | 3 | 1 | 4 | 5 |
| | *Ovis/Capra* | 7 | 1 | 15 | 16 |
| | *Sus scrofa* | 7 | - | 6 | 6 |
| | *Capreolus capreolus* | 1 | - | - | - |
| | Small cervid | 1 | - | - | - |
| | Medium-sized indet. | 198 | 16 | 95 | 111 |
| **Small-sized mammals** | *Vulpes vulpes* | 3 | - | - | - |
| | Small-medium carnivore | 1 | - | - | - |
| | Small-sized indet. | 6 | - | 1 | 1 |
| **Micro-mammals** | Microfauna indet. | 16 | 2 | 2 | 4 |
| **Mammal indet.** | Indeterminate | 1322 | 88 | 210 | 298 |
| **Birds** | Bird indet. | 15 | - | - | - |
| **Reptiles** | Tortoise | 13 | - | - | - |
| **Fish** | Fish indet. | 20 | - | 5 | 5 |
| **Crustacea** | Land crab | 3 | - | - | - |
| **Total** | | **1736** | **111** | **361** | **472** |

Table 9.1. Distribution of animal bone recovered from Bestansur during the summer season 2012 (by all recovery method; number of fragments - NISP).

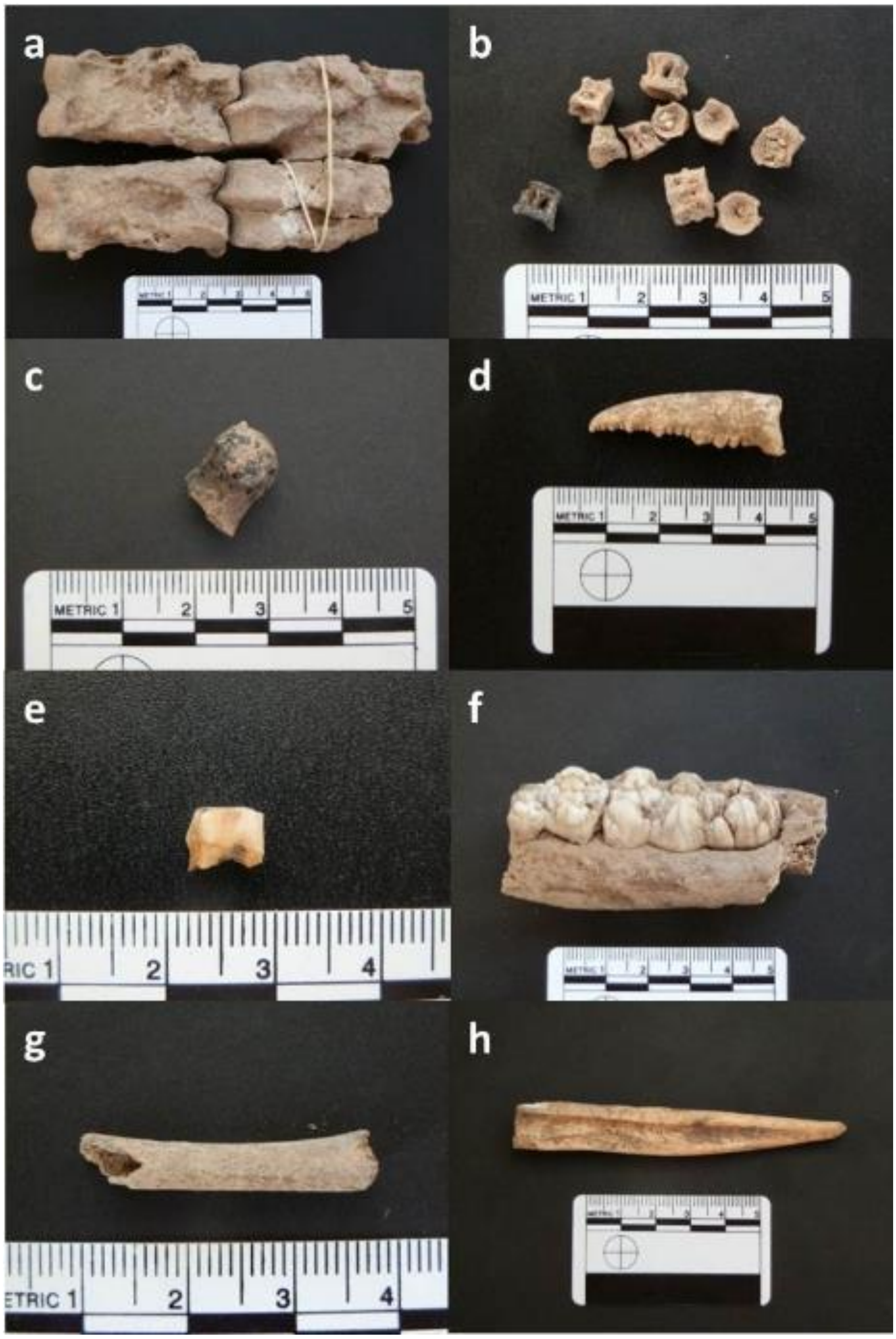


Figure 9.1. Neolithic zooarchaeological finds from **Bestansur**: a). pathological articulating red deer foot (C1220); b). fish vertebrae (C1254, SA749); c). burnt fox femur (C1274); d). crab claw (C1219); e). shed goat $dP_2$ (C1094, SA174); and **Shimshara**: f). pig mandible (SF 113); g). perinatal caprine metacarpal (C1276); h). bone tool (SF134, C1276).

***Assessment of Aceramic Neolithic material recovered to date from Bestansur (Spring and Summer Seasons 2012)***

Table 9.2 presents an overview of the total recovered Aceramic Neolithic zooarchaeological assemblage from Bestansur (recovered from both the spring and summer seasons). As discussed above, the physical sample is relatively small, which brings some limitations in terms of interpretations that require larger pools of data to draw conclusions (such as population structure of herds and metrical analyses of size changes through time). However, as also discussed the data does allow detailed qualitative assessment of activities and processes going-on in the different areas of the site.

| | | hand-picked | dry-sieved | wet-sieved | Total |
|---|---|---|---|---|---|
| **Large-sized mammals** | *Bos* | 13 | 1 | 2 | 16 |
| | *Cervus elaphus* | 11 | - | 1 | 12 |
| | Large cervid | 2 | - | 2 | 4 |
| | Large-sized indet. | 125 | 7 | 21 | 153 |
| **Medium-sized mammals** | *Capra* | 7 | - | 2 | 9 |
| | *Ovis* | 5 | 2 | 1 | 8 |
| | *Ovis/Capra* | 15 | 5 | 7 | 27 |
| | *Sus scrofa* | 9 | 1 | 3 | 13 |
| | *Capreolus capreolus* | 1 | - | - | 1 |
| | Small cervid | - | - | 1 | 1 |
| | Large canid | 2 | - | - | 2 |
| | Medium-sized indet. | 180 | 62 | 121 | 363 |
| **Small-sized mammals** | *Vulpes vulpes* | 1 | - | 2 | 3 |
| | Medium canid | - | - | 1 | 1 |
| | Small-medium carnivore | - | - | 2 | 2 |
| | Small-sized indet. | 2 | - | 11 | 13 |
| **Micro-mammals** | Microfauna indet. | 4 | - | 58 | 62 |
| **Mammal indet.** | Indeterminate | 278 | 93 | 2169 | 2540 |
| **Birds** | Bird indet. | 6 | 1 | 21 | 28 |
| **Reptiles** | Tortoise | 14 | 1 | 1 | 16 |
| | Snake | - | - | 4 | 4 |
| **Fish** | Fish indet. | - | - | 21 | 21 |
| **Crustacea** | Land crab | 2 | - | 1 | 3 |
| **Total** | | **677** | **173** | **2452** | **3302** |

Table 9.2. Distribution of Neolithic animal bone recovered from Bestansur by different recovery method (number of fragments - NISP).

The material is giving a picture of the range of activities at the site, and the breadth of activities contributing to the diet (hunting and fishing). There is currently insufficient age and metrical data to discuss in detail the status of the goat populations at the site (e.g. see Zeder 2008). However, there is a single goat shed deciduous premolar (recovered via the wet-sieving programme in the spring) which may derive from the mouth of an animal living on the site (the deciduous tooth is shed and falls from the animals as the permanent tooth grows out of the jaw beneath). This find comes from C1094, SA174 (Trench 7), and is possible evidence for managed/domestic goats on site. The proportions of taxa recovered are discussed further below.

## The animal bones from Shimshara

***Preservation and taphonomy***

The quality of preservation of the animal bones from Shimshara is very high, with material receiving scores of either excellent or good for all contexts. Bone fractures also exhibited 'spikey' appearances, suggestive of relatively quick burial and limited post-depositional taphonomic attrition of the sample.

***Quantification and distribution of zooarchaeological remains recovered during the summer 2012 season***

The zooarchaeological assemblage analysed to date from those Aceramic Neolithic contexts recovered from Shimshara during the 2012 summer season is presented in Table 9.3. The following taxa have been recorded in the assemblage: cattle, pig, goat, sheep, fallow deer, roe deer, fox, bird, fish and amphibian. Further identification needs to be undertaken on the bird, fish and amphibian remains (see above). These have the potential to inform on local ecology of the nearby lake and river system, and also potentially to provide seasonal evidence for site-use. What is notable within the Shimshara assemblage is the large proportion of pig (*Sus scrofa*) bones (e.g. Figure 9.1a). This is higher than is seen in other contemporaneous assemblages from the Central Zagros region (e.g. Bendrey et al. in press; Bökönyi 1977; Hesse 1978; Stampfli 1983), and may be related to the particular local ecological conditions of the site, located as it was in the catchment of the Lesser Zab river system. It is not possible at the moment to suggest the status of the pig remains, i.e. as to where they may sit in the wild-domestic spectrum, but preliminary assessment of the recovered metrical data indicates that they are of a comparable size with the wild boar-early domestic pig populations identified at Çayönü, Turkey, (Ervynck et al. 2002) and are of comparable size to wild boar populations from Asiab, Iran, and Palaegawra, Iraq (data collected from the Field Museum Natural History, Chicago, Nov 2012).

| | | hand-picked | dry-sieved | wet-sieved | Total |
|---|---|---|---|---|---|
| **Large-sized mammals** | *Bos* | 5 | - | - | 5 |
| | Large-sized indet. | 10 | 1 | - | 11 |
| **Medium-sized mammals** | *Sus scrofa* | 76 | 10 | 1 | 87 |
| | *Capra* | 8 | - | - | 8 |
| | *Ovis* | 21 | 1 | - | 22 |
| | *Ovis/Capra* | 11 | 1 | - | 12 |
| | *Dama dama* | 1 | - | - | 1 |
| | *Capreolus capreolus* | 1 | - | - | 1 |
| | Large cervid | 1 | - | - | 1 |
| | Medium-sized mammal | 117 | 29 | 9 | 155 |
| **Small-sized mammals** | *Vulpes vulpes* | 1 | - | - | 1 |
| | Small-sized mammals | 1 | - | - | 1 |
| **Mammal indet.** | Indeterminate | 48 | 44 | 2 | 94 |
| **Birds** | Bird indet. | 12 | - | - | 12 |
| **Fish** | Fish indet. | - | 2 | - | 2 |
| **Amphibian** | Amphibian indet. | - | 1 | - | 1 |
| **Total** | | **313** | **89** | **12** | **414** |

Table 9.3. Distribution of Neolithic animal bone recovered from Shimshara by different recovery method (number of fragments - NISP).

In addition, a foetal caprine bone was recovered from Shimshara (Figure 1b). This find is of interest in relation to broader evidence for the relatively high representation of foetal caprine assemblages at Neolithic sites in the Central Zagros, notably Ganj Dareh and Sarab, Iran (Hesse 1982; Bökönyi 1977). Changes in the ecology and management of early domestic animal populations through time, as they gradually made the transition from wild to domestic, is expected to have caused different 'stresses' on the animals (Bendrey in press; Ervynck et al. 2001). These stresses (environmental, disease, maternal malnutrition, etc) on the animal populations will differentially affect foetal and neonatal mortality profiles (e.g. Diskin and Morris 2008; Givens and Marley 2008; Mellado et al. 2004; Mellor and Stafford, 2004). Further excavation at Shimshara and recovery of more remains can potentially contribute to on-going CZAP research into variation in perinatal caprine demography aimed at interpreting the likely causes of this mortality.

## Conclusions and future prospects

Although the Aceramic Neolithic assemblage from Bestansur analysed to date is small (Table 9.2), it does demonstrate significant future potential to contribute to project aims (Bendrey 2012), particularly understanding of on-site activities. Further work has the potential to contribute to all project research aims discussed above.

The assemblage from Shimshara is notable for its exceptional preservation and the high proportion of identifiable bones. Excavations at the site are expected to produce a large volume of well-preserved faunal material that in both quantitative and qualitative terms has significant potential to contribute to project aims.

The assemblages of animal bones recovered from CZAP sites to-date are indicating a picture of considerable variation in the proportions of species present at each site, that probably reflect local ecological constraints. This may be seen, for example, in the relative proportions of sheep to goats: with sheep being better represented at the lower altitude sites of Bestansur and Shimshara (Tables 9.2 and 9.3), and goats being better represented at the higher Zagros site of Sheikh-e Abad (Bendrey *et al*. in press). Higher proportions of pig at Shimshara in particular, but also at Bestansur, probably represent proximity to riverine/lacustrine resources and associated vegetation.

Further work on this material will involve the verification/refinement of taxonomic identifications through comparison to comprehensive, regional-specific, osteological reference collections (e.g. those at the Natural History Museum, London) and also integration with stable isotope studies (calculation of environmental base-line data has already begun; study of bone collagen isotopes to begin Summer 2013).

We also need to elaborate the integration of our separate strands of data for the understanding of Early Neolithic lifeways, in both practice and theory. This will include, for example, how Neolithic peoples may have integrated animal husbandry and plant cultivation (e.g. Bogaard 2005; Henton 2012), and how this translates into potentially varying seasonal and geographical rhythms. This will be aided and enriched by our on-going ethnographic studies (Chapter 11). It will also be necessary to consider the articulation of plant and animal foods within the diet of the inhabitants of the site, such as in what seasons the foodstuffs were available, methods of food preservation and storage, and relative possible contributions. A collected snail might weigh 20-30 grams, for example, whereas hunted large game (red deer, wild boar, wild cattle) will produce edible protein weighing hundreds of kilograms. It will be in the knowledge of food processing and preparation, and the seasons and circumstances of food collection, processing, consumption and storage that the conceptualisation and analysis of meals, feasting and food sharing will articulate with wider studies of society and ritual in the processes of Neolithisation in the eastern Fertile Crescent.

## Acknowledgements

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# Chapter Ten: Archaeobotany

Jade Whitlam

This chapter outlines the approach taken to sampling and processing of soils for the recovery of plant macrofossil remains during the summer 2012 season at Bestansur (including trial sampling at the site of Shimshara). It presents initial observations from the preliminary assessment of the marobotanical remains to date, which is subject to both potential revision and amplification in the light of on-going analysis and future sampling at Bestansur and Shimshara.

## Research context and rationale

Archaeobotanical research can provide direct and indirect evidence for the complex relationships between people, plants and the environment. Previous studies of plant remains from early Neolithic sites in the eastern Fertile Crescent have elucidated past human activities relating to diet, fuel use and management of the local environment, including cultivation of wild and/or domesticated crops e.g. (Charles 2007; Hubbard 1990; Miller 1996; Riehl *et al.* 2012). Archaeobotanical evidence can be interpreted across multiple scales of analysis from the site level to regional syntheses and is therefore key to addressing research questions posed by the Central Zagros Archaeological Project (CZAP). Excavations at Bestansur and Shimshara have the potential to provide archaeobotanical evidence that will contribute to our interpretations of how people were utilising and managing plant resources at a site level, over time. Furthermore it is crucial to our appreciation of these sites with regard to the wider changes operating through the Early Neolithic and the emergence of early farming communities in the eastern Fertile Cresecent.

## Methods

During the summer 2012 season at Bestansur excavations followed a programme of systematic sampling and flotation of soil samples for the recovery of macrobotanical remains. Two local women who had worked on the flotation tank during the spring season returned to this job in the summer, and were central to the operations success.

### *Sampling*

The aim of sampling was to collect systematically 50 litres of deposit from each context (bar topsoil removal); contexts of less than 50 litres were sampled in their entirety. Samples were collected from all context areas and types, including midden and open area deposits, areas of *in-situ* burning and hearths, floors and fill within rooms. Additional strategic sampling was also undertaken in discussion with the excavation team and relevant specialists, its aim being to provide a finer spatial resolution of macrobotanical and/or microarchaeological data.

A total of 110 samples were collected for processing during the summer season at Bestansur with a total soil volume of 2913 litres. This was accounted for by 72 strategic samples and 38 systematic bulk samples (Table 10.1). A further two samples were collected during section cleaning and initial sampling at Shimshara with a total soil volume of 37 litres (Table 10.1).

| Samples: | systematic | | strategic | | total | |
|---|---|---|---|---|---|---|
| | no. | vol. (L) | no. | vol. (L) | no. | vol. (L) |
| **BESTANSUR** | 38 | 1317 | 72 | 1596 | 110 | 2913 |
| **SHIMSHARA** | 2 | 37 | - | - | 2 | 37 |

Table 10.1. The number and volume of samples collected during the Summer 2012 season.

A brief account of the strategic sampling of deposits from significant spaces, in Trench 7, Bestansur is presented below

***Trench 7 - strategic sampling***

Space 17 is a large open area, with deposits attesting to repeated activity and, in the south, a double human burial (see Chapter 5). The burial context and its fill (212 litres) were sampled in their entirety for flotation so any potentially significant macrobotanical or microarchaeological finds were not missed. Additionally, three strategic samples (average volume 0.75 litres) were collected from around the hands of each skeleton and the skull of skeleton 1.

To the north of the burial context lay an open area excavated as C1254 and C1274 with the former directly overlaying the latter. Both deposits were typical of Sp17 with discrete clusters of shells, stones, and lithic items. The sampling approach here was chosen to reflect the spatially diverse nature of these deposits. Context 1254 was intensively sampled for flotation (a total 162 litres) with seven strategic samples (average volume *ca*. 8 litres) collected in addition to two systematic bulk samples (average volume *ca.* 52 litres). A further three strategic samples relating to visible deposits of lentils (*Lens* sp.) were also collected (described below). For C1274 a total of six strategic samples (average volume *ca.* 8.5 litres) were collected across the area equalling a total volume of *ca.* 50 litres in preference to a single bulk sample. This was a result of the context being excavated towards the end of the season when time was limited and on the basis that the resulting data could later be amalgamated if necessary with no loss of information.

Two deposits of charred lentils were clearly visible during the excavation of C1254; these are sample SA740 (Fig. 10.1-2) and lying beneath, but not continuous with it, SA746. These were removed as the whole earth matrix following their visible extent and the soils immediately surrounding these were collected as a flotation sample (2 litres) to recover any charred lentils and other macrobotanical remains that may be associated with the lentil deposit but not visible when excavating. Another deposit of charred lentils was visible during the excavation of C1262, Sp11, and sampled in the same manner (Fig. 10.2). Sample 803 defines the visible extent of this deposit and SA802 the surrounding soil collected as a flotation sample (27 litres). Charred lentils from the uppermost and lowermost samples (SA740 and SA803 respectively) have been submitted for radiocarbon dating.

Figure 10.1 SA704 illustrating a visible patch of charred lentils (directly overlying SA746 and surrounded by flotation SA744)

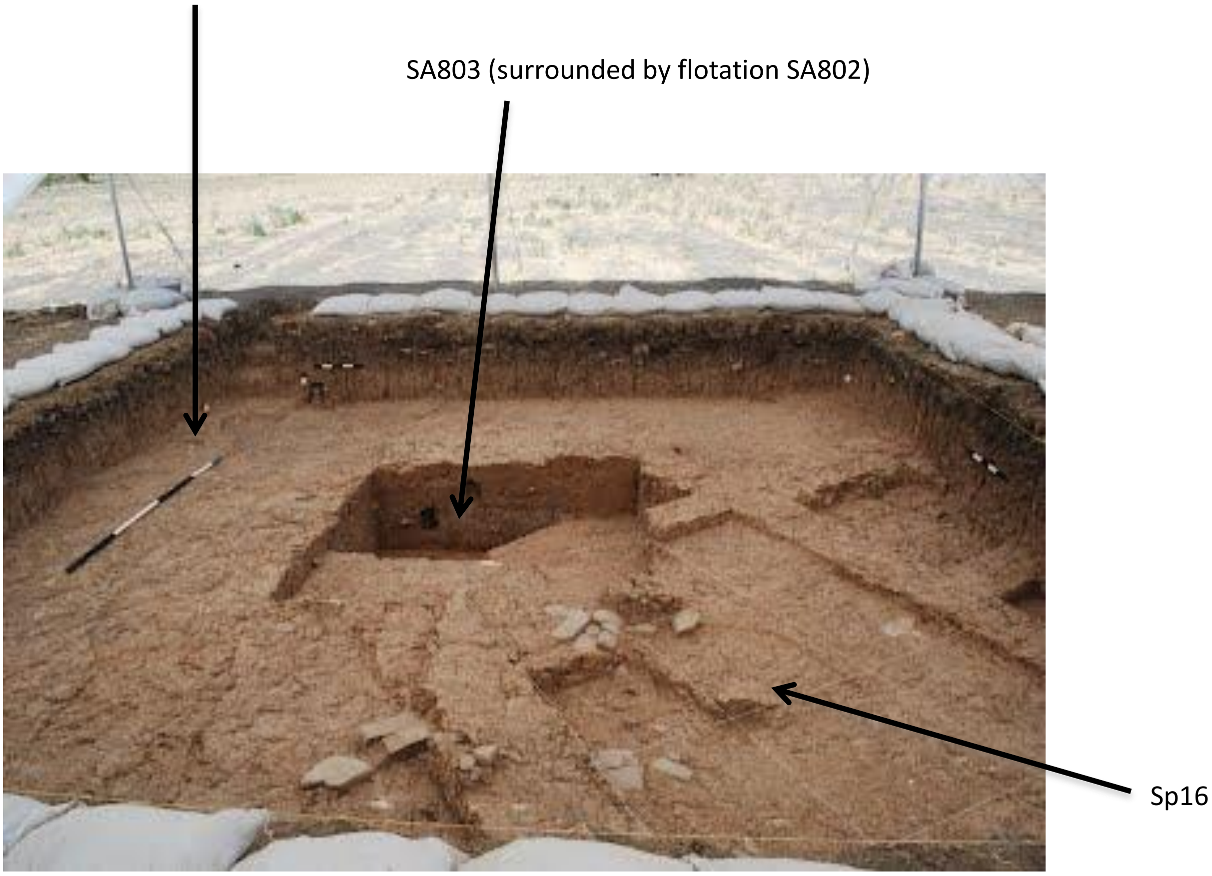



Figure 10.2. the location of visible charred lentil deposits and Sp16, the gridded room, in Trench 7, Bestansur

Space 16 is a well-defined rectilinear room, *ca.* 2.5 x 2.4m in area that contains large quantities of ground-stone artefacts (Fig.10.2; Chapter 3). The deposits were excavated as C1243 in a grid of nine squares to take account of any potential spatial differences within the room and its use. Systematic bulk samples were taken from each square and strategic samples were collected from around and underneath each stone and/or cluster of stones. In total the upper level of occupation provided 30 flotation samples, including 9 bulk samples (average volume *ca.* 46 litres) and a further 21 strategic samples (average volume *ca.* 1 litre). The total volume of soils sampled for this context was *ca.* 441 litres.

***Processing***

The majority of soil samples were processed by machine assisted water flotation using the flotation machine constructed during the Spring 2012 season (Spring 2012 Archive Report). Light fractions (floating material including charred macrobotanical remains) were collected in a chiffon mesh *ca.* 250um aperture and air-dried in the shade. Heavy residues (non-floating material) were retained in a 1mm mesh inside the flotation tank (in effect being submitted to a wet-sieving process) before being sent to the microarchaeology team for further processing (Chapter 6). Smaller samples (ranging from 0.15 litres to 13 litres in volume, average volume *ca.* 3 litres) were routinely processed by bucket flotation with a chiffon mesh *ca.* 250um aperture used to collect light fractions and a 1mm mesh to collect heavy residues. This allowed smaller samples to be processed in parallel with larger samples that went into the flotation machine, increasing the efficiency of the operation. A total of 121 samples were processed during the Summer 2012 season at Bestansur, which included 110 samples collected during summer excavations, nine backlog samples from the Spring 2012 season at Bestansur and two samples from Shimshara (Table 10.2).

| | **Trench** | **samples machine floated** | | **samples bucket floated** | | **total samples floated** | |
|---|---|---|---|---|---|---|---|
| | | **no.** | **vol. (L)** | **no.** | **vol. (L)** | **no.** | **vol. (L)** |
| **Bestansur summer** | 7 | 66 | 2493 | 38 | 117 | 104 | 2610 |
| | 11 | 6 | 303 | - | - | 6 | 303 |
| **Bestansur spring backlog** | 2 | 5 | 271 | - | - | 5 | 271 |
| | 4 | 1 | 52 | - | - | 1 | 52 |
| | 7 | 1 | 59 | - | - | 1 | 59 |
| | 10 | 2 | 77 | - | - | 2 | 77 |
| **Shimshara** | n/a | 2 | 37 | - | - | 2 | 37 |
| **total** | | **83** | **3292** | **38** | **117** | **121** | **3409** |

Table 10.2. Number and volume of samples processed during the Summer 2012 season at Bestansur.

During the Spring 2012 season we encountered concreted/aggregated sediments at Bestansur that required soil samples to be soaked before they could be processed. This was not a problem we encountered again during the summer season, either due to the nature of deposits being excavated or as a result of the heat and aridity affecting the soils. The addition of a well-fitting weir to the flotation tank that had been missing during the Spring also greatly improved the performance of the machine, preventing a lot of the fine sediment from running into the flot-bag and the resulting light fractions were noticeably 'cleaner' as a result.

## Post-excavation

All light fractions were exported to the UK for post-excavation analysis at the School of Archaeology, University of Oxford. A limited number of priority samples (*ca.* 20) where assessed prior to this in the field laboratory at the Bestansur dig house to help inform excavation procedure.

***Light fractions***
When dry, light fractions were separated by passing them through a nested stack of Endicott sieves, 4mm, 2mm, 1mm and 0.3mm aperture. All 4mm, 2mm and 1mm fractions (coarse flots) were 100% sorted under a low-powered stereomicroscope to remove identifiable botanical material: wood charcoal (>2mm) as well as plant macrofossils including caryopses, chaff and pericarp fragments.

With the 0.3mm fractions (fine flots) the aim was to sort 5 -10 ml of the material which often necessitated subsampling. This was achieved by splitting the samples with a riffle box to ensure sub-samples were standardized. Wood charcoal was not systematically removed from the fine flots, as it is considered too small for identification purposes (Chabal *et al.* 1999). Instead a rough volumetric measurement was made for each sample.

Many of the small strategic samples collected did not produce enough material in the light fraction to necessitate splitting into fractions and were sorted in their entirety.

***Heavy fractions***
Plant macrofossils differ in their ability to float and heavier and/or more compact items often end up in the heavy fraction. This concern was addressed at Bestansur by the routine scanning of heavy residue samples for macrobotanical remains. Particular attention was paid toward samples where lentils where present in the light fractions as these are the type of heavy, compact seeds likely to sink. Only a minority of the heavy residue samples contained any macrobotanical remains and only in small numbers. These were subsequently removed and counted with the results of the light fraction for that sample.

***Lentil samples***
The lentil deposits that had been sampled as the whole earth matrix were not floated but processed in the laboratory to limit potential damage to the seeds. The samples were first spread out over a large white tray and, with the aid of a directed light source, all visible items were carefully picked out using flexible forceps. The remaining soil was then very gently sieved through 4mm, 2mm, 1mm and 0.3mm Endicott sieves and the resulting fractions systematically sorted under a low-powered stereomicroscope to recover any remaining lentils and macrobotanical remains.

## Bestansur: Preliminary observations
The observations presented here are based on the material from both the summer 2012 and spring 2012 seasons. 236 samples (*ca.* 7025 litres of soil), 227 from secure layers (*ca.* 6702 litres), were collected and processed during the two seasons at Bestansur across 11 trenches (Table 10.3).

Light fractions are largely dominated by modern roots and/or chaff and fine silt, particularly spring samples that didn't benefit from an adequate weir on the flotation tank. For samples collected in the spring abundant mollusc shell material characterizes the samples with modern seeds occurring occasionally. Whereas samples collected in the summer have the opposite pattern with occasional shell material but abundant modern seeds including Caryophyllaceae and Boraginaceae types. Such a pattern most likely reflects the seasonal components of the soil and their occurrence regardless of depth illustrates a degree of movement up and down the soil column.

All 227 secure samples have been systematically sorted such that each fragment was examined individually. Type-level identifications were made according to morphological characteristics, surface texture, size and where visible internal structure. At the current time no refinement of these type-identifications have been made and those reported here are preliminary and will be subject to change and further refinement through comparison with modern reference material.

| Trench | no. samples | vol. (L) |
|---|---|---|
| 1 | 21 | 860 |
| 2 | 12 | 449 |
| 3 | 1 | 53 |
| 4 | 11 | 592 |
| 5 | 11 | 502 |
| 6 | 1 | 1 |
| 7 | 131 | 2858 |
| 8 | 12 | 496 |
| 9 | 18 | 478 |
| 10 | 3 | 123 |
| 11 | 6 | 290 |
| **total** | **227** | **6702** |

Table 10.3. Number of secure samples collected and processed by trench during Spring 2012 and Summer 2012 seasons at Bestansur.

Initial observations indicate a low density of plant remains across the site (<0.3 items per litre). Forty-six samples were void of any macrobotanical remains. The majority of these (34 samples) are the result of strategic sampling and <1 litre in volume, some as small as 0.15 litres, and therefore the lack of macrobotanical remains is not surprising. Identifiable macrobotanical remains are typically small in size and occur most frequently in 1mm and 0.3mm fractions. Preservation is variable with many items being poorly preserved and thus limiting how far identification can be taken. Wood charcoal is also scarce in terms of abundance, volumes of <1ml are found in the majority of samples and fragments are predominately <2mm in size.

Against this low background signal of macrobotanical remains are the three deposits of Lentils and the surrounding flotation samples from Trench 7 (Table 10.4.). Lentils were quantified according to the presence of the radicle such that a single fragmented lentil could not be counted more than once, providing an estimate of the minimum number of individuals. It is likely this led to underestimates, such as in the case of SA802. A count of eight lentils was estimated for this 27 litre flotation sample based on a count of identifiable radicles but the abundance of fragments in the fine flot suggests the actual number may have been considerably higher. However because of the small size of these fragments the radicles are rarely visible and identification of the fragments can in any case only reliably be taken as far as ‘large-seeded legume indeterminate’.

| lentil deposits | | associated flotation samples | | |
|---|---|---|---|---|
| **sample** | **no. lentils** | **sample** | **vol. (L)** | **no. lentils** |
| 740 | 13 | 744 | 2 | 64 |
| 746 | 92 | | | |
| 803 | 24 | 802 | 27 | 8 |
| **total** | **129** | **-** | **29** | **72** |

Table 10.4. Count of lentils across visible lentil deposits and associated flotation samples.

Concerning the lentil deposits, only sample 740 produced any macrobotanical remains that were not identified to Lentil or large-seeded legume indeterminate. In this case a single fragmented grain of potential wheat (cf. *Triticum* spp.).

## Shimshara: Preliminary observations

Two samples collected during section cleaning and sampling at Shimshara (Fig. 10.3) have been systematically sorted in the same manner as Bestansur samples. Fragments of charred Pistachio (*Pistacia* sp.)-type nutshell sub-sampled from a micromorphology block by Sarah Elliott (Chapter 8) have been sent for radiocarbon dating. A preliminary assessment of the charred plant remains is presented below.


Figure 10.3. The location of flotation samples taken after section cleaning at Shimshara and the location of the micromorphology block subsampled for radiocarbon dating.

Preservation of charred plant material from Shimshara is generally good. 107 plant remains (excluding wood charcoal) belonging to *ca.* 25 plant types have been provisionally identified, the major categories are shown in Table 10.5. Macrobotanical density across the two samples averages *ca.* 3 items per litre. Wood charcoal occurs in both samples at volumes of >1ml (SA760) and >2ml (SA761), the latter having three fragments >2mm in size. Larger fragments of wood charcoal were also observed and handpicked during section cleaning. This indicates a potentially significant wood charcoal assemblage for further study.

At the current time and on the basis of just two samples no reliable inferences about plant use or activity at the site can be made, but a potentially rich and informative archaeobotanical assemblage is attested.

| **Sample** | **760** | **761** |
|---|---|---|
| **vol. (L)** | 21 | 16 |
| **No. of items per litre** | 1.3 | 4.9 |
| ***Triticum/Secale* type grain** | 0 | 1 |
| **Large grass indeterminate (non-*Stipa*) grain** | 3 | 3 |
| ***Triticum* (non-*Einkorn*) glume type** | 0 | 1 |
| **Small grass (*Phleum*-type) grain** | 3 | 14 |
| **Small grass indeterminate grain** | 0 | 2 |
| | | |
| ***Lens* sp.** | 6 | 16 |
| **cf. *Pisum* sp.** | 1 | 0 |
| **Large-seeded legumes indeterminate** | 7 | 11 |
| **Small-seeded legumes indeterminate** | 0 | 1 |
| | | |
| ***Linium* sp.** | 0 | 2 |
| | | |
| ***Papaver* sp.** | 2 | 9 |
| | | |
| **nutshell (thick *Pistacia*-type)** | 1 | 5 |
| **nutshell/fruit (*Prunus*-type)** | 1 | 2 |
| **nutshell indeterminate** | 1 | 1 |
| | | |
| **Phragmites culm** | 1 | 0 |
| | | |
| **Other potentially identifiable remains** | 2 | 11 |
| **Total no. of items** | 28 | 79 |

Table 10.5. Major categories of plant macrofossil remains from sampling of Shimshara

## Discussion

To date, work on the macrobotanical remains from Bestansur and Shimshara is highly provisional and it is too early to attempt to draw any conclusions as to the activities and processes that generated these archaeobotanical assemblages. However, some general patterns can be observed that may provide a useful basis for future interpretations.

Table 10.6 broadly compares the Bestansur and Shimshara assemblages with other contemporaneous sites from the eastern side of the Fertile Crescent, including Sheikh-e Abad (Matthews *et al.* in press).

| | | | **legumes** | | | **cereals** | | | **flax** |
|---|---|---|---|---|---|---|---|---|---|
| **phase** | **site** | **site phase** | lentil | bitter vetch | pea | barley | wheat | indet | flax |
| **PPNA** | Sheikh-e Abad | Tr 1 | | | | | | | |
| | Chogha Golan | | | | | + | + | + | |
| | Chia Sabz | | + | + | | + | + | + | |
| **PPNB** | **BEST** | **Tr 7** | **+** | **+** | **+** | **+** | **+** | **+** | |
| | Nemrik | | | + | + | | | | |
| | Qermez Dere | | | + | | + | | | |
| | Sheikh-e Abad | Tr 2 | + | + | + | + | + | + | |
| | M'Lefaat | | | + | | + | + | | |
| | Sheikh-e Abad | Tr 3 | + | + | | + | | | |
| | Abdul Hosein | | + | | | + | + | | |
| | Ganj Dareh | | + | + | + | + | | + | |
| | Ali Kosh (Bus Mordeh) | | | | | + | + | | + |
| **PPNB - ceramic neolithic** | Jarmo | | + | | + | + | + | | |
| | Ali Kosh (Ali Kosh) | | + | | | + | + | | + |
| | **SHIM** | **lower** | **+** | | | | **+** | **+** | **+** |
| | **SHIM** | **centre** | **+** | | | | | **+** | |

Table 10.6. Comparison of some of the major categories of important plant resources at sites in the eastern Fertile Crescent. NB.no distinction is made in this table as to wild and/or domestic status.

Based on their rough phases of occupation, both Bestansur and Shimshara seem to conform to the general pattern of the region, with earlier sites indicating the variable use of wild and/or domestic crops and later sites demonstrating a more narrow focus on a uniform domesticated crop ‘package’ (Zohary and Hopf 2000). The limited sample size at Shimshara leaves open the possibility that plant categories (as shown in Table 10.6) currently absent at the site may likely be later evidenced after a more extensive programme of sampling has been undertaken.

At both sites legumes are relatively ubiquitous and abundant. Lentils are one of the best-represented crop types throughout the Early Neolithic in the eastern Fertile Crescent and the wild lentil (*L. orientalis*) is locally common along the western Zagros range at higher altitudes (Zohary and Hopf 2000). Lentils are significant at Bestansur in terms of preservation and abundance and appear deposited as small concentrations in three cases. The discrete nature of the three lentil deposits indicates that they are most likely the result of a single action and/or event which we can now date to the Early Iron Age.

Macrobotanical evidence to date has indicated a potentially informative assemblage at Shimshara that includes significant wood charcoal remains. In contrast at Bestansur charred plant remains occur in low density and are often poorly preserved, with discrete deposits such as the lentil samples being the exception to the rule. This may reflect a difference in the use of these sites and we can speculate that Bestansur may represent an open-air site with more temporary phases of occupation and Shimshara a more permanent tell site. Continued analysis and sampling at both Bestansur and Shimshara will allow us to address more adequately these differences, interpret the use and management of plant resources at the sites and contextualise these within the emergence of early farming communities in the eastern Fertile Crescent.

# Chapter Eleven: Ethnography of Animal Husbandry, Bestansur

Sarah Elliott, Robin Bendrey, and Kamal Rouf

## Research context and rationale

To contribute towards the framework of archaeological analysis currently being carried out at the Aceramic Neolithic site of Bestansur we began preliminary ethnoarchaeological research aimed at understanding how modern families use and manage their livestock within the local landscape and the exploration of possible traces of this use, in particular signatures for penning. Understanding the interplay of the varying environmental factors at a local and regional level, and their influences on animal husbandry (e.g. Bendrey 2011) and arable farming practices (e.g. Dreslerová *et al.* 2013) are essential for developing understanding of animal and plant use and economies at and around the Neolithic site of Bestansur.

### *Background to ethnoarchaeology in the Zagros region*

This ethnographic research will be compared and integrated with existing ethnoarchaeological research in the Zagros and within modern animal grazing, foddering and dung studies. Ethnographic research carried out in the Kermanshah area has involved investigating village architecture, layout and use. This research employs the use of ethnographic studies to build models for societal and cultural behaviour patterns (Kramer 1979, Watson 1979, Kramer 1982). Modern animal dung studies to date have involved the identification of animal dung and animal penning/stabling, the study of specific grazing and foddering regimes, studying the formation histories of the dung deposits, the study of dung derived plant remains specifically the survival of plants in dung and secondary use of dung as fuel and fertilizer (Charles 1988, Charles *et.al* 1998. Hall and Kenward 1998, Kenward and Hall 1997, Halstead and Tierney 1998, Anderson and Ertug-Yaras 1998, Zimmermann 1999, Shahack-Gross 2011, Forbes 2012, Wallace and Charles *in prep*).

### *Linking ethnography, isotopes and past landscape and resource use*

There is significant debate as to the expression of practices of mobility in the archaeological past. Such research has often been hampered by the fact that mobile groups often only leave behind only ephemeral traces (Cribb 1991). Within the Near East, recent research by Porter (2012) is arguing for a re-positioning of ideas on the degree of mobility of the population in later prehistory (the 4$^{th}$-2$^{nd}$ millennia BC) and that archaeological models should be based more on the evidence than assumptions. Our research on the landscape around Bestansur will attempt to consider the availability of geographically and seasonally discrete resources, interview local families to understand current and historically recent patterns of land use (especially involving livestock movement), and link this in with knowledge on the full range of mobile subsistence practices in the region, from sedentary farming through to fully mobile pastoralism (e.g. Abdi 2003; Gilbert 1983; Hole 1978; Porter 2012; Roux 2007).

In recent years, it has become possible to directly test assumed patterns of archaeological mobility for past cultures through the analysis of the isotopic composition of preserved skeletal tissues that can be used as proxies for understanding geographical origins and movements of the individuals concerned (Balasse et al. 2002; Bendrey et al. in press; Mashkour et al 2005; Tafuri et al. 2006). Our on-going programme aimed at isotopically mapping the local landscape will produce information on the local biosphere values (Bendrey et al. 2012). It is then aimed that archaeological specimens from Bestansur will be analysed and the isotopic compositions generated compared to our control 'map' of the local region, to test our landscape-movement models based on our ethnographic data for the local area and the wider context of the published literature, with which to interpret past mobility in the landscape and resource use.

## Research aims and objectives

This research aims to integrate a number of data sets focussed on complementary research questions which when applied in the integrated programme outlined here will address a number of problems, from specific methodological issues to wider research themes in Near Eastern archaeology:

- Questionnaire – investigating modern husbandry practices within local landscape and the environmental context
- Landscape characterisation – identify and define different local landscape domains
- Isotopes – our research aims to map geographical and seasonal variation in locally available biosphere isotopic values to act as control data for later study of archaeological specimens (Bendrey et al. 2012)
- Dung – investigating diet: grazing/foddering and the environmental and ecological evidence inferred from the signatures produced by the dung remains. Secondary product use, dung being used as fuel. Relating evidence from animal dung back to archaeological signatures.

## Methodology

***Questionnaire***

Three families were selected for questioning in the summer 2012 field season. Two families provided information on current animal husbandry and use, and one (an elderly couple) on the practices of *ca.*70 years ago. The two families selected for information on current practices were selected as their animal husbandry practices significantly varied in terms of the numbers of animals and also the 'output' production of the husbandry (i.e. home consumption → local village consumption → region market consumption). One family had large herds while the other only a few animals. All of the informants were questioned regarding: general census of animals within a family and details of herd demographics, grazing practices (hours and geographical range), supplementary feed (source and frequency given) and also secondary product use.

***Dung***

We carried out systematic sampling of animal dung from animal pens in order to carry out analysis on known samples. The creation of comparative work and reference collections will aid archaeological interpretation. Phytoliths survive in the dung and can provide a useful tool in archaeology for analysis of animal diet and inferring environment/ecology (Shahack-Gross, 2011, Ghosh *et al.*, 2008, Portillo *et al.*, 2010). Calcareous spherulites are produced in the gut of animals during digestion and survive passage through the animal, they survive in dung deposits and are easily identified microscopically (Canti 1998). Numbers of faecal spherulites vary between species with sheep and goat being prolific producers of spherulites. Highest numbers of spherulites are produced by ruminnant herbivores, numbers are low in omnivores and low-absent in carnivores (Canti 1999).

## Results

The following lays out preliminary findings from the research undertaken in summer 2012.

***Questionnaire results - local landscape and ecology***

Characterisation of the local landscape indicates a number of clearly definable local ecological and functional domains around the modern village of Bestansur, in a southwest-northeast landscape transect selected (Figure 11.1). This work is undertaken with the caveat that present-day environmental variables do not necessarily correspond with those in prehistory. Discussions with all informants indicated geographically and seasonally discrete animal husbandry practices across these domains (Figure 11.2). Two primary factors seem to be driving these patterns: integration of animal husbandry with arable farming (keeping animals off fields during crop, but pasturing them on fallow fields after harvest to allow manure to be applied directly to the fields) and seasonal fluctuations in local climate and availability of vegetation (e.g. snows precluding herding).

The interview with the elderly couple, concerning practices *ca.*70 years ago, allowed understanding of the recent changes in animal husbandry and use brought about by modern innovation and changes in the landscape. Notably, the construction of the road to the northeast of the village largely limits the extent of movement of animal herds from the village, whereas *ca.*70 years ago animal were pastured in the limestone foothills for *ca.*3months during lambing. The latter is a practice that is potentially archaeologically definable from preserved isotopic records [if it is proves possible to distinguish between strontium biosphere values of the limestone foothills and the fields of the farmed alluvial plain (see Bendrey *et al*. 2012)].

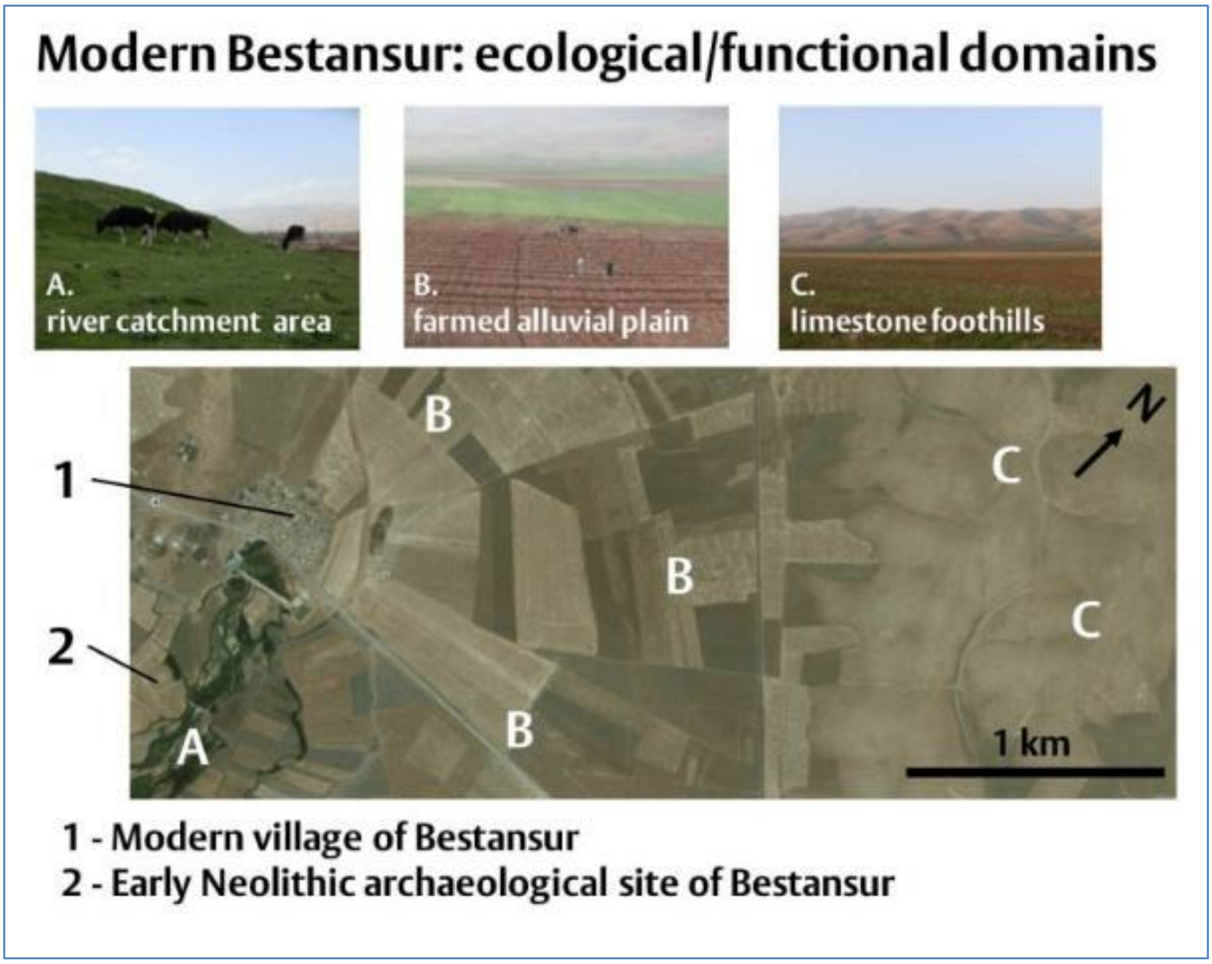



Figure 11.1. Ecological and functional domains, Bestansur, Iraqi Kurdistan.

| | Spring | Summer/Autumn | Winter |
|---|---|---|---|
| *Present day* | daily grazing near the river (**D**) | daily grazing in fallow fields (**E**) | some grazing by river, but mostly fed at houses in the village |
| *c.70 years ago* | three months in the hills (**F**) | daily grazing in fallow fields (**G**) | some grazing in hills, but not in snow; mostly fed at houses |

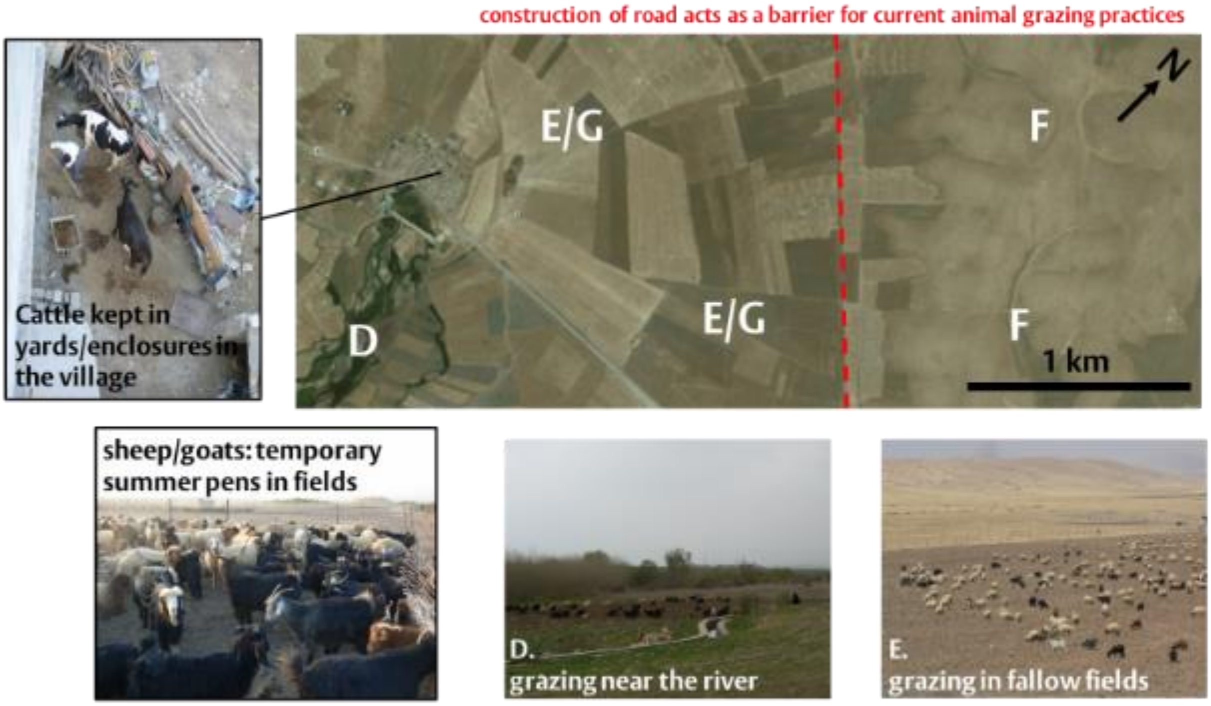



Figure 11.2. Past and present seasonal husbandry and land-use practices around Bestansur, Iraqi Kurdistan

***Questionnaire results - Animal use***

The interviews with informants also produced a range of information on the availability and use of animal products (Figure 11.3). There were some marked differences between the practices of the informants today and the practices of families *ca.*70 years ago. For example, the older generation in their childhood employed the use of dung as a fuel on fires to bake bread. Dung 'bricks' were made seasonally, during the warmer months, as during the winter conditions do not allow the 'bricks' to dry properly. Since the advent of gas, dung is no longer used as a fuel by the families in Bestansur today.

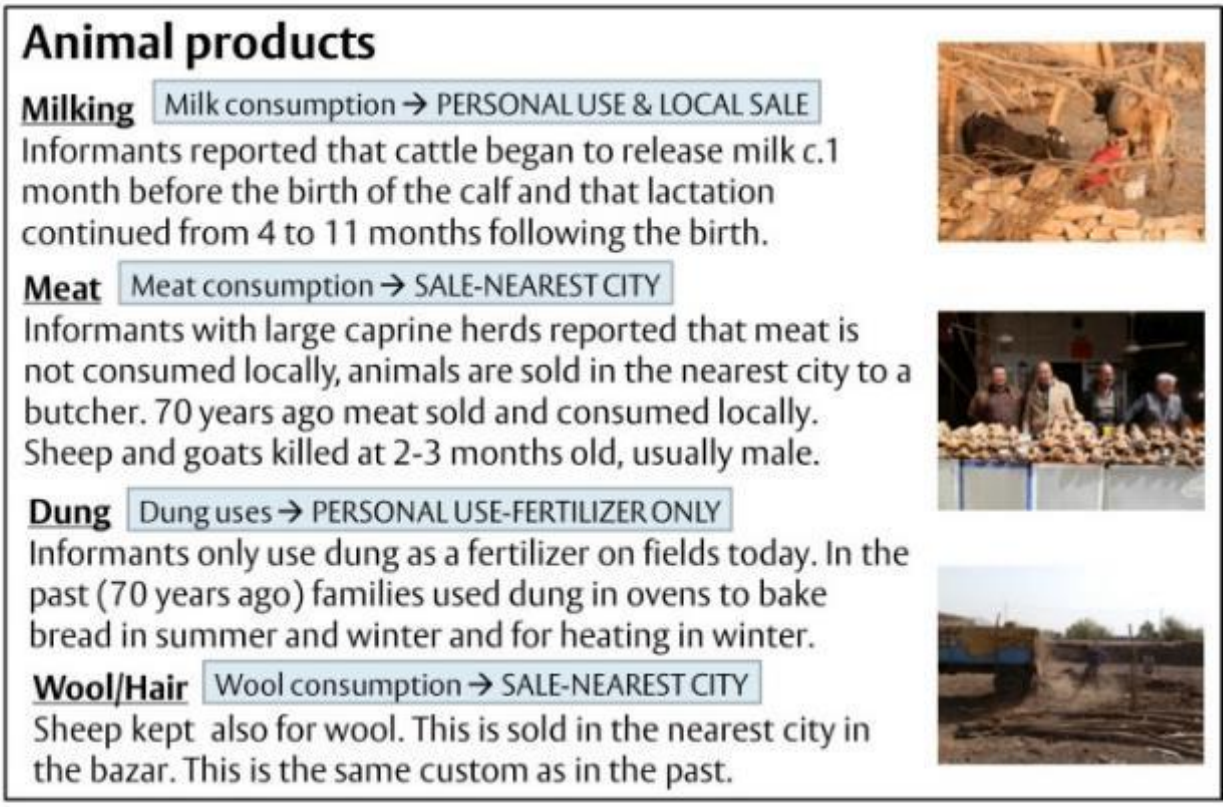



Figure 11.3. Animal products indicating the main use within the informants questioned

***Dung***

The interviews with informants (two families only) provided information on the foddering and grazing practices of the animals. Thus, the diets for the different groups of animals was established. Analysis of phytoliths extracted from the dung samples which were collected in the pens of these animals could therefore be related back to a known diet. Collecting samples from both goat pens and cow sheds enabled a comparison between different dung types. The dung samples have been analysed for phosphorus values, spherulite content and phytolith assemblages.

Phosphorus values for cow dung on average are twice the value of the sheep/goat dung (Table 11.1.). The spherulite numbers are very high in sheep/goat dung but low or non-existent in the cow dung (Table 11.1). On average phytolith numbers are slightly higher in the cow dung when compared with the average number in the sheep/goat dung. The phytolith assemblages vary between the two types of dung with sheep/goat dung having a mainly monocotyledon assemblage but with a dicotyledon component. The cow dung on the other hand is mainly composed of monocotyledonous phytoliths.

# Penning signatures/dung analysis

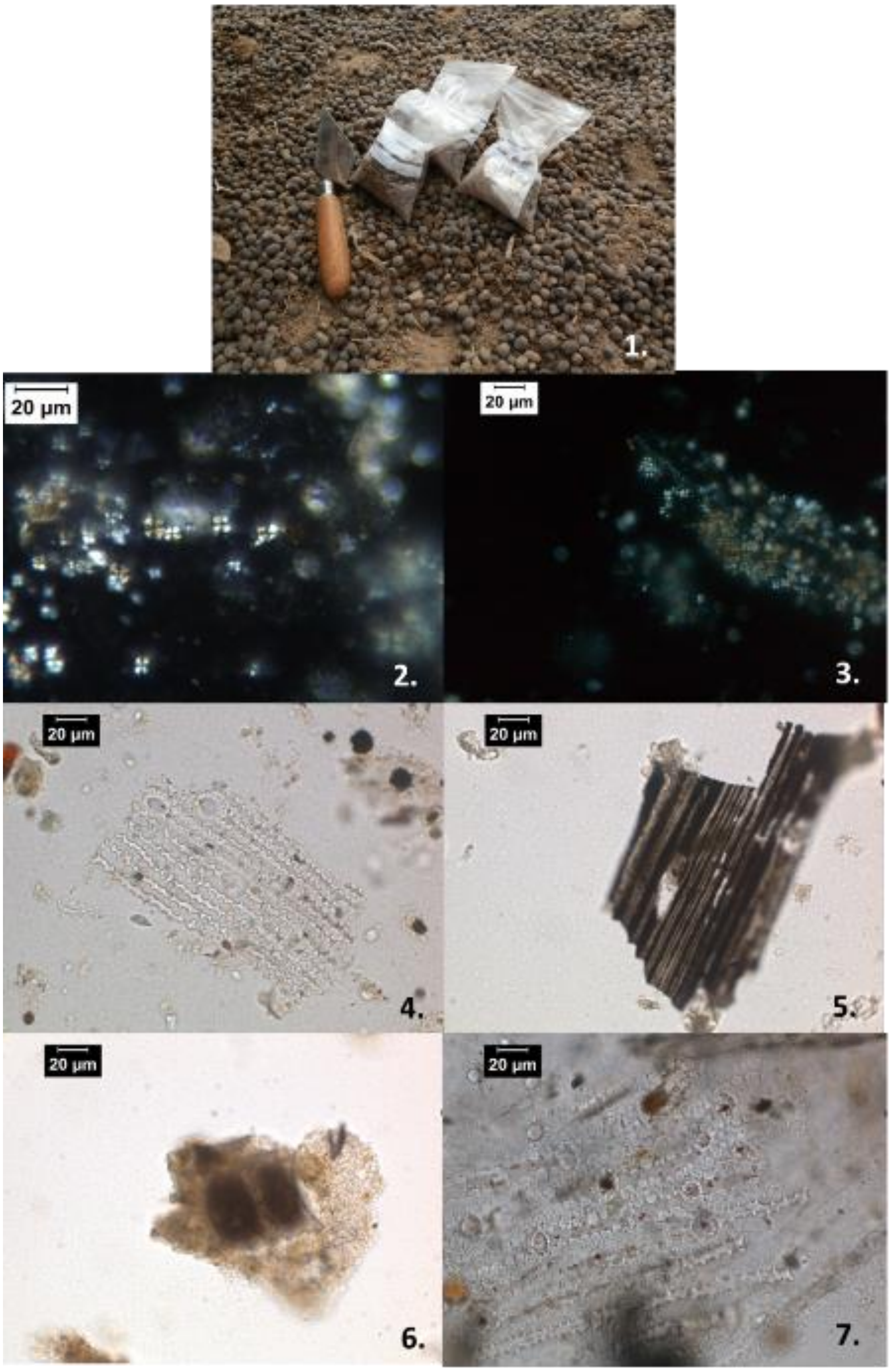



Figure 11.4. Phytoliths and spherulites have been extracted and quantified from the dung collected from sheep/goat pens and cow sheds in Bestansur.

1: Dung samples being collected from sheep/goat pens. 2: Spherulites from sample 'Ata goat/sheep 2'. 3: Spherulites from 'Ata goat/sheep 3'. 4: Multicelled elongate dendritic husk phytoliths from *Hordeum* (barley) from 'Ata goat/sheep 4'. 5: Multicelled elongate smooth phytolith from grass stem/leaves from sample 'Ata cow far end'. 6: Stacked multicelled bulliform phytoliths from *Phragmites* (reed) from sample 'Umaid cow 1'. 7: Multicelled elongate dendritic husk phytoliths from *Triticum* (wheat) from sample 'Cow dung heap'

| | Phosphorus (ppm) | Spherulites | Phytoliths (total no.) | Monocotyledons (%) | Dicotyledons (%) | Known Diet (based on data from informants) | Plants identified from phytoliths (parts and/or genus) |
|---|---|---|---|---|---|---|---|
| **Sheep/goat dung** | | | | | | | |
| **Ata Goat/sheep 1** | 9346.61 | 1194 | 47 | 83 | 17 | Grass, wheat, barley (grazed on fields after harvest) | awns, barley, leaf/stem, reed stem, wheat |
| **Ata Goat/sheep 2** | 5087.16 | 2210 | 59 | 89 | 11 | Grass, wheat, barley (grazed on fields after harvest) | awns, barley, leaf/stem, reed stem, wheat |
| **Ata Goat/sheep 3** | 4699.76 | 962 | 69 | 91 | 9 | Grass, wheat, barley (grazed on fields after harvest) | leaf/stems, reed, wheat |
| **Ata Goat/sheep 4** | 6333.97 | 1456 | 69 | 96 | 4 | Grass, wheat, barley (grazed on fields after harvest) | awns, barley, leaf/stem, reed stem, wheat |
| **Ata Goat/sheep 5** | 7390.26 | 1554 | 63 | 93 | 7 | Grass, wheat, barley(grazed on fields after harvest) | awns, barley, leaf/stem, wheat |
| **Umaid sheep** | 1879.87 | 4 | 48 | 100 | 0 | Barley, straw, weeds, tree leaves, tree bark, plastic | awns, barley, leaf/stems |
| **Average:** | **5789.605** | **1230** | **59** | **92** | **8** | | |
| **Cow dung** | | | | | | | |
| **Ata cow near door** | 15384.5 | 0 | 96 | 100 | 0 | Grass, wheat, barley (grazed on fields around river) | awns, leaf/stems, wheat |
| **Ata cow far end** | 15674.53 | 0 | 108 | 100 | 0 | Grass, wheat, barley (grazed on fields around river) | awns, barley, leaf/stems |
| **Umaid cow 1** | 6785.37 | 2 | 99 | 100 | 0 | Barley, straw, grass (grazed on fields around river) | leaf/stems, reed stems, wheat |
| **Umaid cow 2** | 3865.2 | 0 | 51 | 98 | 2 | Barley, straw, grass (grazed on fields around river) | leaf/stems, barley |
| **Cow dung heap** | 11812.88 | 1 | 95 | 97 | 3 | Barley, straw, grass (grazed on fields around river) | awns, barley, leaf/stems, reed leaf |
| **Average:** | **10704.496** | **0.6** | **89.8** | **99** | **1** | | |

Table 11.1. Results of phosphorus values, spherulite and phytolith extraction from modern dung samples. Numbers of spherulites and phytoliths counted in 20 fields of view counted at x400 magnification. Phytoliths divided by monocotyledons (grasses) and dicotyledons (shrubs and trees) and an indication of any specific plant material identified.

## Discussion and future directions

These preliminary results from a small initial dataset collected in the summer 2012 indicates a huge wealth of information which is embedded in local rural communities which can be readily accessed and utilised to aid archaeological interpretation. The marked differences between families with large and small herds as well as the contrast to practices just 70 years ago highlights the need for extensive investigation into valuable local knowledge.

Analysis of dung samples from known animals enables the assessment of variation in spherulite production, phytolith concentration and phosphorous values across different species. This can be used to interpret variation in archaeological dung signatures found across Early Neolithic sites. Micromorphological thin sectioning of the dung samples still needs to be carried out in order to compare archaeological dung in thin section to these modern samples to look at microstructure, microlaminations and the of compacted dung. In the future we also need to integrate pastoral and arable parts of farming, as this is an essential consideration for the elaboration of early Neolithic practices (e.g. Bogaard 2005; Henton 2012). Future expansion of the dataset is required, with additional families (locally and regionally), including modern plant use and tracking of grazing herds integrated with plant sampling (with Jade Whitlam). It is important to be able to see first-hand what the animals are grazing as initial results show some disparity between data provided by the informants and the results from the dung analysis. For example, informants told us that the animals did not graze on reeds down by the river (he thought that the reeds were bad for them), but in many cases reed phytoliths were present in the animal dung.

The aim is that this programme of ethnoarchaeological research will also integrate closely with our on-going research on analysis of mapping modern landscape isotopic and ecological variables (Bendrey et al., 2012). Modern behaviours can suggest testable patterns for past practices within the same topographical and ecology contexts (e.g. seasonal use of different altitudes for animal grazing, etc), and that if these areas are distinguishable by analyses of the modern biosphere, we may then be able to infer past use of these areas from isotopic analysis of archaeological finds (e.g. enamel in animal teeth formed at different seasons (e.g. Bendrey et al. in press; Balasse *et al.* 2002)). It is essential to understand the full social and environmental context for integrated farming systems, to explore the drivers behind mobility, such as how mobile herding practices may be associated on differing local resource pressures.

In the Spring 2013 season we aim to double our dataset with carrying out questionnaires and sampling of modern dung. In addition to this, further investigation and experimental work needs to be employed. In addition to learning about grazing practices though discussion with informants, we aim to accompany a shepherd and cow herder for a day to follow the herds and carry out a programme of GPS mapping of mobility (times spent at different locations) and plant collecting so that we can see first-hand what the animals are grazing on and for how long in specific ecological zones around Bestansur. Some experimental dung burning will also be carried out to assess the changes which occur in dung signatures as a result of exposure to fire. The changes that will be assessed are those in chemistry and the preservation of faecal spherulites and phytoliths. This can therefore be related back to the secondary use of dung as a fuel in hearths in the Neolithic.

## Acknowledgements

We would especially like to thank the families of Bestansur who invited us into their homes and kindly answered our questions, and also Dr Wendy Matthews and Prof Roger Matthews for encouraging us in this research.

# Chapter Twelve: Chipped Stone Tools and Debitage from Bestansur and Shimshara

Roger Matthews and Zoe Robinson

## Introduction

Chipped stone tools and debitage are one of the most significant and ubiquitous forms of material culture from Bestansur, and they can inform us on a range of issues including access to, movement of, and use of raw materials, knapping and production procedures, and spatial distribution of lithic-related activity across space within the settlement. The archive report for the spring 2012 season at Bestansur gives a full account of the recovery and recording methods employed in processing lithic materials from excavations at the site, and that information is not repeated here (Matthews and Richardson 2012). Portable x-ray fluorescence analyses of cherts and obsidians are discussed in the following chapter.

In this preliminary report we focus on the use of lithic materials and the distribution of tool types through space and time in Trench 7 at Bestansur, with an emphasis on evidence for *in situ* activity as attested by chipped stone materials lying directly on floor surfaces or within occupation debris. We conclude with an initial appraisal of the chipped stone material recovered from section work at Shimshara on the Rania Plain.

## Bestansur Trench 7: selection of excavated contexts

The presence of both internal and external contexts in Trench 7 allows us to make meaningful comparisons between these types of context, while the stratified sequence of surfaces and occupation deposits in the external area enables a diachronic analysis of chipped stone use. See Chapter 3 for plan and matrix in order to situate these contexts. Excavated contexts selected for this study are presented in Table 12.1.

| Context no | Context type | Area type | Space no |
|---|---|---|---|
| 1274 | Surfaces/occupation | External | 17 |
| 1261 | Burnt? | External | 17 |
| 1259 | Surfaces/occupation | External | 17 |
| 1254 | Surfaces/occupation | External | 17 |
| 1248 | Surfaces/occupation | External | 17 |
| 1220 | Surfaces/occupation | External | 17 |
| 1226 | Lower pit fill | External | 17 |
| 1218 | Upper pit fill | External | 17 |
| 1249 | Surfaces/occupation | External | 18 |
| 1227 | Occupation | External | 18 |
| 1225 | Occupation | External | 18 |
| 1275 | Occupation | External | 22 |
| 1255 | Occupation | Internal | 16 |
| 1280 | Occupation | Internal | 16 |
| 1243 | Occupation | Internal | 16 |
| 1229 | Occupation | Internal | 16 |
| 1253 | Room fill | Internal | 19 |
| 1266 | Room fill/floors | Internal | 20 |
| 1268 | Occupation | Internal | 20 |
| 1224 | Fill of human burial | Burial | 17 |

Table 12.1. Excavated contexts studied in this chapter.

## Bestansur Trench 7: analysis of chipped stone debitage

Table 12.2 and Fig. 12.1 graphically demonstrate the differential distribution of chipped stone debitage across the context types excavated in Trench 7 at Bestansur. The internal spaces of the building are significantly lacking in lithic debris, and the fill deposits of the human burial and of the clay-lined pit also have low quantities of chert and obsidian pieces. External surfaces and occupation deposits, by contrast, have high quantities of both chert and obsidian, particularly the former, and individual pieces are larger than those found in internal spaces. This pattern agrees with that for other forms of material evidence, supporting the interpretation that internal spaces were kept very clean while debris was allowed to accumulate in external areas.

Also notable here is the more careful curation of obsidian as against chert, as attested in the much lower average weight of recovered obsidian pieces (0.16g) against chert pieces (0.60g) (Fig. 12.2). This pattern is common in all deposits, both within Trench 7 and in other trenches excavated in spring 2012. It suggests that obsidian was reworked into ever smaller tools through time to maximise usage of a cherished material arriving at Bestansur from afar while chert was more freely and locally available.

| **Context type** | **Area type** | **Chert (g)** | **Chert (no)** | **Chert (av g)** | **Obsidian (g)** | **Obsidian (no)** | **Obsidian (av g)** | **Space no** | **Context no** |
|---|---|---|---|---|---|---|---|---|---|
| Fill of human burial | Burial | 3.31 | 18 | 0.18 | 0.36 | 4 | 0.09 | 17 | 1224 |
| | | **3.31** | **18** | **0.18** | **0.36** | **4** | **0.09** | | |
| | | | | | | | | | |
| Occupation | Internal | 1.10 | 7 | 0.16 | 0.00 | 0 | 0.00 | 16 | 1229 |
| Occupation | Internal | 2.31 | 10 | 0.23 | 2.16 | 19 | 0.11 | 16 | 1243 |
| Occupation | Internal | 0.00 | 0 | 0.00 | 0.36 | 5 | 0.07 | 16 | 1255 |
| Occupation | Internal | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 20 | 1268 |
| Occupation | Internal | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 16 | 1280 |
| | | **3.41** | **17** | **0.20** | **2.52** | **24** | **0.11** | | |
| | | | | | | | | | |
| Room fill | Internal | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 19 | 1253 |
| Room fill/floors | Internal | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 20 | 1266 |
| | | **0.00** | **0** | **0.00** | **0.00** | **0** | **0.00** | | |
| | | | | | | | | | |
| Surfaces/occupation | External | 20.55 | 17 | 1.21 | 1.25 | 11 | 0.11 | 17 | 1220 |
| Surfaces/occupation | External | 0.66 | 5 | 0.13 | 0.65 | 4 | 0.16 | 17 | 1248 |
| Surfaces/occupation | External? | 11.47 | 10 | 1.15 | 5.43 | 6 | 0.91 | 18 | 1249 |
| Surfaces/occupation | External | 23.70 | 17 | 0.91 | 3.76 | 28 | 0.13 | 17 | 1254 |
| Surfaces/occupation | External | 2.05 | 3 | 0.68 | 0.40 | 5 | 0.08 | 17 | 1259 |
| Surfaces/occupation | External | 22.84 | 30 | 0.76 | 0.16 | 7 | 0.02 | 17 | 1274 |
| | | **81.27** | **82** | **0.99** | **11.65** | **61** | **0.19** | | |
| | | | | | | | | | |
| Occupation | External? | 13.72 | 46 | 0.30 | 0.81 | 7 | 0.12 | 18 | 1225 |
| Occupation | External? | 8.26 | 14 | 0.59 | 0.43 | 3 | 0.14 | 18 | 1227 |
| Occupation | External? | 5.41 | 5 | 1.08 | 0.30 | 1 | 0.30 | 22 | 1275 |
| | | **27.39** | **65** | **0.42** | **1.54** | **11** | **0.14** | | |
| | | | | | | | | | |
| Lower pit fill | External | 0.00 | 0 | 0.00 | 0.30 | 2 | 0.15 | 17 | 1226 |
| Upper pit fill | External | 0.00 | 0 | 0.00 | 0.00 | 0 | 0.00 | 17 | 1218 |
| | | **0.00** | **0** | **0.00** | **0.30** | **2** | **0.15** | | |
| | | | | | | | | | |
| Burnt? | External | 1.14 | 12 | 0.10 | 0.29 | 2 | 0.15 | 17 | 1261 |
| | | **1.14** | **12** | **0.10** | **0.29** | **2** | **0.15** | | |

Table 12.2. Distribution across context types of chipped stone debitage, chert and obsidian.

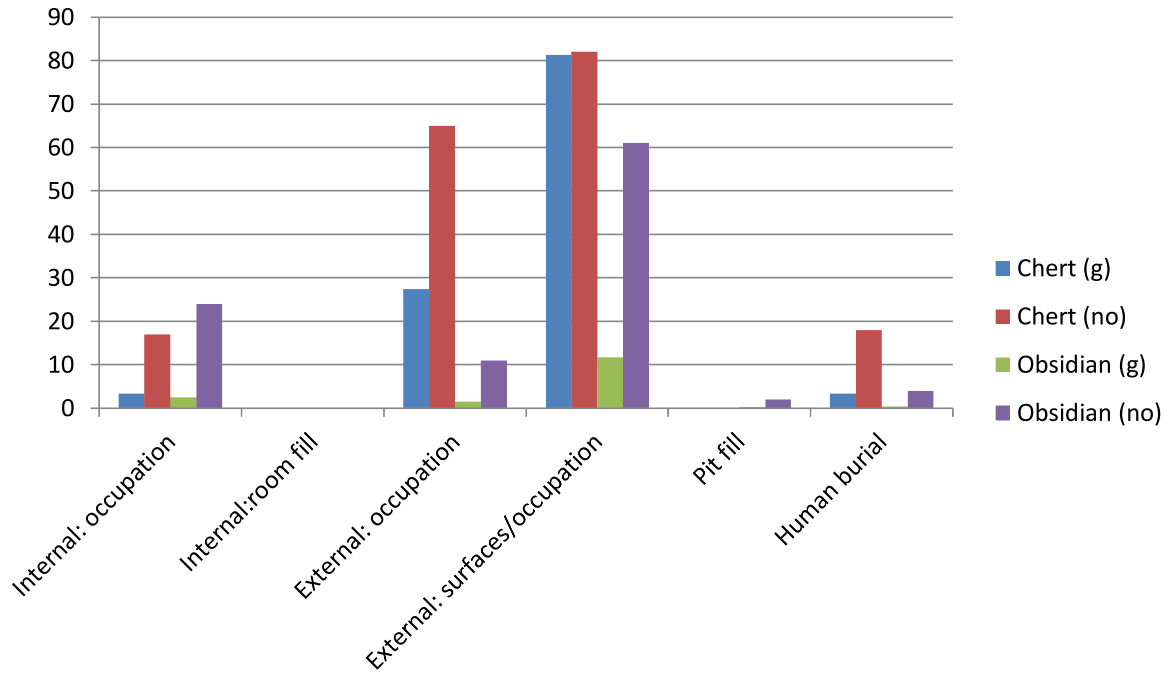



Figure 12.1. Summary distribution by context type of chipped stone debitage, chert and obsidian.

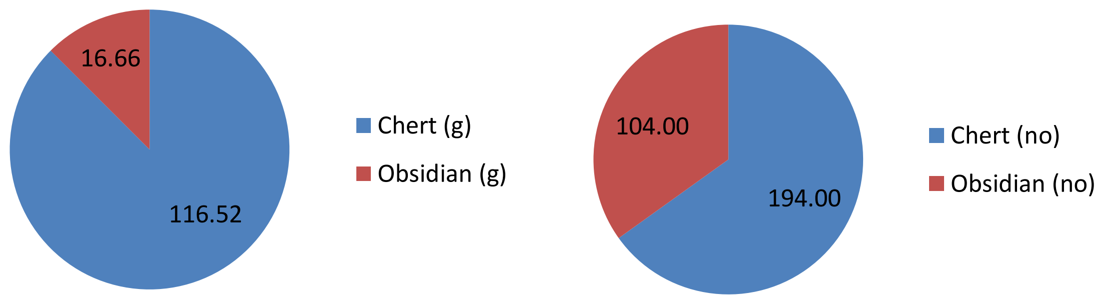



Figure 12.2. Chipped stone debitage: chert against obsidian by weight and by quantity.

## Bestansur Trench 7: analysis of chipped stone tools

Tools are here broadly defined as all blades, whether retouched or not, and all retouched pieces, as well as cores and core trimming elements. Table 12.3 and Fig. 12.3 show the distribution of chipped stone tools of chert and obsidian across the different context types in Trench 7. Again the relatively high representation of tools in external contexts is notable, although two internal occupation contexts, C1243 and C1255, both have significant numbers of tools, particularly of obsidian, which are likely to relate directly to activity within Sp16. The 17 obsidian tools from C1243 and C1255 in Sp16, a room with multiple ground-stone items possibly deposited as off-season storage, comprise 14 unretouched blades, two drill-borers and one diagonal-ended blade. Chert tools from the same contexts include six unretouched blades and one serrated blade.

More generally, the strong representation of obsidian tools as against chert tools (Fig. 12.4) is in sharp contrast to that attested by the debitage (Fig. 12.2). These figures indicate the major significance of obsidian tools within the range of activities carried out by the Early Neolithic occupants of Bestansur, and they underline the considerable care and skill employed by them to maximise the tool-yielding potential of their imported obsidian nodules or blocks.

| Context type | Area type | Chert tools | Obsidian tools | Total tools | Space no | Context no |
|---|---|---|---|---|---|---|
| Fill of human burial | Burial | 8 | 6 | 14 | 17 | 1224 |
| | | **8** | **6** | **14** | | |
| | | | | | | |
| Occupation | Internal | 0 | 0 | 0 | 16 | 1229 |
| Occupation | Internal | 4 | 8 | 12 | 16 | 1243 |
| Occupation | Internal | 3 | 9 | 12 | 16 | 1255 |
| Occupation | Internal | 0 | 0 | 0 | 20 | 1268 |
| Occupation | Internal | 0 | 0 | 0 | 16 | 1280 |
| | | **7** | **17** | **24** | | |
| | | | | | | |
| Room fill | Internal | 3 | 2 | 5 | 19 | 1253 |
| Room fill/floors | Internal | 0 | 0 | 0 | 20 | 1266 |
| | | **3** | **2** | **5** | | |
| | | | | | | |
| Surfaces/occupation | External | 21 | 29 | 50 | 17 | 1220 |
| Surfaces/occupation | External | 6 | 8 | 14 | 17 | 1248 |
| Surfaces/occupation | External | 8 | 14 | 22 | 18 | 1249 |
| Surfaces/occupation | External | 26 | 16 | 42 | 17 | 1254 |
| Surfaces/occupation | External | 6 | 5 | 11 | 17 | 1259 |
| Surfaces/occupation | External | 23 | 27 | 50 | 17 | 1274 |
| | | **90** | **99** | **189** | | |
| | | | | | | |
| Occupation | External | 14 | 11 | 25 | 18 | 1225 |
| Occupation | External | 15 | 15 | 30 | 18 | 1227 |
| Occupation | External | 0 | 3 | 3 | 22 | 1275 |
| | | **29** | **29** | **58** | | |
| | | | | | | |
| Lower pit fill | External | 0 | 2 | 2 | 17 | 1226 |
| Upper pit fill | External | 2 | 1 | 3 | 17 | 1218 |
| | | **2** | **3** | **5** | | |
| | | | | | | |
| Burnt? | External | 13 | 4 | 17 | 17 | 1261 |
| | | **13** | **4** | **17** | | |

Table 12.3. Distribution across context types of chipped stone tools, chert and obsidian.

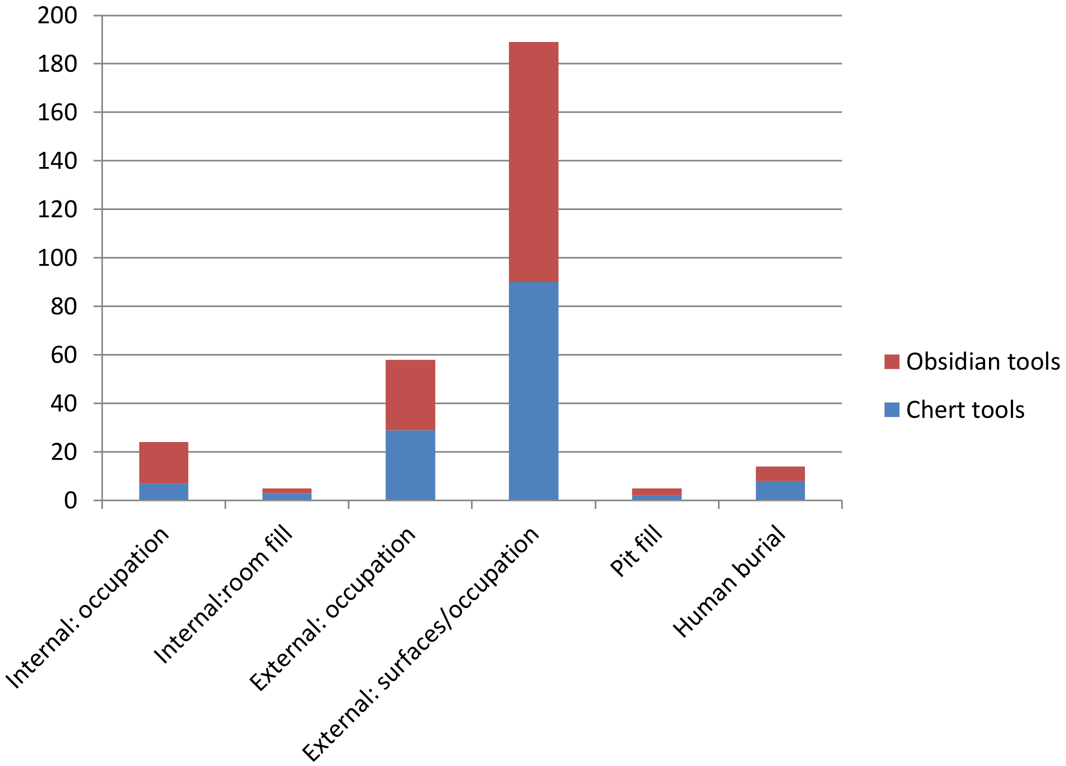



Figure 12.3. Summary distribution by context type of chipped stone tools, chert and obsidian.

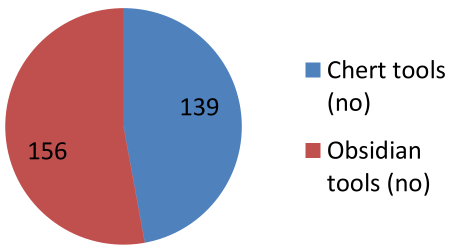



Figure 12.4. Chipped stone tools: chert against obsidian by quantity.

If we remove unretouched blades and bladelets from the analysis, making the provisional assumption that they may relate more to tool production than serve themselves as tools, we can examine the distribution of all other tools and production elements such as cores, as shown in Table 12.4. In fact, it is highly likely that many of the unretouched blades of obsidian, in particular, do represent finished tools, as such pieces can serve as first-class cutting implements without any retouching modification to the blade edge after the blade's initial detachment from the core.

| Context type | Area type | Notched blade | Serrated blade | Blade with burin facet | Diagonal-ended blade(let) | Drill/ borer | Shouldered drill | Scoop/ handle | Blade end scraper | Flake scraper | Point | Core | Space no/ Context |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fill of human burial | Burial | | | | | | | | | | 1 | | 17/1224 |
| | | | | | | | | | | | | | |
| Occupation | Internal | | | | | | | | | | | | 16/1229 |
| Occupation | Internal | | 1 | | | | | | | | | | 16/1243 |
| Occupation | Internal | | | | 1 | 2 | | | | | | | 16/1255 |
| Occupation | Internal | | | | | | | | | | | | 20/1268 |
| Occupation | Internal | | | | | | | | | | | | 16/1280 |
| | | | | | | | | | | | | | |
| Room fill | Internal | | | | | | | 1 | | 1 | | | 19/1253 |
| Room fill/floors | Internal | | | | | | | | | | | | 20/1266 |
| | | | | | | | | | | | | | |
| Surfaces/ occupation | External | 1 | 1 | | | 1 | | | 1 | | | | 17/1220 |
| Surfaces/ occupation | External | 3 | | | | | | | | | | 1 | 17/1248 |
| Surfaces/ occupation | External | 1 | | | | | | | | | | | 18/1249 |
| Surfaces/ occupation | External | 2 | | | 1 | | 2 | | | 2 | | 1 | 17/1254 |
| Surfaces/ occupation | External | 1 | | 1 | | | | 2 | | | | | 17/1259 |
| Surfaces/ occupation | External | 7 | 1 | | 3 | | 1 | | | 1 | | | 17/1274 |
| | | | | | | | | | | | | | |
| Occupation | External | | | | 2 | | | | | | | | 18/1225 |
| Occupation | External | 1 | | | | | 1 | | | | 1 | 1 | 18/1227 |
| Occupation | External | | | | | | | | | | | | 22/1275 |
| | | | | | | | | | | | | | |
| Lower pit fill | External | | | | | | | | | | | | 17/1226 |
| Upper pit fill | External | | 2 | | | | | | | | | | 17/1218 |
| | | | | | | | | | | | | | |
| Burnt? | External | 1 | | | 3 | | | | | | | | 17/1261 |

Table 12.4. Distribution across context types of chipped stone tools excluding unretouched blades and bladelets.

The exclusive occurrence of notched blades, of both chert and obsidian, in external deposits, represented in all contexts of 'surfaces/occupation' type, is especially striking in Table 12.4. This distribution is likely to be related to activities taking place on these surfaces. Notched blades would be useful for trimming and sharpening wooden sticks and implements, perhaps especially tapering and pointed sticks that might be convenient for extracting snails from their shells once cooked, for example, but also for a range of other possible activities such as working of leather, basketry and netting. It may be significant that no obvious Çayönü tools, or fragments thereof, were found in any of the deposits featured in this analysis, although they do occur in other contexts in Trench 7. Whether this apparent absence is a factor of chronology or of functional differentiation of spatial activity is not yet clear. Selected chipped stone tool types are illustrated in Fig. 12.5.

Cores, all of chert, are also found only in external deposits, indicating a preference for tool manufacture in outside areas. Distinctive deposits of associated knapping material include a group of 18 debitage fragments of an unusual red chert from C1225 in Sp18 in the northeast corner of the trench (Fig. 12.6). It has been suggested (Pullar 1975; Kozlowski and Aurenche 2005: 83) that red cherts were especially valued in the Early Neolithic of the Zagros and may have been traded across the region. Certainly this deposit of red chert at Bestansur is markedly different in colour from the cherts commonly employed at the site, and shows evidence for careful knapping. In upper levels of the trench, in C1221, a collection of obsidian fragments of a distinctive fine-grained material indicate *in situ* working of obsidian in areas of Trench 7 (Fig. 12.7).


Figure 12.5. Chipped stone tools from Trench 7, all of chert. Top left: serrated blade from C1218; top right: point from C1224; bottom left: notched blade from C1261; bottom right: shouldered drill from C1274.


Figure 12.6. Red chert knapping debitage from C1225, Sp18.


Figure 12.7. Obsidian knapping debitage and tools from C1221, NE quadrant of Trench 7.

## Chipped stone tools and debitage from Shimshara

Large quantities of chipped stone materials were recovered during section cleaning and analysis at the mound of Shimshara on the Rania Plain. These materials are here discussed in broad terms only as they originate from a single context, C1276, of section cleaning.

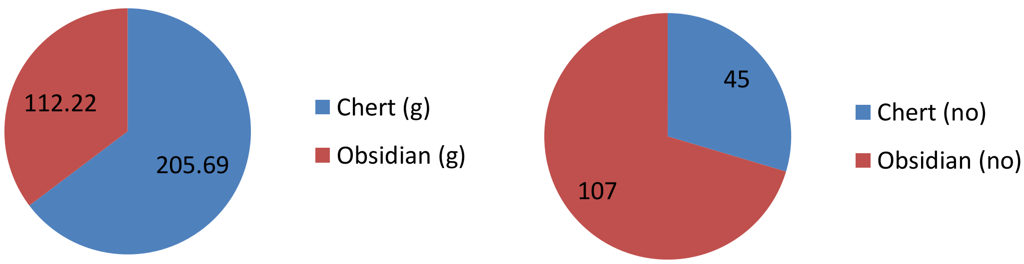



Figure 12.8. Debitage of chert and obsidian, by quantity and weight, from Shimshara.

In terms of debitage from Shimshara, Fig. 12.8 shows that obsidian is much more significant in the Shimshara chipped stone assemblage, both by quantity and by weight, than at Bestansur (Fig. 12.2). While varying recovery and processing methods have doubtless had an impact on the figures, it is also clear that obsidian debitage at Shimshara has a greater average weight than at Bestansur (1.05g as against 0.16g) as does chert debitage (4.57g as against 0.60g).

Turning to tools from Shimshara, 216 tools were identified amongst the recovered materials, of which only 20 are of chert and no fewer than 196 of obsidian (Fig. 12.9), a huge increase over the representation of obsidian in the Bestansur tool assemblage. The strong representation of obsidian in the debitage and tool assemblages from Shimshara likely results from its closer proximity to exploited obsidian sources in Anatolia to the north (Chapter 13) and perhaps also to the location of Shimshara on a key route of north-south communication across the highland zone.

The vast majority of the Shimshara tools are unretouched obsidian blades, but notched blades and scrapers also occur (Table 12.5, Figs 12.10-12.11).

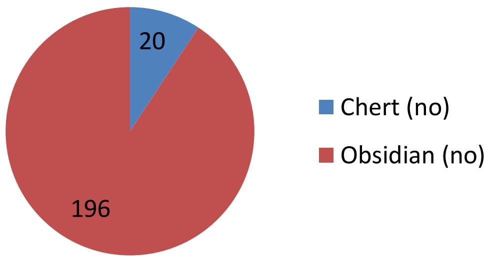



Figure 12.9. Shimshara chipped stone tools: chert against obsidian by quantity.

| | Unretouched blade | Beaked blade | Notched blade | Blade end scraper | Diagonal-ended blade(let) | Serrated blade | Drill/borer | Trapeze | Point | Core trimming elelentn |
|---|---|---|---|---|---|---|---|---|---|---|
| Chert | 17 | | 1 | | | 1 | 1 | | | |
| Obsidian | 165 | 3 | 12 | 6 | 4 | | 1 | 1 | 3 | 1 |

Table 12.5. Chipped stone tool types at Shimshara.

Figure 12.10. Obsidian tools from Shimshara.


Figure 12.11. Obsidian tools from Shimshara.

# Chapter Thirteen: pXRF of Obsidian and Chert

Amy Richardson

## Research context and rationale

The chipped stone assemblages have highlighted the potential of chemical analysis for examining sources and networks of material in the Neolithic. Work undertaken in the course of the Spring 2012 field season demonstrated that obsidians were derived primarily from a single source, but that a secondary source was potentially supplying clear obsidian to Bestansur (see Spring 2012 Archive Report). These results required further investigation of the range of obsidians recovered from Neolithic contexts at Bestansur and further comparison with the archaeological materials from the CZAP sites at Zarzi and Shimshara, as well as with obsidian source materials.

## Research aims and objectives

The continuation of pXRF analysis of cherts and obsidians at Bestansur, and the addition of analyses of materials from Shimshara and Zarzi, aims to better characterise the sourcing of raw materials and the movement of complete stone tools around the Central Zagros. Through inter-site comparisons and identification of sources, this research intends to establish a framework for material networks operating across the region. In establishing an understanding of these networks, the CZAP sites may in future be integrated into the broader landscape, and their pan-regional relationships explored more fully.

## The data-set

Selection of material for analysis was conducted during the course of lithics processing. All cores were analysed, in concordance with protocols established in Spring 2012. Materials of note, both from the chert and obsidian assemblages, were flagged by R. Matthews and Z. Robinson, as were a cross-section of tools from Shimshara. In total, from Bestansur a total of 19 obsidian and 20 chert tools were analysed (see Table 13.1). From Shimshara, nine obsidian tools and four chert tools were selected for analysis (see Table 13.2).

## Research methods and approaches

Analysis of all artefacts was conducted in accordance with the protocols established in Spring 2012, to ensure consistency of results. The Niton XL3t GOLDD+ was run in 'Mining mode', with high, low and main filters operating for 20 seconds, and the light elements analysed for 60 seconds. The analyser was given time to stabilise to high temperature conditions at the beginning of each period of analysis and a full system check run. All readings were recorded in parts per million (ppm). NIST standard samples were run at the beginning and end of each period of analysis to check for drift. All samples were analysed in the tungsten-lined stand.

The silica-rich obsidians are best characterised by their trace elements. For the purposes of preliminary analysis of the obsidians, research has focussed on the zirconium (Zr) and rubidium (Rb) indices, consistent with Spring 2012 analyses. The selection of trace elements for identification may be further tailored to each source, for best accuracy (see Chataigner 1998). On the basis of NIST standard samples run on our analyser and the published values, correctional calibration has been applied to the Zr and Rb values, to ensure comparability with published values for obsidian sources.

Cherts are analysed according to major, minor and trace elements. However, at this stage the analysis of cherts is not anticipated to lead to the identification of sources. Field observations, conducted during the Zarzi Survey in January 2013, have highlighted the presence of abundant nodules of a wide range of stone materials evident across the river valleys. The location of Bestansur, in the foothills of the Zagros mountains, along which the Iraq-Iran border runs, may hinder chert source investigation due to travel restrictions.

## Obsidian results

For the purposes of integrated analyses, the pXRF readings taken during Spring 2012 and Summer 2012 are treated here together. To date, 85 obsidian tools have been analysed, from the sites of Bestansur (BEST), Shimshara (SHIM) and Zarzi (ZARZ). Methodological approaches have been applied with consistency, including the deliberate selection of translucent materials for further analysis. The results have illustrated that amongst the *ca.*1200 obsidian artefacts recovered at Bestansur, the vast majority are derived from a single source, be they cores, tools or debitage. Only six examples of almost perfectly clear obsidian have been identified, accounting for 0.5% of the total assemblage.

At least three distinct repeated signatures have been identified by the Zr/Rb index. The primary source for obsidian supplied to Bestansur can be identified to Lake Van, as is accepted for the Neolithic sites in this region (Cauvin and Chataigner 1998). Moreover, comparison with data for other regional sources appears to indicate that the source is very likely to be at Nemrut on Lake Van (Fig. 13.1). Nemrut may be claimed as the principal source providing obsidian from Eastern Anatolia to the Central Zagros, based on the tools analysed thus far from Bestansur, Zarzi and Shimshara. In fact, at the latter two sites, this appears to be the only source supplying obsidian. A single obsidian tool has been collected by CZAP at Zarzi, from the Hollina mound, across the river from the cave mouth. However, early excavations recovered 2 pieces of obsidian from the cave (Garrod 1930), and subsequent analyses have attributed these also to the Nemrut/Bingöl A group (for a directory of archaeological sites and obsidian sources, see Varoutsikos and Chataigner 2012).

At least two different sources appear to be supplying the rare blades of clear and colourless obsidian to Bestansur ('BEST Clear' and 'BEST Other', Fig. 13.1), the origins of which are more difficult to identify. Nenezi Dag is a known source of clear obsidian (Fig. 13.2), and has been proposed as the source for the single clear obsidian tool recovered during the Spring 2012 season (Tool #374, Trench 4). In the Summer 2012 season, two further colourless pieces that bear a similar chemical signature were identified during the processing (low Zr, low Rb; 'BEST Clear'), Tools #1076 (Trench 10) and #2051 (Trench 11). If Nenezi were the secondary source for Bestansur clear obsidian, this would support arguments for much broader and further-reaching complex networks of Neolithic material interaction; conversely, if Suphan of Lake Van were the source, it would indicate this was in use much earlier than previously known. Thus far, only complete tools in clear obsidian have been recovered at Bestansur, suggesting that these pieces are arriving as complete, worked tools, rather than providing evidence for the long-range transportation of this material. Regardless, the presence of clear obsidian at Bestansur, and its rarity in the eastern Fertile Crescent, let alone the Central Zagros, highlights the possibility for new insights that may be derived from the pXRF results.

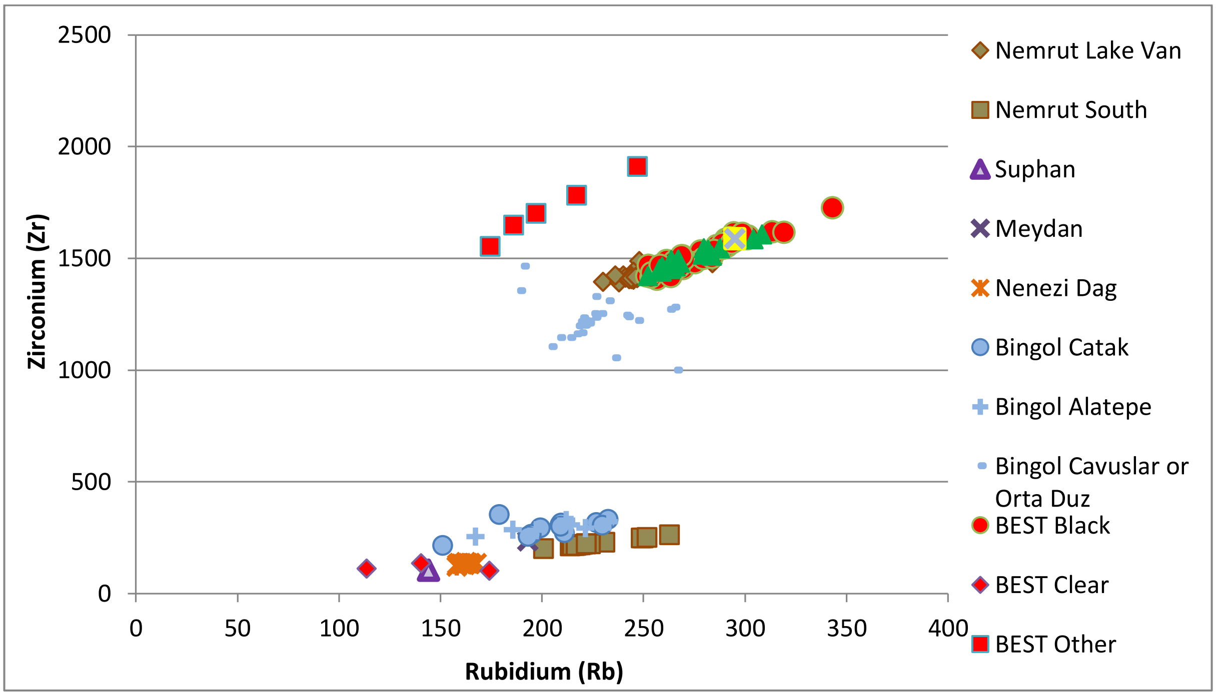



Figure 13.1. Comparison of calibrated pXRF results from CZAP sites and known geological sources.

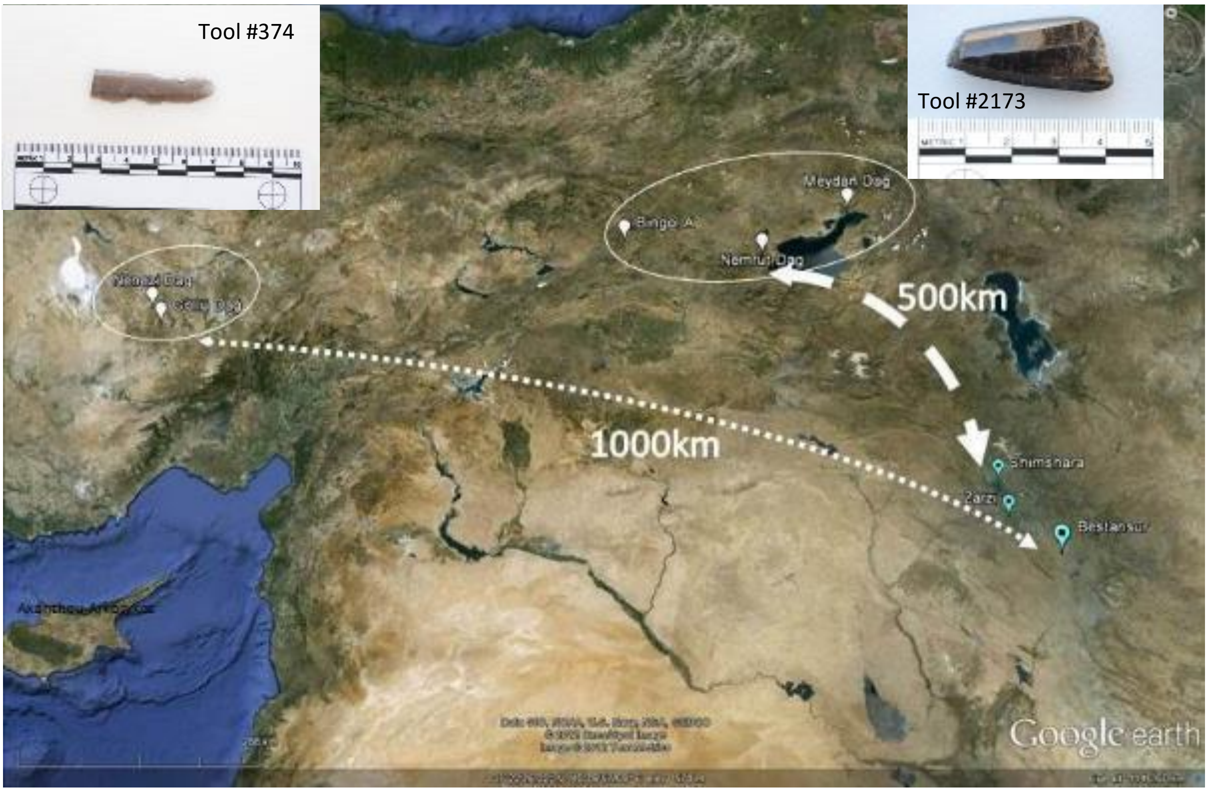



Figure 13.2. Location of likely sources supplying obsidian to CZAP sites.

A third grouping may be observed, with higher Zr and lower Rb than the Nemrut Lake Van sourced material, represented as 'BEST Other' in Fig. 13.1. This group of five obsidian tools represents three grey, translucent blades and bladelets (Tools #1903, #1955, #2143) and two Çayonu tools Tools #1329 and #1312; Fig. 13.3), from Trenches 7 and 11. This unusual grouping may represent anomalies from the

Nemrut group, but further data interrogation is required to exclude the possibility of an alternative source supplying this material to Bestansur.


Figure 13.3. Tool #1312, SF59, Çayonu tool from C1223, Trench 7

## Chert results

The selection of cherts for pXRF analysis followed the same principles as the selection process applied in Spring 2012. All chert cores have been analysed, in order to focus this research on the materials brought to site for working. A few instances of single blades or debitage have been further selected for analysis, where the form or material was considered to be of note.

In analysing the cherts, a few key features may be highlighted. Whereas the identification of chert sources may prove difficult on the basis of geographical limitations, the pXRF analysis of the chemistry can reveal critical features of the resource usage at the sites. For example, simply through the comparison of the major elements present (and detectable by pXRF) in the 20 Bestansur and four Shimshara cherts, it is evident that two major classifications may be immediately identified (Fig. 13.4). The bulk of the assemblage demonstrates a range of Si between 350-500,000ppm (35-40%), with calcite impurities accounting for 10-30,000ppm (1-3%). However, two tools analysed from Bestansur have comparatively low Si and high Ca proportions (Tools #2202, a chopper, and #2102, a pink-brown core; see Table 13.2). Both came from mixed contexts in Trench 11, and may not be indicative of Neolithic material variation. One further outlier may be discussed: a single, tiny, mottled grey, diagonal-ended bladelet (Tool #1552) was run on the 3mm spot. This has indicated a higher proportion of Si than its counterparts (*ca.* 650,000ppm, 65%), and very high Al (Fig. 13.5), though the data may be affected by the restricted surface area available for analysis in this case, or possibly surface residues.

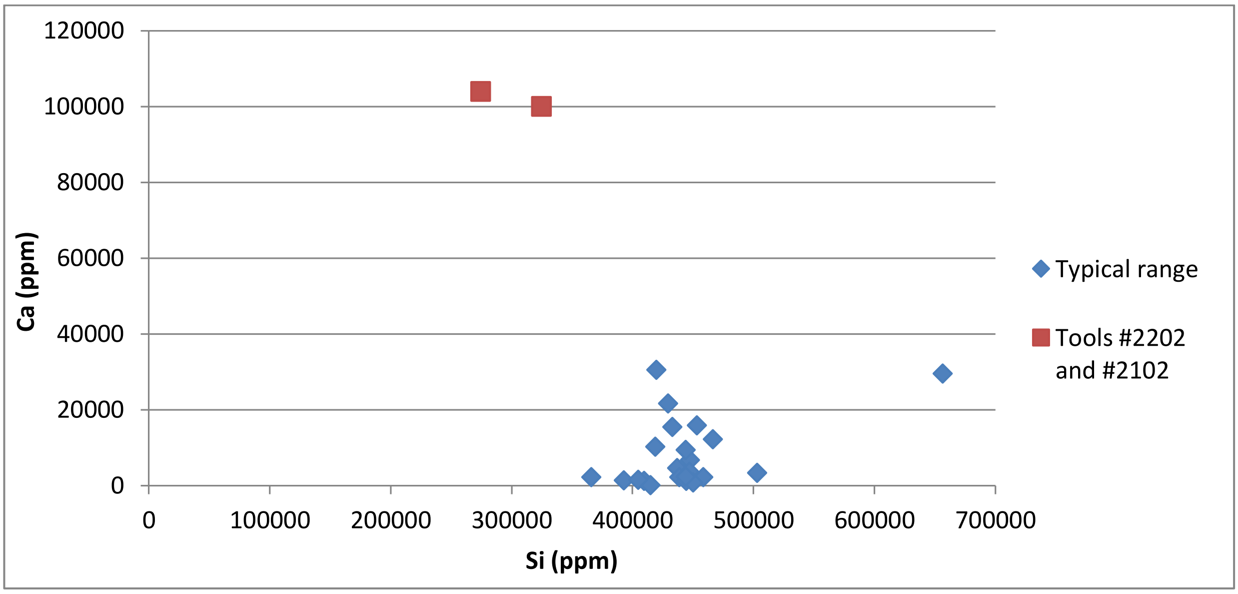



Figure 13.4. Scatter-plot of major elements identified through pXRF analysis (Si, Ca), highlighting typical and atypical values seen in cherts at Bestansur and Shimshara.

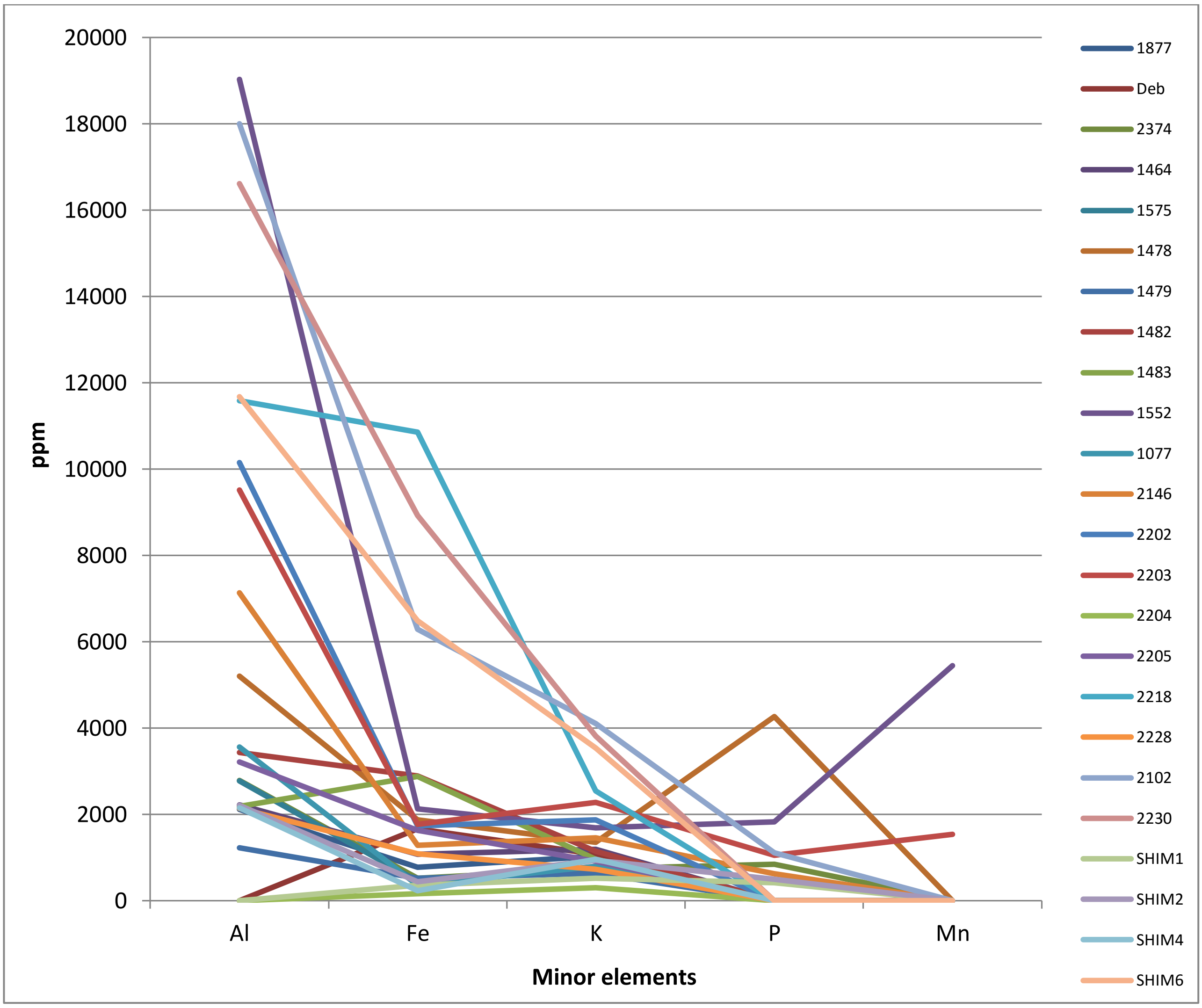



Figure 13.5. Correlation of minor element variations, identified through pXRF analysis, in cherts at Bestansur and Shimshara.

The minor elements reveal a more complex picture: some homogeneity, with a handful of outliers (Fig. 13.5). Higher Al and/or Fe compositions appear to dominate the Trench 11 tools (#2102, #2202, #2203, #2218, #2230), whereas the Neolithic tools from the secure deposits in Trench 7 are predominantly represented by moderate values for Al, Fe and K. Very little P and Mn are seen in the assemblage (<2000ppm, 0.2%), with higher P present on Tool #1478, an olive-green flake scraper from Trench 7.

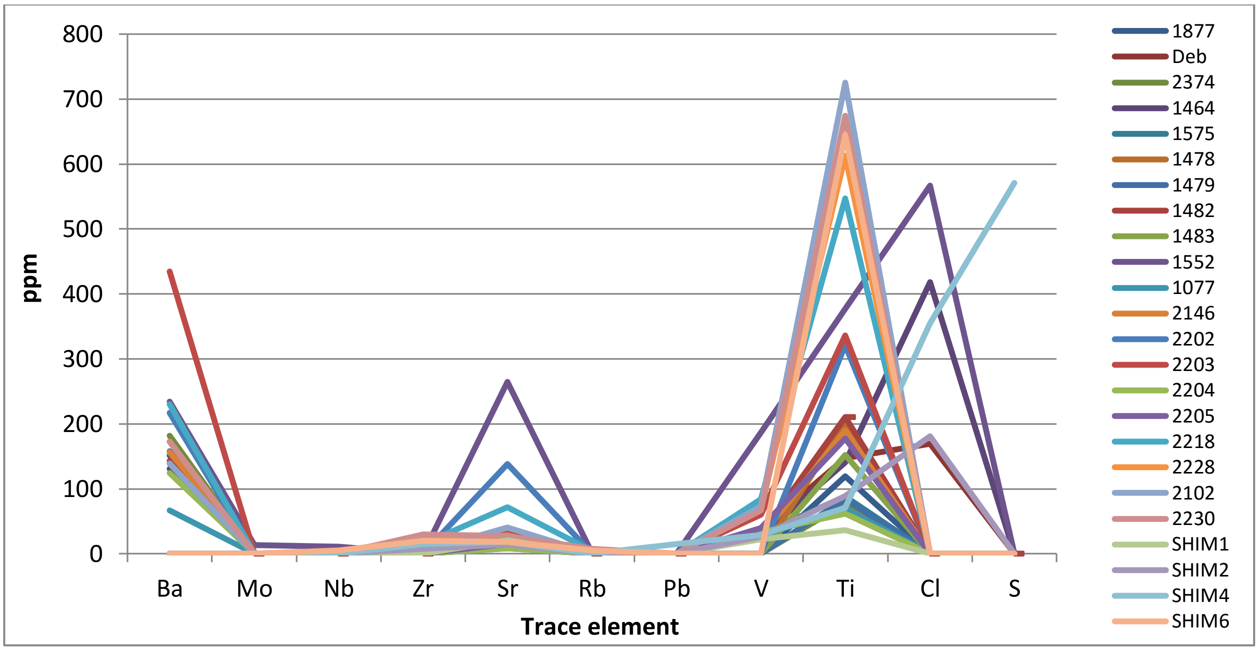



Figure 13.6. Trace elements identified through pXRF analysis of cherts at Bestansur and Shimshara.

The patterns established through the major and minor elements are reiterated in the results of the trace element analysis (Fig. 13.6). Tools #1552 and #2203 are displaying distinctively different compositions from the bulk of the cherts, the former high in Sr and Cl, the latter high in Ba. The Shimshara cherts overall appear to display consistently higher quantities of the metal elements in the cherts, including Al and Fe in the minor elements, and Ti in the trace elements. This could potentially relate to distinct differences in the localised geological zones from which cherts were sourced. Furthermore, the highlighted differences in the chemistry of the cherts from Trenches 7 and 11 at Bestansur indicate the potential for shifts over time in the preferred cherts sourced for chipped stone tools on this site.

## Discussion

Overall, pXRF analysis of the chipped stone assemblages has begun to highlight key themes in the sourcing of material and networks of resources operating in the Neolithic. The cherts demonstrate localised patterns of resource use, with stone tools predominantly crafted from materials locally available to the Central Zagros sites. Furthermore, the differentiation in the chemistry of the cherts recovered from Trench 7 and Trench 11 at Bestansur imply temporal variations in the exploitation of these local natural resources. This analysis supports the evidence from the small finds (see Chapter 14), which has illustrated the substantial use of resources local to the sites, with only a few materials travelling greater distances from source.

Conversely, the analysis of obsidian artefacts aims exclusively at examining long-range networks, as there are no sources of obsidian local to the CZAP sites. This has demonstrated connections between Shimshara and Bestansur that are not present in the cherts or other stone artefacts. The large proportions of obsidian at Shimshara, compared with the quantities of chert (see Chapter 12), illustrate the preference for this material and its transportation from Eastern Anatolia in large, unworked quantities. At Bestansur, however, where chert tools are better represented in the archaeological assemblage, we see obsidian from sources further afield, possibly Central Anatolia, alongside artefacts of jasper (Chapter 14) and gypsum alabaster (see Spring 2012 Archive Report, chapter 11), demonstrating the inhabitants' interaction with complex and far-reaching early Neolithic networks.

## Future directions

This research will be continued during the course of fieldwork undertaken in 2013, following the same methodological protocols, to ensure comparability of data. An expansion of the database of the variable obsidian materials identified at Bestansur may elucidate proportional quantities of material derived from sources, and indicate whether raw materials or only complete tools were brought from the minor sources to the site at Bestansur. Further analysis of materials of tools from Shimshara and Zarzi will provide more conclusive evidence for the presence or absence of secondary sources supplying obsidian to these sites. The integration of data from all sites and seasons will be conducted and further analysis of the trace elements may provide confirmation of minor sources. Samples from the natural sources may be supplied by Dr Tristan Carter of McMaster University, for inter-instrument comparisons to be established.

pXRF analysis of the cherts from all CZAP sites will be continued, with further consideration given to locally occurring nodules transported into the valleys and plains of the Central Zagros foothills. Consistent or anomalous signatures will continue to be observed, in order to further explore the potential of chert analysis through pXRF.

| Tool # | Trench | Context | Tool Type | Colour |
|---|---|---|---|---|
| BESTANSUR | | | | |
| 1867 | 7 | 1212 | core | black, patinated |
| 1897 | 7 | 1214 | blade, truncated | dark grey, translucent |
| 1903 | 7 | 1214 | bladelet, truncated | dark grey, translucent |
| 1822 | 7 | 1215 | blade, truncated | black, striated |
| 1829 | 7 | 1215 | blade, truncated | dark grey, translucent |
| 1835 | 7 | 1215 | blade, truncated | dark grey, translucent |
| 1306 | 7 | 1217 | blade, truncated | green-grey |
| 1948 | 7 | 1221 | bladelet truncated | dark grey, translucent |
| 1955 | 7 | 1221 | bladelet truncated | pale grey |
| 1312 | 7 | 1223 | drill/borer | black |
| 1313 | 7 | 1223 | drill/borer | black |
| 1329 | 7 | 1223 | drill/borer | black |
| 2362 | 7 | 1224 | bladelet truncated | dark grey, patinated |
| 1576 | 7 | 1256 | core trimming element | black |
| 1524 | 7 | 1259 | scoop or drill/borer handle | black |
| 1076 | 10 | 1162 | blade, truncated | clear |
| 2143 | 11 | 1240 | bladelet truncated | mid grey, clear |
| 2173 | 11 | 1241 | core | black |
| 2051 | 11 | 1246 | bladelet truncated | clear, translucent |
| SHIMSHARA | | | | |
| 20 | SHIM | 1276 | beaked blade | black |
| 21 | SHIM | 1276 | ?beaked blade, truncated | black |
| 32 | SHIM | 1276 | blade, notched | black |
| 33 | SHIM | 1276 | blade, notched | black |
| 41 | SHIM | 1276 | core trimming element | black |
| 48 | SHIM | 1276 | blade, truncated | grey |
| 115 | SHIM | 1276 | blade, truncated | black |
| 116 | SHIM | 1276 | blade, truncated | grey |
| 117 | SHIM | 1276 | blade, truncated | black |

Table 13.1. Obsidians from Bestansur and Shimshara, analysed during the Summer 2012 field season

| Tool # | Trench | Context | Tool Type | Colour |
|---|---|---|---|---|
| BESTANSUR | | | | |
| 1877 | 7 | 1212 | mixed core | pale grey |
| Deb | 7 | 1225 | knapping debitage | Red |
| 2374 | 7 | 1227 | Core, SF85 | pale grey |
| 1464 | 7 | 1248 | core | pale pink/reddish |
| 1478 | 7 | 1254 | flake scraper | olive green |
| 1479 | 7 | 1254 | flake scraper | pink with brown stripes |
| 1575 | 7 | 1254 | core | pale grey |
| 1482 | 7 | 1260 | core | pale grey with dark and pink mottle |
| 1483 | 7 | 1260 | blade, truncated | soapy green/grey |
| 1552 | 7 | 1274 | diagonal-ended bladelet | mottled grey |
| 1077 | 10 | 1161 | core | very pale grey |
| 2146 | 11 | 1240 | core | mid grey |
| 2202 | 11 | 1241 | chopper | pale grey with dark mottling |
| 2203 | 11 | 1241 | core | dark grey |
| 2204 | 11 | 1241 | core | white |
| 2205 | 11 | 1241 | core | grey with red striping |
| 2218 | 11 | 1241 | core | dark red-brown |
| 2228 | 11 | 1241 | core | small, mottled grey-brown |
| 2102 | 11 | 1246 | core | pale pink-brown |
| 2230 | 11 | steps | core | dark grey |
| SHIMSHARA | | | | |
| 1 | SHIM | 1276 | blade, truncated | light brown streaked with mid brown |
| 2 | SHIM | 1276 | blade, truncated | mid-grey |
| 4 | SHIM | 1276 | blade | dark grey |
| 6 | SHIM | 1276 | blade | dark brown |

Table 13.2. Cherts from Bestansur and Shimshara, analysed during the Summer 2012 field season

# Chapter Fourteen: Small Finds

Amy Richardson

## Aims and objectives

This summary of the small finds recorded during the Summer 2012 field seasons at Bestansur and Shimshara aims to provide a brief overview of those special finds which merit attention beyond the scope of the bulk finds summaries. Material resource usage is highlighted and preliminary portable XRF analysis conducted, where appropriate. The relationships between these artefacts are provisionally examined across the sites, setting them into a broader geographical context and elucidating their implications in terms of dating, where possible.

## Data-set

Over the course of the 2012 Summer season, a total of 124 artefacts were assigned small find numbers, 27 from Shimshara and 97 from Bestansur. The allocation of numbers during the course of the field season was utilised as a tool for the plotting of a geographical reference for an artefact, applied to bulk material where necessary to accurately record artefact distributions, particularly on surfaces. These bulk material artefacts were logged and integrated with their appropriate bulk finds collections for the purposes of quantification and specialist analysis, including unworked bone, chipped stone, ground stone, ochre, fired clay and molluscs. Once this re-integration process had been performed, 39 artefacts remained in the Small Finds assemblage, 16 of which were recovered from section work at Shimshara and 23 from Bestansur (see full lists in Tables 14.1-2). These artefacts were catalogued, photographed and drawn, ready for storage at the Sulaymaniyah Museum, and future integration into their collections.

## Bestansur

The 23 small finds (SFs) from Bestansur include 18 from Trench 7 (15 Neolithic, 3 post-Neolithic; Chapter 3), 3 post-Neolithic SFs from Trench 11 (Chapter 7), and 2 post-Neolithic surface finds.

### *Beads*

A total of 9 beads were recovered from Neolithic contexts at Bestansur (Fig. 14.1). These are primarily crafted from 3 different materials: stone (SFs 48, 54, 63, 65 and 84), shell (SFs 72, 74 and 99) and clay (SF100).

#### *Stone*

Five Neolithic stone beads were catalogued over the course of the Summer 2012 season at Bestansur. Four of the five cylindrical beads are red-orange in colour (SFs 48, 54, 63 and 84), often banded and completely opaque. PXRF of these beads has revealed that the chemical composition indicates a structure likely to fall within the chalcedony range, but more appropriately described as jasper (Fig. 14.2; Bishop *et al.* 2001, 132-3).

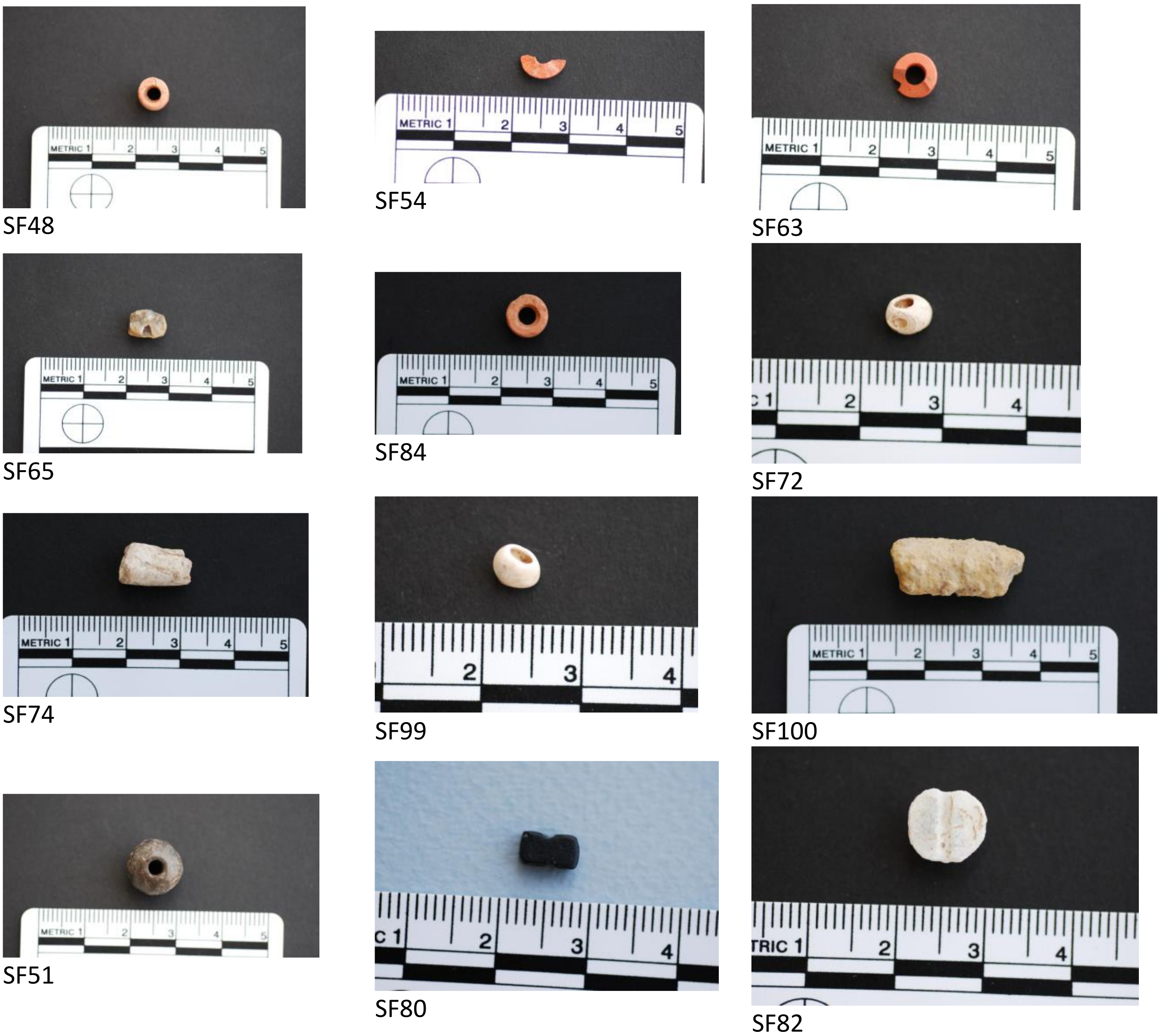
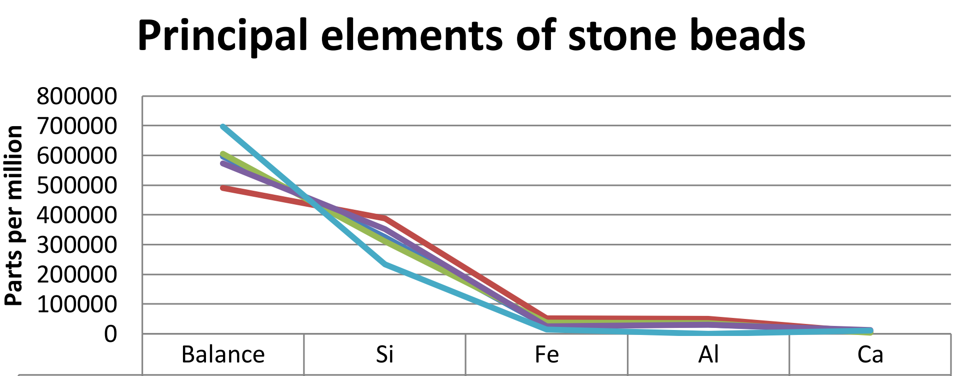



Figure 14.1. Stone beads from Neolithic contexts at Bestansur




| | Balance | Si | Fe | Al | Ca |
|---|---|---|---|---|---|
| SF48 | 596724.81 | 325841.94 | 27340.33 | 29324.17 | 8887.87 |
| SF54 | 489685.81 | 387818.25 | 51447.55 | 50074.77 | 5895.91 |
| SF63 | 605806.38 | 309873.34 | 36833.13 | 36257.44 | 2879.88 |
| SF84 | 573771.31 | 351224.22 | 24247.43 | 30373.09 | 12288.17 |
| SF65 | 696994.38 | 232895.81 | 14693.55 | 0 | 9757.26 |

Figure 14.2. pXRF results of the principal element compositions of stone beads

### *Shell*

Three stone beads were recovered through excavation and heavy residue analysis of Neolithic contexts at Bestansur (SFs 72, 74 and 99). SF72 and SF99 are both formed from the apex of molluscs, potentially *helix salomonica*, found in deposits across the site (see Chapter 15), and likely consumed by the inhabitants. SF72, with three perforations, bears similarities to SF56 from the heavy residue from C1024, whereas SF99 is closer to SF53, from C1036, both in Trench 2, excavated during Spring 2012. SF74 was a worked crab claw, the surface ground down and the edges smoothed to form a curved, conical bead. A similar claw was observed in the Spring 2012 heavy residue from C1073 SA59 BF1144, located in Trench 5, which may be suitable for species identification. Shell beads are commonly seen across Neolithic sites in the region, and crab claw beads have been observed at the proto-Neolithic cemetery at Shanidar cave (Solecki and Solecki 2004, 57-8). Traces of ochre have been observed on those shell beads from Trench 2, verified by pXRF analysis, although none is visibly present on the Trench 7 examples.

### *Clay*

The only example of a clay bead, SF100, is similar in style to SF30 from C1171, recovered during excavations in Trench 7 during the Spring 2012 Season (Spring 2012 Archive Report). SF100 was excavated from C1223, an early spit from the SW quadrant. The bead is roughly crafted and, although a central perforation is evident at the terminals of the cylindrical shape, it does not extend the full length of the bead.

### *Post-Neolithic beads*

Three beads were recovered from post-Neolithic contexts (SFs 51, 80 and 82). SF51, a brown-black multi-faceted bead with possible vitreous surface decoration came from the topsoil of Trench 7. Both SF80 (a black stone, oblong bead with dual perforation) and SF82 (half a round glass bead) came from the topsoil of Trench 11.

### ***Pendants***

Five perforated stones were excavated from Neolithic contexts in Trench 7 at Bestansur (Fig. 14.3). Three of these (SFs 73, 78 and 102) appear to be roughly disc-shaped with a central perforation, demonstrating drill marks on both sides. The remaining two pendants, SF57 and SF102, have been pierced at a tapering, rounded angle. On both these finds, the stone thins towards the pierced edge. These ‘pendants’ no doubt were pierced for suspension, although whether this was as weights, or for other purposes is undetermined. The contexts from which they derive are general occupation fill or surfaces. It may be noted that the stone pendants are very large in comparison to the small beads found at Bestansur and, visually, do not appear to relate to the repertoire of personal adornment. However, SF57 and SF75 both occur in contexts with shell beads, SF72 (mollusc) and SF74 (crab claw) respectively. On this basis, it may be possible to align the stone pendants with corner piercings to the personal adornment or visual material culture range, and consider that those circular discs with central piercings performed a different, more utilitarian function.

### ***Stone bowl***

A single stone bowl base fragment was found at Bestansur (SF167; Fig. 14.3). This limestone fragment indicates a steep, thick-walled vessel, at least 8cm wide at the base. The fragment was located in the occupation deposits of Sp6, C1280, in the southern half of Trench 7.

SF57

SF73

SF75

SF78

SF102

SF167

Figure 14.3. Stone 'pendants' and stone bowl fragment from Neolithic contexts at Bestansur

***Post-Neolithic metalwork***

Only five metal artefacts were found during the Summer 2012 excavations at Bestansur (SFs 46, 49, 55, 83 and 101; Fig. 14.4). These include two surface finds, a copper alloy Islamic coin (SF55) and a copper alloy pin (SF101). From excavated contexts in Trench 7, a copper alloy toggle (SF46) and an iron tack (SF49) were recovered from the topsoil. Trench 11 yielded a single metal artefact, a copper alloy arrowhead (SF83; see Chapter 7). The arrowhead finds parallels with SF38 (Fig. 14.4), recovered during the Spring 2012 field season, from Trench 10, which displayed signs of impact.


SF46


SF49


SF55


SF83


SF101


*Cf.* SF38 from Spring Season

Figure 14.4. Metalwork from post-Neolithic contexts and surface finds, and SF38 for comparison with SF83

## Shimshara

The 16 SFs from Shimshara are all from Neolithic contexts, recovered in the course of section cleaning (Chapter 15) and wet-sieving of the heavy residues (see Chapter 6: Microarchaeology). Chemical analysis, through pXRF, of the stone bowls, bracelets and bead have indicated that the stone used for their production is an impure marble, with a high silica content, indicative of quartz and other impurities in the rock or calc-silicate rocks (Bishop *et al.* 2001, 180), which would produce the veined and banded colour variations seen in the Shimshara assemblage.

### *Stone bracelets*

Fragments from six stone bracelets were recorded from section cleaning at Shimshara (SFs 116, 139, 140, 141, 142 and 143; Fig. 14.5). Worked from white, grey or cream crystalline stone, the diameters range between 60 and 95mm, with the exception of SF140, which may have a diameter of up to 200mm. SF140 and SF142 have irregular, angular sections, comparable with bracelets excavated at Shimshara by Danish archaeologists in the 1950s (*cf.* Mortensen 1970: fig. 42L). SF143 is oval in section (*cf.* Mortensen 1970: fig.

42i & k). SFs 116, 139 and 141 are lenticular in section, comparable with material found elsewhere across the Fertile Crescent in the seventh millennium BC (Kozlowski and Aurenche 2005: fig. 5.3.2.5). Although these have been termed 'bracelets' in accordance with Mortenson's (1970) study, the weight and diameter of these artefacts merits further consideration of their function.

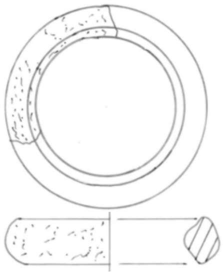
***Bowls***

Three stone bowl fragments were recovered during the course of work at Shimshara (SFs 135, 136 and 137; Fig. 14.6). These three marble fragments of wide, globular vessels are between 180 and 240mm in diameter. SF136 and SF137 are both thick-walled, the latter with incised decoration, in the form of approximately parallel lines (SF136: *cf.* Mortensen 1970: fig. 38L; Kozlowski & Aurenche 2005: 3.1.1.3, although with thinner wall, as 3.2.1; SF137: *cf.* Kozlowski & Aurenche n2005: 3.1.4.1 for decoration, although vessel is shorter). SF135 is thinner walled, from a banded marble, with a rounded lip and slightly inverted rim. All display a high degree of craftsmanship unlike the crude, thick-walled vessel at Bestansur (SF167).

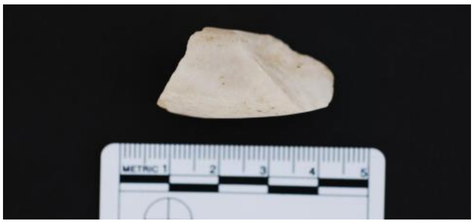
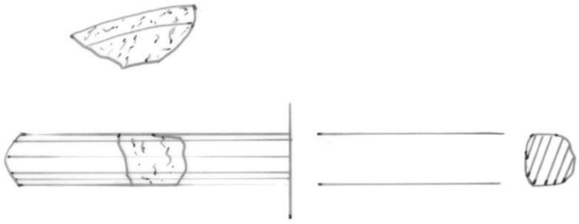
***Bead***

A single stone bead was recovered from Shimshara (SF138; Fig. 14.6). Made from polished, cream-coloured marble, the drilling of the stepped perforation from each side is evident, demonstrating a slight variation from the drilled, cylindrical holes seen in the jasper beads at Bestansur.

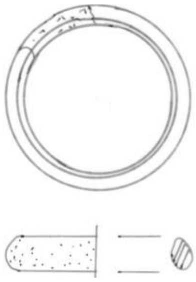

SF116

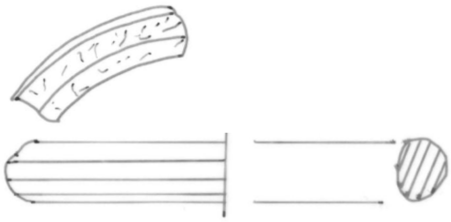
SF139

SF140

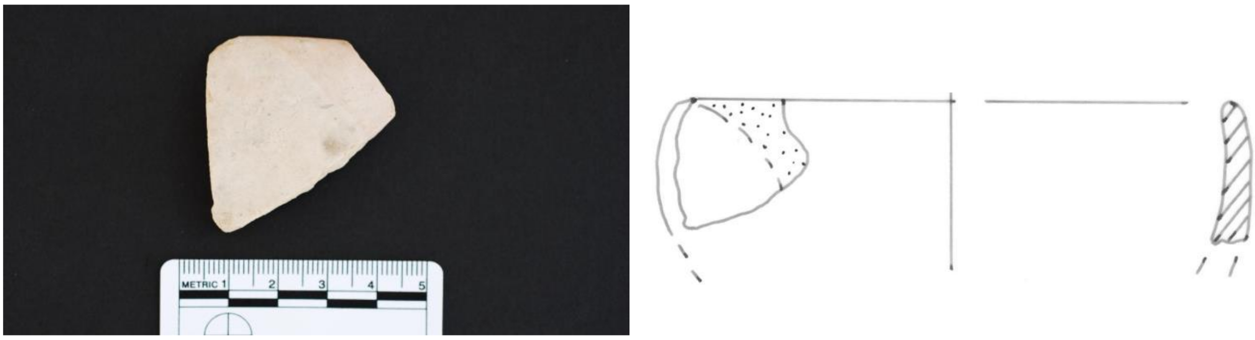
SF141

SF142

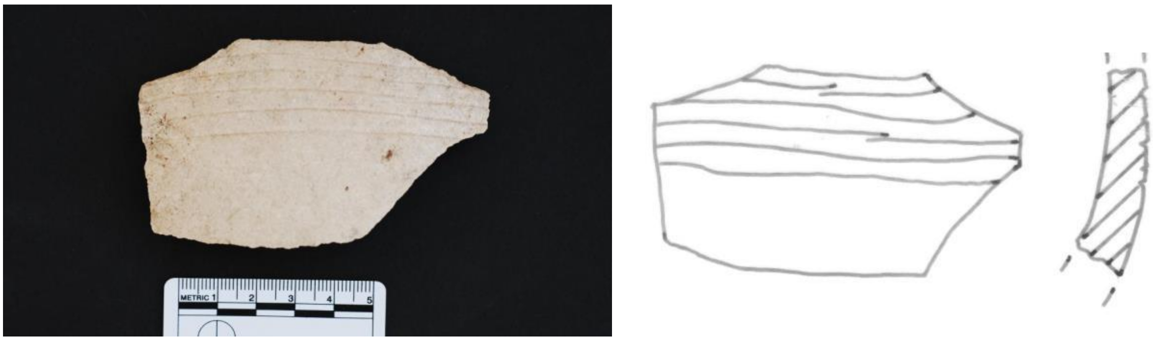

SF143

Figure 14.5. Stone 'bracelets' from Shimshara



SF135

SF136



SF137


SF138

Figure 14.6. Stone bowls and bead from Shimshara


Figure 14.7. Worked bone artefacts from Shimshara

***Worked bone***

A single bone pendant (SF117), a bone needle (SF127), three fragments of bone points (SFs 134, 170 and 171) and a tooled piece of bone (SF172) were all recovered at Shimshara (Fig. 14.7). The pendant (SF117), which is oval with a circular perforation and a bulbous lower terminal, finds parallels from the excavations by Mortenson (1970). The bone needle (SF127), the point of which is absent, has an eye tooled from both sides and a tapering shaft. The bone point fragments have tooling marks along the shafts and have clearly been worked to points, but do not appear to have the decorative heads seen on examples at Sheikh-e Abad. SF172 has clearly been worked, but its purpose is unidentifiable.

## Discussion

The small finds from Bestansur clearly represent two phases of occupation at the site. The Neolithic material, though small in quantity, does not indicate extensive stylistic development in stone working, suggesting that the material largely relates to a single period of activity early in the Neolithic. The materials utilised represent both local and regional sourcing, including readily available limestone and molluscs, whereas jasper may have been obtained from further afield. The range of materials worked at Bestansur is broad when compared with the artefacts from Shimshara, which are limited to calc-silicate stone and bone. The Shimshara stone bowls and bracelets, however, appear to represent a later period of activity, possibly in the late eighth or seventh millennium. This assemblage represents a high degree of skill in the working of stone, for which a source is yet to be ascertained.

## Future directions

The artefacts at Bestansur and Shimshara merit further investigation, in terms of both materials and stylistic analyses. A more precise identification of the source of materials could elucidate the networks of material engagement already highlighted by the chipped stone analysis (See Chapter 12). Further integration into the technological developments of the Neolithic across the Zagros, through typological analyses will provide further insights into the relationships between sites within the region.

| SF | Item | Context | Trench | Description |
|---|---|---|---|---|
| 46 | Bronze toggle | 1212 | 7 | Copper alloy toggle with 3mm off-centre notch. Section is ovoid in centre with squared profile at flared terminals. |
| 48 | Bead | 1211 | 7 | Pale pink-red, cylindrical bead, likely carnelian, with colour variation throughout stone. Section is circular, with an off-centre perforation, 3mm wide, demonstrating drill marks from working at both ends. |
| 49 | Metal pin/tack | 1213 | 7 | Iron tack, possibly for horseshoe, with squared, tapering section and oblong head. Shaft is bent and corroded. |
| 51 | Bead | 1213 | 7 | Brown-black, multifaceted, biconical bead with flattened terminals. Central perforation tapers from 4mm to 1mm, likely worked from one end. Traces of polychromatic, possibly vitreous, surface decoration and copper-coloured flecks. |
| 54 | Clay bead | 1217 | 7 | Fragment of small red stone bead, likely carnelian, from the mid-section of a cylindrical bead with central perforation. Surface shows some colour variation. |
| 5 | Bronze Islamic coin | Unstratified | Unstrat | Copper alloy coin, with limited corrosion, concretions and ferrous staining. Excellent preservation, including of script. Recovered from surface during geophysical survey. |
| 57 | Perforated stone | 1217 | 7 | Fragment of large stone pendant, with perforation in upper corner, which is set at a right angle. Broken edges form opposing right angle at thickened mid-section. Perforation appears to be worked from both sides, narrowing towards centre. Pattern of thinning either side of suspension perforation, extending towards exterior edges, may be indicative of wear. |
| 63 | Bead | 1223 | 7 | Red-orange cylindrical bead, likely carnelian, with central perforation. Chip missing. Some scars from drilling on one side of hole, which is otherwise uniform and 3mm in diameter. |
| 65 | Bead blank (broken) | 1223 | 7 | Green-brown, soft stone bead blank, broken during manufacture. Multi-faceted surface with striations from working. Drill scars visible on either side of attempted central perforation. |
| 72 | Shell bead | 1217 | 7 | Cream-coloured shell bead with 3 perforations, possibly for suspension as a pendant, with suspension perforations located either side of apex. All traces of apex and all surfaces worn smooth. Likely from helix salomonica. |
| 73 | Stone disc | 1219 | 7 | Pierced stone disc (in two pieces) with central perforation, possibly worked from both sides. Substantially thinner along one edge, suggesting wearing from suspension. Concretions cover one face. Modern break and chip missing from circumference. |
| 74 | Shell bead | 1222 | 7 | Part of a crab claw with hollowed centre, spines removed and evidence of smoothing/polishing on external and internal surfaces to form bead. Wider terminal suggests smoothing also; narrow terminal shows fractured, rough edges. Cf. C1073 SA59 BF1144. |

| SF | Item | Context | Trench | Description |
|---|---|---|---|---|
| 75 | Stone pendant (large) | 1222 | 7 | Trapezoid stone pendant with perforation at upper edge (broken), appearing to be worked from one side, and missing uppermost third to ancient fracture. Flaking and coarse surface on one side, possibly caused by flaws encountered in manufacture process – other surfaces smooth and polished. Fracture across width is modern; chips retained in bag. |
| 78 | Pierced stone disc | 1220 | 7 | Half a red stone disc, with central perforation, worked from both sides. Concretions on one side. Disc is thinned and chipped on one side, towards break. Colour fades to grey at edges. |
| 80 | Stone bead | 1236 | 11 | Black stone, oblong bead with dual parallel perforations and slight narrowing between, off-centre of width. |
| 82 | Stone bead | 1240 | 11 | Round bead produced from silicate, likely glass. Only half bead is present, with shallow central groove for perforation. Clean break at diameter and narrowing of hole may indicate breakage in process of manufacture. |
| 83 | Bronze arrowhead | 1246 | 11 | Copper alloy arrowhead. Triple-winged with slightly corroded surface. Shaft intact. Cf. SF38 |
| 84 | Bead | 1243 | 7 | Pink-orange, cylindrical stone bead with off-centre hole, worked from both sides. Likely carnelian. Some abrasion of surface. |
| 99 | Shell bead | 1221 | 7 | Small, cream-coloured, shell bead, likely helix salomonica, with perforations either side of the apex. Surface has been worn to smooth, possibly deliberately. |
| 100 | Clay bead | 1223 | 7 | Cylindrical bead with rough, uneven surface. Central perforation evident from both terminals, but does not appear to extend length of bead. Cf. SF30 |
| 101 | Bronze pin | Unstratifi ed | Unstrat | Copper alloy pin with oval section, tapering to ends, which appear broken. Pin is bent and twisted along shaft. Original form unidentifiable. |
| 102 | Stone disc frag | 1254 | 7 | Quarter of a perforated stone disc, with off-centre perforation. Original diameter *ca.* 66mm. beneath concretions, stone appears smooth, tapering towards circumference. Perforation shows drill scars, worked from both sides. |
| 167 | Stone bowl base | 1280 | 7 | Plain ground stone bowl base, 24mm thick, supporting steep walls (10mm thick). Profile indicative of shallow vessel, at least 8cm wide at base. |

Table 14.1. Small finds from Bestansur (shaded rows are post-Neolithic)

| SF | Item | Context | Description |
|---|---|---|---|
| 116 | Marble bracelet fragment | 1276 | Large, circular, cream marble bracelet with lenticular section. 13% remaining. |
| 117 | Bone pendant | 1276 | Oval pendant, with perforation at upper terminal and bulbous lower terminal, made from polished bone. Surface is mottled white and black. Recovered while taking micromorph block SA763, see section 43 for location. Recorded in Zooarch database (SHIM Bone ID41). Species/taxa unidentifiable. Similar to pendant/s recovered during 1950s excavations, cf. Mortensen 1970. |
| 127 | Bone needle | 1276 | Upper portion of bone needle, with eye which appears to be worked from both sides. Eye and shaft are wide, possibly suitable for weaving or attaching hides, if bored with a stone tool in first instance. |
| 134 | Polished bone tool | 1276 | Polished bone point, made from left small artiodactyl tibia. Cf. Mortensen 1970: fig. 49f. Zooarch catalogue: SHIM Bone ID 11; photo P9190377 |
| 135 | Stone bowl fragment | 1276 | Small fragment (5%) of marble bowl rim. Vessel is thin-walled (5-8mm), globular, tapering to a rounded lip and slightly inverted rim. Stone has two-toned appearance, varying from cream-beige to dark, soft pink. |
| 136 | Stone bowl fragment | 1276 | Fragment of stone bowl with small portion of rim (4%) and body, including most of profile. Vessel is thick-walled (13mm), semi-globular, with upright shouldered rim. Marble is cream-coloured, with dark speckle. Cf. Mortensen 1970: fig. 38L, Cf. Kozlowski & Aurenche 2005: 3.1.1.3, although with thinner wall, as 3.2.1 |
| 137 | Stone bowl fragment | 1276 | Body and shoulder sherd from a globular vessel, with roughly parallel, incised lines some of which overlap rather than meet. Walls of the vessel are thick (9-14mm), flaring steeply towards base. Shoulder diameter indicates bowl is likely to be at least 20cm wide. Stone is pale beige. Cf.Kozlowski & Aurenche n2005: 3.1.4.1 for decoration, although vessel is shorter. |
| 138 | Stone bead | 1276 | Cream-coloured cylinder bead, produced from polished cream-coloured marble, with rounded profile. Perforation drilled and stepped from both sides, narrowing from 4mm to 2mm wide. Cf. Mortensen 1970: fig. 42.n-o |
| 139 | Stone bracelet fragment | 1276 | Fragment of small stone bracelet (25%), with one ancient and one modern break to reveal crystalline structure. Mottled grey marble; section is lenticular. Similar to SF141. Kozlowski & Aurenche 2005: 5.3.2.5 |
| 140 | Stone bracelet fragment | 1276 | Fragment of stone, possibly belonging to an adornment. Marble is cream-coloured with grey veins. Rounded cuboid section with irregularly squared edges. If circular, curvature suggests diameter of 20cm (5%), larger than a bracelet. |
| 141 | Stone bracelet fragment | 1276 | Fragment (13%) of lenticular-section marble bracelet. See SF139. Cf. Kozlowski & Aurenche 2005: 5.3.2.5 |
| 142 | Stone bracelet fragment | 1276 | Fragment (12.5%) of a marble bracelet with an irregular, angular section. Cf. Mortensen 1970: fig. 42L |
| 143 | Stone bracelet fragment | 1276 | Fragment (8%) of thin marble bracelet with oval section. Marble is cream-coloured with white mottle. Cf. Mortensen 1970: fig. 42i & k |
| 170 | Bone point | 1276 | Two fragments from apex and shaft of polished bone point (modern fracture). Zooarchaeology Catalogue, SHIM Bone ID: 42 |
| 171 | Bone point | 1276 | Tip of polished, worked bone point, with blackened surface. Zooarchaeology Catalogue, SHIM Bone ID: 43 |
| 172 | Worked bone | 1276 | Small fragment of worked bone with clear tooling marks for shaping. Zooarchaeology Catalogue, SHIM Bone ID: 44 |

Table 14.2. Small finds from Shimshara

# Chapter Fifteen: Molluscs

Nicholas Harper

## Research question

Very little modern scientific research has been conducted on molluscs discovered at Neolithic sites in the Near East. At Bestansur we have found large quantities of molluscs throughout the site, often in discrete clusters, on surfaces and in association with other objects such as lithic tools and burnt stones. The question is whether molluscs constituted a major food source for the Neolithic inhabitants of Bestansur.

## Methodology

We first had to clean the molluscs and remove as much of the soil as possible from inside the shells. The soil from Bestansur contains a large amount of clay which is hard to break down and dissolves very slowly with water. This meant that our first attempt at cleaning the molluscs was unsuccessful. After soaking them in water for over three weeks the soil had still not been broken down. To remove the soil we had to use Calgon and hydrogen peroxide and then manually remove the soil. To make sure we did not miss any particularly small shells we then sieved all the samples.

| Trench | Context | Sample No | Weight (g) |
|---|---|---|---|
| 1 | 1011 | - | 600 |
| 2 | 1034 | - | 860 |
| 2 | 1039 | - | 215 |
| | 1062 | - | 766 |
| 5 | 1074 | - | 1400 |
| 5 | 1077 | 116 | 340 |
| 5 | 1078 | 122 | 1050 |
| 5 | 1078 | 123 | 1035 |
| | 1139 | - | 124 |

Table 15.1. Mollusc samples studied.

Once we had fully cleaned the shells we were able to separate the molluscs into their different species and then count them. Although we are still in the middle of this process the results so far have been very revealing.

## Results

We have identified four different types of mollusc in the samples. Two are large specimens which are edible and we believe that they are different variations of the same species, *Helix salomonica*. One variant has a much taller spiral than the other but they are similar in every other respect. We also have one burrowing mollusc which we believe to be a modern intrusion and another small mollusc called *Cernuella*.

The most important molluscs in this research are the large *Helix salomonica* shells which constitute the vast majority of molluscs looked at so far. In fact of the 193 molluscs found so far 161 of them have been *Helix salomonica*. This emphasis on just one species, and the fact that they are all adult specimens, indicates human selection but what also supports this theory is the age of the molluscs. We would expect a wider range of age if the molluscs in wild population.

To discover how old the larger molluscs were when they died we decided to section them in order to see the growth layers in the shell. Just like trees with their tree rings, molluscs also have layers of growth in their shells. To obtain a section through the shells we placed the molluscs in resin which then became hard. We then cut the shell in half to have a look at a section. We had to polish the surface to remove all the scratches placed there by the saw. This task also makes it easier to identify the growth rings as it makes the resin more transparent.

We prepared this experiment on just two molluscs as the process does take time. These two molluscs came from samples 1034 and 1039. Both were *Helix salomonica* and both were of the taller variant. The results for both molluscs indicated that they were four years of age when they died which may suggest that this is the approximate age at which the Neolithic people at Bestansur deemed the snails to be edible.

## Conclusion

More research into molluscs will be conducted. The small age range and the small number of mollusc types at Bestansur indicate deliberate human selection of molluscs by species and by size/age in order to provide a major component of the diet. Seasonal availability of molluscs in the spring only, at least in large quantities, further suggests spring-time presence of humans at the site of Bestansur in the Early Neolithic.

# Chapter Sixteen: Shimshara Section Investigations

Wendy Matthews, Roger Matthews and Sarah Elliott

## Introduction

***Rationale for investigation***

The Neolithic site of Shimshara was selected for excavation as it is known to have Neolithic Levels from Mortensen's (1970) excavations in 1957. It is located in the Rania Plain, Sulaimaniyah Province, the second most fertile plain in Iraqi Kurdistan, after the Shahrizor Plain. The site therefore provides an important comparison to Bestansur on the Shahrizor Plain, for investigation of local and regional variation in Neolithic ecological and social strategies, a key aim of the Central Zagros Archaeological Project. Bestansur is close to a major perennial spring, while Shimshara is on the banks of a major river, the Lesser Zab.

A second major aim is to assess the impact of submergence and erosion by dam waters on this ancient settlement mound as many sites of major importance like Shimshara have been subject to these impacts across the Near East and globally. The site is currently accessible periodically, generally in late summer, as it is no longer flooded year-round by waters from the Dukan dam on the Lesser Zab.

An intial assessment of Shimshara was conducted from 14$^{th}$-16$^{th}$ September 2012 in order to investigate the nature, depth and preservation of extant deposits to enable planning for future excavation seasons. It was carried out by Roger Matthews, Wendy Matthews and Sarah Elliott, with kind support from the Sulaimaniyah Department of Antiquities, the local guard and two workmen, with hospitality from the joint Danish and Dutch teams.

***Location and environment***

Shimshara is *ca.* 500m above sea level at 36˚12'02.71" N, 44˚56'18.10" E. It is strategically sited on a raised conglomerate outcrop covered by *ca.* 5-8m of pale brown natural sandy (silty) clay on a major natural route network. It is located on the right bank of the Lesser Zab river at the north-eastern edge of the Rania Plain close to a major pass, the Sungasur Gorge, where the river cuts through a ridge of mountains *ca*. 1000m high (Fig. 16.1). This gorge leads north-east to a small plain and the mountainous Iraq/Iran border. Other natural routes include the Lesser Zab river which leads south then west to the Mesopotamian plain in the Kirkuk region, or provides access south to a network of basins leading to the Shahrizor Plain and the Diyala River. Routes to the northern Mesopotamia plain and Turkey are accessible via the Erbil region to the west. A dam was constructed at the southern edge of the Rania Plain in 1959.

Figure 16.1. Eastern edge of Shimshara looking north-east to where the Lesser Zab river enters the Rania Plain through the Sungasur Gorge. Fertile agricultural fields in the middle distance.

The Rania Plain is the second most fertile plain in Sulaimaniyah, after the Shahrizor Plain, and is surrounded by limestone mountains and hills, some with cliffs. It is currently used extensively for agriculture (Fig. 16.1) and grazing, with large mixed flocks of goat and sheep observed during fieldwork. The region of the Dukan Dam Lake is currently a Key Biodiversity Area, surveyed by Nature Iraq in 2007-10 (Bachmann *et al.* 2013).There a high number of plant species in this region. These are characterised as Mountain Forest Vegetation and Mountain Riverine Forest, with oak forest, steppe and riverine ecosystems (Bachmann *et al.* 2013). The inhabitants of Shimshara therefore are likely to have had access to a range of different ecozones and biomes within 4-5km, one hour's walking distance, as attested in the plant (Chapter 10) and animal remains (Chapter 9), notably pig, which thrives in riverine forest. Lake core data from Lake Zeribar, 130km south-east, suggests that there was a slight increase in oak and shrub (Chenopodiaceae) pollen during occupation at Shimshara, at higher elevations of 1400m above sea level (van Zeist and Bottema 1977; Stevens *et al.* 2001). Oak pollen, however, remains low at <10% of the total pollen spectra in contrast to recent levels of 40%, whilst Chenopodiaecea represent 20-30%. Quantities of grass pollen remain high, at 40-30%, but continue to fall from a peak *ca*. 8500 BC, probably due to impact of human cultivation and animal grazing.

One key aim in future seasons is to collect and analyse local palaeoecological and palaeoclimate evidence, as Shimshara is in a different ecozone to Lake Zeribar, and at lower elevation by 900m. Sulphur mineral ponds 1.3km north of the site will be assessed along with other locations for coring and investigation in future seasons by CZAP in collaboration with The Department of Antiquities and Heritage, Sulaimaniyah University and Nature Iraq.

***Previous excavations at Shimshara***

Shimshara was excavated in 1957 by a Danish team (Mortensen 1970) prior to flooding of the site by waters from the Dukan Dam, which was constructed in 1959. The site is *ca.* 330m long. It has a high northern mound, which was *ca.* 110 x 80m and 12m above a low adjoining southern mound in 1957. In the high northern mound, Mortensen excavated 16 levels of occupation to a depth of 8m below the top of the mound, numbered from the top down, recorded as *ca.* 519-511m above sea level (Mortensen 1970, 2, pl. I, fig. 8).

Levels 9-16 were attributed to the 'Hassuna period', which spans *ca.* 6500-6000 BC. They were exposed in a *ca*. 15 x 2m trench in the south of the high mound, in squares L10-O10. These early levels were 3.4m thick in total, recorded as spanning *ca.* 511-514.4m above sea level. The basal two to three levels, however, are likely to pre-date the Hassuna period as no pottery was recovered from Levels 15-16, and only one pottery sherd from Level 14.

Mortensen (1970, figs 10-20) uncovered stretches of rectilinear mud brick architecture often with stone foundations in Levels 16, 15 and 14, within the 15 x 2m trench. Traces of pebble floors were uncovered in a number of these levels, as well as clay lined basin/ovens in Levels 10 and 9, the latter close to a child's burial. Levels 16 and 13 had been destroyed by intensive fire. Mortensen did not reach natural in any trenches in the high mound nor on the lower mound. The upper Levels 8-1 are Hurrian, early second millennium BC, and Islamic in date.

The lower mound is predominantly early second millennium BC in date, and contemporary with Samsi-Addu I. Contemporary cuneiform texts refer to Shimshara as the 'Kingdom of the Gate-Keepers', indicating the strategic importance of the site, discussed above.

## Assessment of the impact of Dukan Dam flood waters and topographic survey

The topography of the upper and lower mounds is currently being mapped by the Netherlands Institute for the Near East, directed by Prof Jesper Eidem, and their survey team lead by Dr Martin Uildriks.

The entire eastern flank of the *ca*. 330m mound is currently being undercut by seasonal dam waters and currents from the Lesser Zab River. Although the conglomerate outcrop is comparatively resistant to erosion, the overlying unconsolidated slightly sandy silty clays on which the site is located are highly susceptible to erosion by wind and water.

Figure 16.2. Shimshara West-East and North-South Sections prior to cleaning. Erosion and undercutting of the natural unconsolidated sediments on which the site was founded (right). Looking north. Scales = 2m.

The local workmen informed us that the last time the mound was fully submerged was in the wet winter of 1998. Each year, however, the waters rise close to or above the conglomerate/silty clay/base of the mound interface. There is a well-sorted beach on the lower eastern flanks of the mound.

Initial analysis of the high northern mound suggests that a significant proportion of the south eastern corner of the mound has been eroded by dam waters, exploiting a weakness close to edge of Mortensen's 15 x 2m north-south trench in L10-O10.

## Methodology

We began our assessment of Neolithic occupation at Shimshara by study of two large sections that had been created by this erosion, one west-east *ca*. 8.5m long, another north-south *ca*. 40m long, on 14th-16th September 2012 (Fig. 16.2).

We cleaned, photographed and drew the 8.5m W-E section and >6m of the longer N-S section to assess the nature and depth of extant occupation. The sections were cleaned by hoe, trowel, artist's palette knife, large and small brushes and by wafting the dust from the section faces with a board, and a photography 'rocket' air-blower. Loose colluvium at the base of the mound was shoveled and hoed away from the sections bases to reveal the base of the mound and underlying natural (Fig. 16.3). Working conditions were challenging on the 16th September as there was a very high wind from the east.

Figure 16.3. Section cleaning. Looking south along the upper and lower mounds of Shimshara towards the Dukan Dam Lake. The mound of Basmusian, now an island, is just visible in the far distance.

Bone, lithics and small finds were collected for analysis. No pottery was encountered, either in the colluvium at the base of the mound or *in-situ* within the *ca*. 15m of section recorded.

The sections were systematically photographed and drawn at 1:10. The sections were then sampled for a range of analyses including:

- micromorphological analysis (6 blocks: SA752, SA753, SA756, SA757, SA758, SA763 - Chapters 4, 8) to analyse architectural materials and accumulated deposits to investigate the nature, range and periodicity of activities at the site
- spot geochemical and phytolith samples (Chapter 8)

- integrated wet-sieving and flotation (SA761 earliest deposits, SA760 slightly later midden-like deposits) for analysis of charred plant remains assemblages, zooarchaeology and micro-archaeology (Chapters 9 and 10)
- spot collection, mapping and labelling of key bones in the section face for zooarchaeological analysis (Chapter 10)
- $^{14}C$ and charcoal analysis.

## Analysis of field sections

The natural pale brown to pale slightly reddish brown slightly sandy silty clay deposits at the base of both sections appears to have been stepped/cut down from west to east either naturally or deliberately in the Neolithic. There is a *ca.* 1.5m step/cut down in the natural close to the edge of the N-S section line, marked by an arrow in Fig. 16.4. In addition deposits tend generally to slope down to the east towards the Lesser Zab River, evident in the W-E section.


Figure 16.4. Cleaned sections West-East (right) and North-South (Left). Looking north-west. Scales = 2m and 50cm. Micromorphology block sample locations also visible. For points numbered on the photograph see discussion in the text below.

### *West-East section*

In the W-E section, there are *ca*. 2-2.5m of extant deposits above natural. These deposits extend *ca.* 25m north behind the section face. They are particularly vulnerable to erosion by rising dam waters as they protrude out into flood stream flow.

The earliest deposits in the west of this section comprise lenses of ash and grey mixed deposits with charred nutshells, one of which was radiocarbon dated (Fig. 16.4 [1]), as discussed below. These early deposits were sampled for integrated flotation and wet-screening, SA761, and micromorphology SA757. They were overlain by a thin band of orange brown deposits, *ca.* 10cm thick, mixed grey deposits, then a second band of orange-brown deposits. The band of subsequent grey deposits with stones was sampled for comparative integrated flotation and wet-screening, SA760. These deposits were covered by a third band of orange-brown packing/leveling that extended across the entire E-W section (Fig. 16.4 [2]), *ca*. 14-25cm thick, then mixed grey deposits with stones.

Overlying this, in the west of the section was a series of at least five prepared surfaces, *ca*. 7-10cm thick, with overlying lenses of orange-brown ?plaster, ash, charred plant remains and a white plaster *ca*. 1cm thick (Fig. 16.4 [3]; Fig. 16.5). The uppermost sequence was sampled in micromophology sample SA753 (Chapter 4). They were covered by a mixed layer with stones, below the modern surface of the mound.

Figure 16.5. Well-preserved sequence of surfaces and lenses of ash, charred plant remains and white plaster floor (top) in the west of the West-East section. Scale = 50cm.

Deposits in the east of this section comprise a sequence of thick grey banded deposits with layers of stones, perhaps comprising or on a rough floor/surface. At *ca*. 0.8m above natural, there is then an extensive band of orange-brown packing/leveling, *ca*. 25cm thick, which corresponds with the third band of orange-brown deposits in the western half of the section (Fig. 16.4 [2]). Overlying this is a layer of pale greyish brown deposits that were leveled to form an extensive surface more than 2m in length in section (Fig. 16.4 [4]). On this surface, there was a layer of burnt plant remains and phytoliths, visible in the field, bone fragments and a bone pendant (SF117, Chapter 14). This surface and sequence was sampled for higher-resolution analysis in micromorphology block S763 (Fig. 16.4 [4]; Chapter 4). It was overlain by mixed grey deposits with scattered stones, and another extensive orange-brown band of packing/leveling, then mixed deposits with stones below the modern surface of the mound.

***Dating***

A charred nutshell from the earliest deposits in the West-East section was dated by Beta Analytic (Fig. 16.4 [1]). It provided an AMS radiocarbon age estimation at 2 sigma (95% probability) of 7450-7080 cal. BC, which at 1 sigma (68% probability) is 7330-7180 cal. BC (Beta-342482).

***North-South section***

In the N-S section, there are *ca*. 1.5-2m of extant deposits above natural (Fig. 16.6). Deposit thickness increases further from the N-S section face north-west towards the centre of the mound. A thick band of natural deposits at least 70-100cm thick was revealed at the base of the N-S section (Fig. 16.6 [1]). It comprises pale slightly reddish brown slightly sandy silty clay with white carbonate inclusions, overlain by pale brown deposits, sampled as micromorphology block SA756.

The Neolithic occupation sequences predominantly comprise thick bands of mixed greyish brown deposits with stone inclusions (Fig. 16.6 [2]). A lens of grey deposits, sparse pebbles and white aggregates was sampled in micromorphology block S758 to investigate whether this may be a surface. A higher line of large stones in the south of the cleaned section may be a stone wall foundation *ca.* 40cm below the surface of the modern mound (Fig. 16.6 [3]), similar to that found in Level 15 for example by Mortensen (1970, fig. 8).

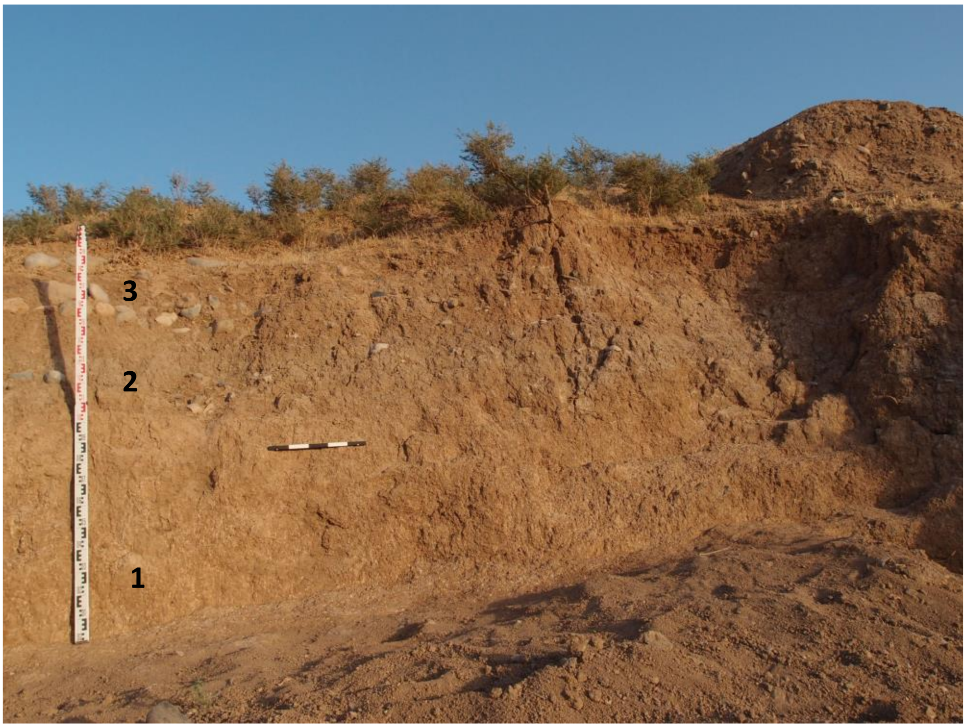



Figure 16.6. North-South section showing natural terrace [1], banded grey deposits [2] with scattered stones [2] and probable stone wall foundation [3].

## Discussion

### *Dating*

At least some of these deposits pre-date those excavated by Mortensen, as they lie directly on natural, which Mortensen (1970) did not reach. Like Mortensen's Levels 16-15, the absence of pottery suggests they are Neolithic and pre-date Hassuna, which spans *ca.* 6500-6000 BC. This pre-Hassuna date is supported by a radiocarbon date from the earliest deposits above natural, at the base of the W-E section, of 7450-7080 cal. BC, at 2 sigma (95% probability), on one of a cluster of charred nutshells. The style of lithics and marble bracelets support this date (Chapters 12 and 14).

Provisional working estimates suggest that the base of the Neolithic levels recorded in these new sections is at least *ca*. 3-4m below the lowest level excavated by Mortensen, Level 16. This is based on our comparison of a) the relative current heights of the extant lower mound and the base of the West-East section recorded by us from the new topographic map kindly provided by Dr Martin Uildriks and Prof Jesper Eidem, and b) the relative heights of the lower mound and the base of Level 16 as recorded by Mortensen (1970, pl. I). If the lower mound has been subject to significant erosion, then the new Neolithic levels will be more than *ca*. 3-4m below those excavated by Mortensen, as the height differences will be greater. This estimate is provisional only and will be refined in future seasons.

The radiocarbon date and the Hassuna pottery excavated by Mortensen (1970) indicate that the prehistoric occupation at Shimshara spans *approximately* 7400-6000 BC. It is contemporary, therefore, in central and south-eastern Turkey with Çatalhöyük, of similar duration 7400-6000 BC, and the later levels at Çayönü which end *ca*. 6600 BC. In Iraq it is slightly earlier than and contemporary with Jarmo and Hassuna. In Iran it is contemporary with Tepe Guran, Ali Kosh, Sarab, Choga Bonut and Haji Firuz (Aurenche *et al.* 2001; Zeder 2005; 2009).

***Architecture and occupation sequences***

The stratigraphic sequences at Shimshara are well-preserved with intact surfaces and lenses of articulated phytoliths, charred plant remains and ash (Fig. 16.5; Chapter 4). One plaster includes re-used aggregates of multiple layers of white-wash that were taken from the walls of a building from elsewhere on the site or from another site and then added to a white calcareous silty clay, possibly marl, to form a new plaster on surfaces in the West-East section. These fine white-washes are coated in some instances in soot and are similar to those encountered on the walls of elaborate buildings from Çatalhöyük, central Turkey (Matthews 2005, figs 19.8-9). That there were shared architectural practices and some form of contact or exchange network between peoples in the Iraqi Zagros and central Anatolia is supported by possible pXRF identification of Central Anatolian obsidian at Bestansur (Chapter 13). These data are currently provisional and are being investigated further.

***Artefacts***

Shimshara is a rich site with abundant obsidian (Chapter 12) and marble bracelets and carved stone bowls (Chapter 14).

***Archaeobotany and zooarchaeology***

A rich range of plant and animal remains were recovered, including well-preserved reed and grass phytoliths (Chapter 4); diverse cereals and legumes (Chapter 10) and well-preserved abundant fauna, including pig, sheep, birds and fish (Chapter 9).

## Future aims

A major aim is to excavate the Neolithic levels in 2013 as they are:

- under threat from erosion by the annual rise and fall in dam waters and the currents of the Lesser Zab River
- rich in animal bone, plant remains and artefacts,
- and stratigraphic sequences are well preserved with a range of architectural surfaces, walls, and plasters, including secondary aggregates of multiple white washed surfaces, similar to those on walls at Çatalhöyük (Chapter 4).

Other aims are:

- to provide a robust dating framework for the site by a systematic programme of well-stratified radiocarbon dates
- to survey the base of the upper mound to establish, if possible, the extent of the Neolithic site. The site may be up to *ca*. 60m W-E x 60-100m N-S, given the contours of the conglomerate ridge on which it is located.
- to continue to evaluate and record the impact of dam-waters on this mound, which to date have eroded a significant proportion of the south-east of the mound, and continue to be a major threat, especially as the site is founded on unconsolidated sediments.
- to conduct palaeoclimate and palaeoecological research in the environs.

# Chapter Seventeen: Intensive Field Survey in the Zarzi Region

Roger Matthews, Wendy Matthews, Dominik Fleitmann, Kamal Rouf Aziz, Amy Richardson, Robin Bendrey and Sarah Elliott

## Introduction: research aims

The CZAP team conducted a short season of intensive field survey in the region of Zarzi in January 2013. The survey included systematic, intensive field-walking in transects in order to search for archaeological sites. The emphasis of the survey was on early prehistoric sites with the particular aim to identify sites of Late Pleistocene and Early Holocene date that would be approximately contemporary with the project's research focus on the transition from hunter-forager to farmer-herder in the Early Neolithic period, *ca.* 10,000-7000 BC. The project permit issued by the Directorates of Antiquities and Heritage in Erbil and Sulaimaniyah allows for archaeological survey by the CZAP team in a region 15 x 15km, with the Chemi Rezan valley of Zarzi located in the north of the survey region (Fig. 17.1).

We also commenced exploration of appropriate cave sites, in particular with the aim to identify potential candidates for speleothem analysis in order to contribute new evidence for research into the ancient climate of the region, including the interaction between climate change and human social change during the Late Pleistocene and Early Holocene.

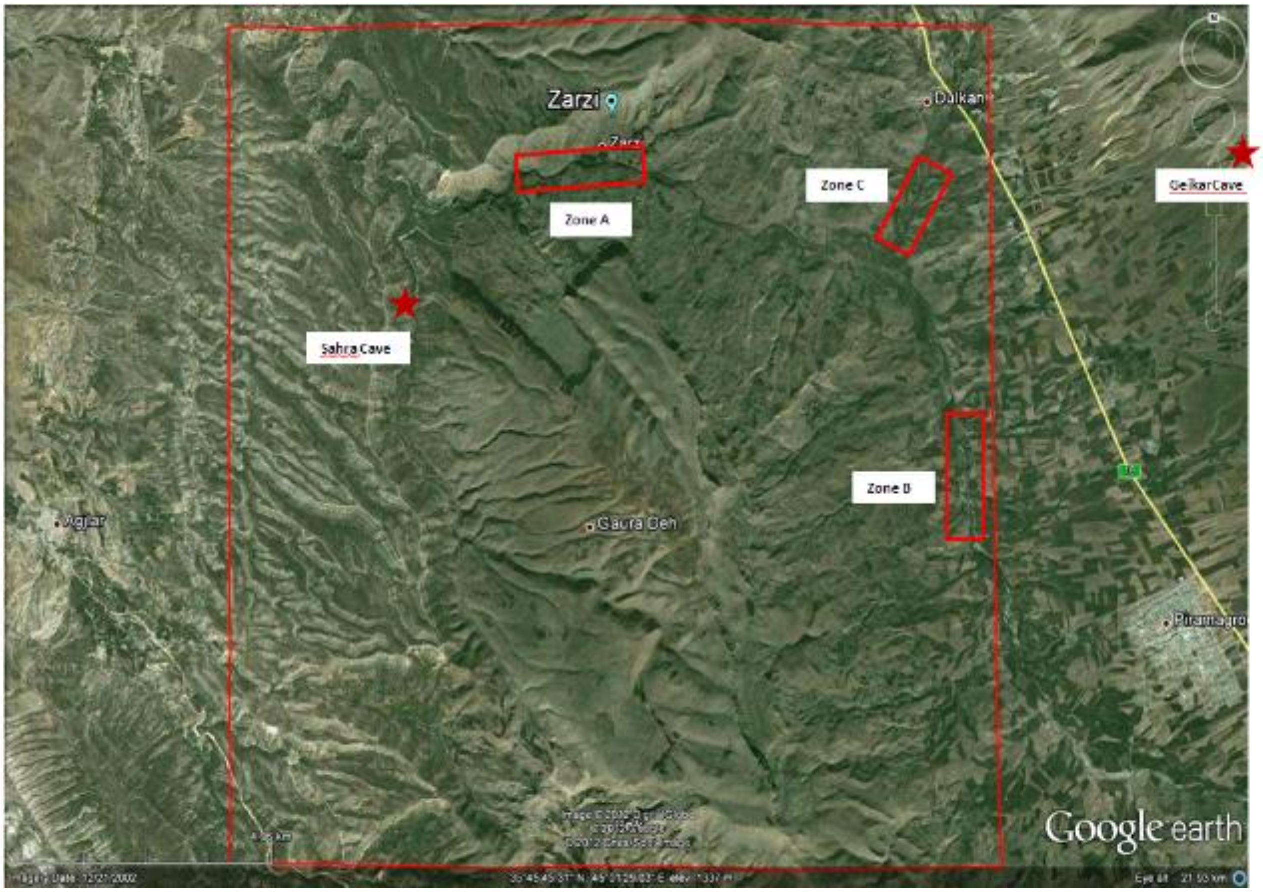



Figure 17.1. 15 x 15km extent of CZAP Zarzi survey region, showing location of intensive survey zones and visited caves.

## Systematic intensive field-walking: methodology

Archaeological surveys in Iraq have focused on readily identifiable components in the landscape such as tells, route-ways and rock-cut sites, employing what may be called an extensive survey methodology. There has so far been virtually no use in Iraq of systematic, intensive field survey techniques that have been developed in Mediterranean archaeology and frequently applied in landscape research projects in countries such as Italy, Greece, Bulgaria and, occasionally, Turkey (Matthews and Glatz 2009). Only with the application of systematic, intensive techniques can truly representative quantities of archaeological material be recovered and adequate emphasis be given to less obvious features in the archaeological landscape such as lithic scatters or small rural sites.

During the January 2013 Zarzi survey season, a total of ten transects was walked in three major zones, with a consistent team of six members walking at 20m intervals, thus covering a breadth of 100m. Survey zones and transects within the zones were not randomly chosen but were selected on the basis of a range of factors, including type of landscape, nature of local resources, and proximity to known archaeological sites. We carried out the survey in winter as the ground vegetation cover is very low at this time of year and thus visibility of artefacts and cultural debris on the ground is high. Weather conditions were mixed but there was no snow cover and we were able to walk transects for three full days and to carry out cave survey for two further days. We will conduct further periods of survey in the Zarzi region in future seasons in accordance with the CZAP permit.

The location of the three survey zones is indicated on the map, Fig. 16.1. Within these zones ten transects were walked (Zone A: Transects 1-6; Zone B: Transects 7-9; Zone C: Transect 10). The priority was to survey along the major river valleys of the region, walking on the terraces parallel with the river courses (Figs 17.2-17.4). All cultural materials were noted but only materials from early prehistoric sites were collected. In fact, cultural materials were rarely encountered and no sites were identified other than those discussed in this report.

Figure 17.2. Intensive field-walking in Zone A.

Figure 17.3. Intensive field-walking in Zone B.

Figure 17.4. Intensive field-walking in Zone C.

## Field survey results

In all, six archaeological sites were investigated during the survey, as listed in Table 17.1.

| Zone/Transect | Site | Name | Material | Dating |
|---|---|---|---|---|
| A | ZS1 | Zarzi Cave | Lithics | Late Upper Palaeolithic ('Zarzian') |
| A | ZS2 | Zarzi slopes | Lithics | Late Upper Palaeolithic ('Zarzian') |
| A/3 | ZS3 | None | Lithics | Late Upper Palaeolithic ('Zarzian') |
| A/1 | ZS4 | Holina | None | ? |
| C/10 | ZS5 | None | Hand-axe | Lower Palaeolithic ('Barda Balkan') |
| C/10 | ZS6 | None | Lithics, pottery | Chalcolithic/Early Bronze Age |

Table 17.1. Archaeological sites investigated during the Zarzi survey.

In the context of early prehistoric research, one of the most significant sites is the hand-axe find at ZS5 in Zone C, Transect 10 (Fig. 17.5), a site which appears to consist of a single hand-axe, perhaps dropped during use or re-deposited from elsewhere by natural agencies. The hand-axe has good parallels with material excavated at the Lower Palaeolithic site of Barda Balka, located only 25km to the south-southwest, and dates to approximately 150,000 BP or earlier (Wright and Howe 1951; Braidwood and Howe 1960).

Figure 17.5. *In situ* Lower Palaeolithic hand-axe at Site ZS5.

A highly significant site is ZS3 in Zone A, Transect 3. This is a flat open site located on a level spur overlooking the Chemi Rezan river and situated within good sight of Zarzi Cave, across the river exactly 1km to the northeast (Fig. 17.6). Site ZS3 consists of a dispersed scatter of chipped stone materials over an area of *ca.* 50 x 50m (Fig. 17.7), as well as a large boulder of limestone with cup hollows (Fig. 17.8) and a small number of ground-stone implements. The lithic material compares well to Late Upper Palaeolithic assemblages excavated at Zarzi Cave (Wahida 1981). We interpret this site as a small open air encampment of hunter-foragers moving in seasonal patterns across the landscape according to availability of plant and animal resources. Open air sites of this period are extremely difficult to locate, being small, flat and with dispersed surface remains, and they can only be located using intensive survey methods. Site ZS3 is the first open air (non-cave or rock shelter) Upper Palaeolithic site discovered in this region of Mesopotamia since Braidwood's 1951 discovery of the sites of Turkaka and Kowri Khan on the Chemchemal Plain 25km south-southwest of Zarzi (Braidwood and Howe 1960, 55-57).

Figure 17.6. The Upper Palaeolithic site of ZS3 in the foreground. Zarzi Cave is marked by an arrow.


Figure 17.7. Lithics from Site ZS3.

Figure 17.8. Boulder with cup hollows, Site ZS3.

## Cave survey

Initial visits were made to two major caves of the region, as a first step in a new programme of palaeoclimate research through analysis of speleothems. To the east of the survey region, Gejkar Cave (Fig.

17.9) was visited and a sample collected for future analysis. In the west of the survey region, Sahra Cave (Fig. 17.10) was visited and was found not to contain suitable material for sampling. Other caves in the region will be visited in future field activities.

Figure 17.9. Entrance to Gejkar Cave.

Figure 17.10. Approach to Sahra Cave.

## Bibliography


Abdi, K. 2003. The early development of pastoralism in the Central Zagros mountains. *Journal of World Prehistory* 17.4, 395-448.

Allison, P. M., 1999. Introduction. In: P. M. Allison, (ed.), *The Archaeology of Household Activities.* London and New York: Routledge, 1-18.

Anderson, S. and Ertug-Yaras, F. 1998. Fuel fodder and faeces: an ethnographic and botanical study of dung fuel use in central Anatolia. *Environmental Archaeology* 1, 99-110.

Arbuckle, B.S. and Özkaya, V. 2006. Animal exploitation at Körtik Tepe: an early Aceramic Neolithic site in southeastern Turkey. *Paleorient* 32.2, 113-36.

Aurenche, O., Galet, P., Régagnon-Caroline E. and Evin, J. 2001. Proto-Neolithic and Neolithic cultures in the Middle East- The birth of agriculture, livestock raising, and ceramics: A calibrated 14C chronology 12,500-5,500 cal BC. Proceedings of the 17th International 14C Conference 'Near East Chronology: Archaeology and Environment'. *Radiocarbon* 43.3, 1191-202.

Balasse, M., Stanley, A.H., Smith, A.B. and Price, T.D. 2002. The seasonal mobility model for prehistoric herders in the south-western cape of South Africa assessed by isotopic analysis of sheep tooth enamel. *Journal of Archaeological Science* 29, 917-32.

Banning, E.B.and Byrd, B.F., 1987. Houses and the Changing Residential Unit: Domestic Architecture at PPNB 'Ain Ghazal, Jordan. *Proceedings of the Prehistoric Society*, 53, 309-325

Barker, G. 2006. *The Agricultural Revolution in Prehistory: Why Did Foragers Become Farmers?* Oxford: Oxford University Press.

Bendrey, R. *In press*. Animal paleopathology. In C. Smith (ed.) *Encyclopedia of Global Archaeology*. New York: Springer.

Bendrey, R. 2012. Chapter six: preliminary assessment of the zooarchaeological assemblage. In R. Matthews *et al. Excavations at Bestansur, Sulaimaniyah Province, Kurdistan Regional Government, Republic of Iraq 17th March – 24th April 2012*. Central Zagros Archaeological Project Archive Report 1.

Bendrey, R., Cole, G. and Lelek Tvetmarken, C. *In press*. Economy, ecology and society: preliminary interpretations of the animal bones. In R. Matthews, Y. Mohammadifar and W. Matthews (eds) *The Earliest Neolithic of Iran: The Central Zagros Archaeological Project 2008 Excavations at Sheikh-e Abad and Jani*. Oxford: Oxbow Books and British Institute for Persian Studies.

Bendrey, R. 2011. Some like it hot: environmental determinism and the pastoral economies of the later prehistoric Eurasian steppe. *Pastoralism: Research, Policy and Practice*, 1.8.

Bendrey, R., Lepetz, S., Zazzo, A., Balasse, M., Turbat, T., Giscard, P.-H., Vella, D., Zaitseva, G. I., Chugunov, K. V., Ughetto, J., Debue, K. and Vigne, J.-D. *In press*. Nomads, horses and mobility: an assessment of geographic origins of Iron Age horses found at Tsengel Khairkhan and Baga Turgen Gol (Mongolian Altai) based on oxygen isotope compositions of tooth enamel. In M. Mashkour and M. Beech (eds) *Proceedings of the 9th ASWA Conference, Al Ain, 2008*. Oxford: Oxbow.

Bendrey, R., Whitlam, J., Elliott S., and Martin, G., 2012. Chapter eight: modern landscape transect sampling programme. In R. Matthews *et al. Excavations at Bestansur, Sulaimaniyah Province, Kurdistan Regional Government, Republic of Iraq 17th March – 24th April 2012*. Central Zagros Archaeological Project Archive Report 1, 101-05.

Bishop, A.C., Woolley, A.R. and Hamilton, W.R. 2001. *Minerals, Rocks and Fossils*. George Philip Limited.

Boessneck, J., 1969. Osteological differences between sheep (*Ovis aries* Linné) and goat (*Capra hircus* Linné). In D. Brothwell and E. Higgs (eds) *Science in Archaeology: A Survey of Progress and Research*. London: Thames and Hudson, 331-58.

Bogaard, A. 2005. 'Garden agriculture' and the nature of early farming in Europe and the Near East. *World Archaeology* 37**,** 177-96.

Bökönyi, S. 1977. *The Animal Remains from Four Sites in the Kermanshah Valley, Iran: Asiab, Sarab, Dehsavar and Siahbid*. BAR Supplementary Series 34. Oxford: B.A.R.

Bourdieu, P., 1990. *The logic of practice (translated by Richard Nice).* Cambridge : Polity.

Braidwood, R. J. and Howe, B. 1960. *Prehistoric Investigations in Iraqi Kurdistan*. Chicago: Oriental Institute.

Byrd, B.F., 1994. Public and private, domestic and corporate: the emergence of the southwest Asian village. *American Antiquity*, 59, (4) 639-666

Canti, M. G. 1998. The micromorphological identification of faecal spherulites from archaeological and modern materials. *Journal of Archaeological Science* 25**,** 435-44.

Canti, M.G. 1999. The production and preservation of faecal spherulites: animals, environment and taphonomy. *Journal of Archaeological Science* 26, 251-58.

Cessford, C. Microartifactual floor patterning: the case at Çatalhöyük: www.assemblage.group.shef.ac.uk/issue7/cessford.html

Cessford, C. and Mitrovic, S., 2005. Heavy-residue Analysis. In: I. Hodder , (ed.), *Changing materialities at Çatalhöyük : reports from the 1995-99 seasons.* London: McDonald Institute for Archaeological Research: British Institute at Ankara, 45-63.

Chabal, L., Fabre, L., Terral, J.F. and Thery-Parisot, I. 1999 L'anthracologie. In C. Bourquin-Mignot, J.-E. Brochier, L. Chabal, S. Crozat, L. Fabre, F. Guibal, P. Marnival, H. Richard, J.-F. Terral and I. Thery (eds) *La Botanique*. Paris: France, 43-104.

Charles, M. 1998. Fodder from dung: the recognition and interpretation of dung-derived plant material from archaeological sites. *Environmental Archaeology: The Journal of Human Palaeoecology* 1, 111-22.

Charles, M. 2007. East of Eden? A consideration of Neolithic crop spectra in the eastern Fertile Crescent and beyond. In S. Colledge and J. Conolly (eds) *The Origins and Spread of Domestic Plants in Southwest Asia and Europe.* Walnut Creek: Left Coast Press Inc., 37-52.

Charles, M., Halstead, P. and Jones, G. 1998. The archaeology of fodder: introduction. *Environmental Archaeology: The Journal of Human Palaeoecology* 1**,** i-ii.

Chataigner, C. 1998. Sources des artefacts du proche orient d'après leur charactérisation géochimique. In M.-C. Cauvin *et al*. (eds) *L'Obsidienne au Proche et Moyen Orient. Du volcan a l'outil*. BAR International Series 738. Oxford: Archaeopress, 273-324.

Cauvin, M.-C. and Chataigner, C. 1998. Distribution de l'obsidienne dans les sites archéologiques du proche et du moyen orient. In M.-C. Cauvin *et al*. (eds) *L'Obsidienne au Proche et Moyen Orient. Du volcan a l'outil*. BAR International Series 738. Oxford: Archaeopress, 325-350.

Conolly, J., Colledge, S., Dobney, K., Vigne, J.-D., Peters, J., Stopp, B., Manning, K. and Shennan, S. 2011. Meta-analysis of zooarchaeological data from SW Asia and SE Europe provides insight into the origins and spread of animal husbandry. *Journal of Archaeological Science* 38, 538-45.

Cribb, R. 1991. *Nomads in archaeology*. Cambridge: Cambridge University Press.

CZAP 2012, *Excavations at Bestansur, Sulaimaniyah Province, Kurdistan Regional Government, Republic of Iraq, 17th March-24th April 2012, Archive Report*, Central Zagros Archaeological Project.

Diskin, M. and Morris, D. 2008. Embryonic and early foetal losses in cattle and other ruminants. *Reproduction in Domestic Animals* 43, 260–67.

Dreslerová, D., Kočár, P., Chuman, T., Šefrna, L. and Poništiak, Š. 2013, Variety in cereal cultivation in the Late Bronze and Early Iron Ages in relation to environmental conditions. *Journal of Archaeological Science* 40.4, 1988-2000.

Ervynck, A., Dobney, K ., Hongo, H. and Meadow, R. 2002. Born free!: new evidence for the status of pigs from Çayönü Tepesi, Eastern Anatolia. *Paléorient* 27, 47-73.

Forbes, H. 2012. Lost souls: ethnographic observations on manuring practices in a Mediterranean community. In R. Jones (ed.) *Manure Matters: Historical, Archaeological and Ethnographic Perspectives.* Aldershot: Ashgate, 159-172.

Garrod, D.A.E. 1930. The paleolithique of Southern Kurdistan: excavations in the caves of Zarzi and Hazar Merd. *Bulletin of the American Society of Oriental Research* 6, 13-43.

Giddens, A., 1984. *The constitution of society : outline of the theory of structuration.* Cambridge : Polity.

Gilbert, A.S. 1983. On the origins of specialized nomadic pastoralism in western Iran. *World Archaeology* 15, 105–119.

Givens, D.M. and Marley, M.S.D. 2008. Infectious causes of embryonic and fetal mortality. *Theriogenology* 70.3, 270-285.

Ghosh, R., Gupta, S., Bera, S., Jiang, H., Li, X. and Li, C. 2008. Ovi-caprid dung as an indicator of paleovegetation and paleoclimate in northwest China. *Quaternary Research* 70**,** 149-57.

Hall, A. and Kenward, H. 1998. Disentangling dung: pathways to stable manure. *Environmental Archaeology* 1**,** 123-26.

Halstead, P. and Collins, P. 2002. Sorting the sheep from the goats: morphological distinctions between the mandibles and mandibular teeth of adult *Ovis* and *Capra*. *Journal of Archaeological Science* 29, 545-53.

Halstead, P. and Tierney, J. 1998. Leafy hay: an ethnoarchaeological study in NW Greece. *Environmental Archaeology* 1**,** 71-80.

Henton, E. 2012. The combined use of oxygen isotopes and microwear in sheep teeth to elucidate seasonal management of domestic herds: the case study of Çatalhöyük, Central Anatolia. *Journal of Archaeological Science* 39.10, 3264-3276.

Hesse, B. 1982. Slaughter patterns and domestication: the beginnings of pastoralism in western Iran. *Man* 17.3, 403-17.

Hesse, B. 1978. *Evidence for Husbandry from the Early Neolithic Sites of Ganj Dareh in Western Iran*. Ph.D. Dissertation. Columbia University, Ann Arbor: University Microfilms.

Hodder, I., 2006. *Çatalhõyûk, the leopard's tale : revealing the mysteries of Turkey's ancient 'town'Catahoyuk.* London: Thames & Hudson.

Hodder, I. and Cessford, C., 2004. Daily practice and social memory at Çatalhöyük. *American Antiquity*, 69, (1) 17-40

Hole, F. 1978. Pastoral nomadism in western Iran. In R.A. Gould (ed.) *Explorations in Ethnoarchaeology*. Albuquerque: University of New Mexico Press, 127-67.

Hubbard, R.N.L.B. 1990. The carbonised seeds from Tepe Abdul Hosein: results of preliminary analyses. In J. Pullar (ed.), *Tepe Abdul Hosein: A Neolithic Site in Western Iran, Excavations 1978*. Oxford: BAR International Series 563, 217-22.

Kenward, H. and Hall, A. 1997. Enhancing bioarchaeological interpretation using indicator groups: stable manure as a paradigm. *Journal of Archaeological Science* 24**,** 663-73.

Kozlowski, S.K. and Aurenche, O. 2005. *Territories, Boundaries and Cultures in the Neolithic Near East*. BAR International Series 1362. Oxford: Archaeopress.

Kramer, C. 1979. An archaeological view of a contemporary Kurdish village: domestic architecture, household size, and wealth. In C. Kramer (ed.) *Ethnoarchaeology: Implications of Ethnography for Archaeology.* New York: Columbia University Press, 139-63.

Kramer, C. 1982. *Village Ethnoarchaeology: Rural Iran in Archaeological Perspective*. New York: Academic Press.

Krader, L. 1955. Ecology of central Asian pastoralism. *Southwestern Journal of Anthropology* 11, 301-26.

Kuijt, I., 2000. An Introduction. In: I. Kuijt, (ed.), *Life in Neolithic farming communities: social organization, identity, and differentiation.* New York, London: Kluwer Academic/Plenum, 3-13.

LaMotta, V. M. and Schiffer, M. B., 1999. Formation processes of house floor assemblages. In: P. M. Allison, (ed.), *The Archaeology of Household Activities.* London and New York: Routledge, 19-29.

Lovejoy, C.O. 1985. Dental wear in the Libben population: its functional pattern and role in the determination of adult skeletal age at death. *American Journal of Physical Anthropology* 68, 47-56.

Mashkour, M., Bocherens, H. and Moussa, I. 2005. Long distance movement of sheep and goats of Bakhtiari nomads tracked with intra-tooth variations of stable isotopes ($^{13}C$ and $^{18}O$). In J. Davies, M. Fabiš, I. Mainland, M. Richards, and R. Thomas (eds) *Diet and Health in Past Animal Populations: Current Research and Future Directions*. Oxford: Oxbow books, 113-24.

Matthews, R. 2000. *The Early Prehistory of Mesopotamia, 500,000-500 BC*. Turnhout: Brepols.

Matthews, R. and Glatz, C. (eds) 2009. *At Empires' Edge. Project Paphlagonia Regional Survey in North-Central Turkey*. London: BIAA.

Matthews, R. and Richardson, A. 2012. Chipped stone tools and debitage. In R. Matthews *et al*. *Central Zagros Archaeological Project.* R. Matthews *et al. Excavations at Bestansur, Sulaimaniyah Province, Kurdistan Regional Government, Republic of Iraq 17th March – 24th April 2012*. Central Zagros Archaeological Project Archive Report 1, 106-25.

Matthews, R., Mohammadifar, Y. and Matthews, W. (eds). *In press*. *The Earliest Neolithic of Iran: The Central Zagros Archaeological Project 2008 Excavations at Sheikh-e Abad and Jani*. Oxford: Oxbow Books and British Institute for Persian Studies.

Matthews, W., 2005. Micromorphological and microstratigraphic traces of uses of space. In I. Hodder (ed.) *Inhabiting Çatalhöyük: Reports from the 1995-99 Seasons.* McDonald Institute for Archaeological Research and British Institute of Archaeology. UK: Cambridge, 355-98, 553-72.

Mellado, M., Valdez, R., Lara, L.M. and García, J.E. 2004. Risk factors involved in conception, abortion, and kidding rates of goats under extensive conditions. *Small Ruminant Research* 55.1-3, 191-8.

Mellor, D.J. and Stafford, K.J. 2004. Animal welfare implications of neonatal mortality and morbidity in farm animals. *The Veterinary Journal* 168.2, 118-33.

Miller, N.F. 1996. Seed eaters of the ancient Near East: human or herbivore? *Current Anthropology* 37.3, 521-28.

Mortenson, P. 1970. *Tell Shimshara: The Hassuna Period*. Historisk-Filosofiske Skrifter 5.2. Copenhagen: Kongelige Danske videnskabernes selskab.

O'Connor, T. P. 1991. *Bones from 46-54 Fishergate*. The Archaeology of York 15/4. London: Council for British Archaeology for the York Archaeological Trust.

Owen, W., *In prep*. *Neolithic Burial Practice in the Central Zagros: A Study of the Human Burials Found at the Site of Bestansur, Iraq.* Undergraduate dissertation, University of Reading.

Õzbal, R. 2006. *Households, Daily Practice and Cultural Appropriation at Sixth Millenium Tell Kurdu.* (PhD dissertation). Northwestern University.

Parker, B.J., Foster, C.P., nicoll, K., kennedy, j., graham, p., smith, a., hopwood, d., hopwood, m., butler, k., healey, e., uzel, m., and jensen, r., 2009. The Upper Tigris Archaeological Research Project (UTARP): A Preliminary Report from the 2007 and 2008 Field Seasons at Kenan Tepe. *Anatolica*, 35, 85-152

Pereira, F. and Amorim, A. 2010. Origin and spread of goat pastoralism. In *Encyclopaedia of Life Sciences (ELS)*. Chichester: John Wiley & Sons Ltd.

Peters, J., von den Dreisch, A. and Helmer, D. 2005. The upper Euphrates-Tigris basin: cradle of agro-pastoralism? In J.-D. Vigne, J. Peters and D. Helmer (eds) *The First Steps of Animal Domestication: New Archaeozoological Approaches*. Oxford: Oxbow Press, 96-124.

Portillo, M., Albert, R.M., Kadowak, S. and Nishiak, Y. 2010. Domestic activities at Early Neolithic Tell Seker al-Aheimar (Upper Khabur, Northeastern Syria) through phytoliths and spherulites studies. In C. Delhon, I. Théry-Parisot and S. Thiébault (eds) *Des hommes et des plantes: exploitation du milieu et gestion des ressources végétales de la Préhistoire à nos jours.* Antibes: ADPCA, 19-30.

Porter, A. 2012. *Mobile Pastoralism and the Formation of Near Eastern Civilizations: Weaving Together Society*. Cambridge: Cambridge University Press.

Prummel, W. and Frisch, H.-J. 1986. A guide for the distinction of species, sex and body side in bones of sheep and goat. *Journal of Archaeological Science* 13, 567-77.

Pullar, J. 1975. *The Neolithic of the Iranian Zagros*. PhD thesis, University of London.

Rainville, L., 2003. Results from microarchaeology in 2001 and 2002. In: Excavations at Tell Brak 2001-2002: Preliminary report. Geoff Emberling and Helen McDonald. *Iraq*, 65, 63-72

Rainville, L., 2005. *Investigating Upper Mesopotamian households using micro-archaeological techniques.* Oxford : Archaeopress.

Riehl, S., Benz, M., Conard, N., Darabi, H., Deckers, K., Nashli, H. and Zeidi-Kulehparcheh, M. 2012. Plant use in three Pre-Pottery Neolithic sites of the northern and eastern Fertile Crescent: a preliminary report. *Vegetation History and Archaeobotany*, 1-12.

Roaf, M., 1989. Social Organization and Social Activities at Tell Madhur. In: E. F. Henrickson and I. Thuesen, (eds.), *Upon this foundation : the `Ubaid reconsidered : proceedings from the `Ubaid Symposium, Elsinore, May 30th-June 1st 1988.* Copenhagen: Museum Tusculanum Press: University of Copenhagen., 91-146.

Roux, V. 2007. Ethnoarchaeology: a non-historical science of reference necessary for interpreting the past. *Journal of Archaeological Method and Theory* 14, 153-78.

Saeedi, S., 2010. Microdebris analysis. In: S. Pollock, R. Bernbeck, and K. Abdi, (eds.), *The 2003 excavations at Tol-e Baši, Iran: social life in a Neolithic village.* Mainz: Verlag Philipp Von Zabern, 246-255.

Schmidt, E., 1972. *Atlas of Animal Bones - For Prehistorians, Archaeologists and Quaternary Geologists*. Amsterdam: Elsevier Publishing Company.

Shahack-Gross, R. 2011. Herbivorous livestock dung: formation, taphonomy, methods for identification, and archaeological significance. *Journal of Archaeological Science* 38**,** 205-18.

Shmidt, A.2007. Archaeology: magnetic methods. In D. Gubbins and E. Herroro-Bervera (eds) *Encyclopedia of Geomagnetism and Paleomagnetism*. Encyclopaedia of Earth Sciences Series Heidelberg. New York: Springer, 23-31.

Silanikove, N. 2000. The physiological basis of adaptation in goats to harsh environments. *Small Ruminant Research* 35. 181-93.

Solecki, R.L. and Solecki, R.S. 2004. Burial offerings and other goods from the proto-Neolithic graves. In R.S. Solecki, R.L. Solecki and A.P. Agelarakis (eds) *The Proto-Neolithic Cemetery at Shanidar Cave*. Texas: Texas A&M University Press.

Souvatzi, S.G., 2008. *A social archaeology of households in Neolithic Greece:an anthropological approach.* Cambridge: Cambridge University Press.

Stampfli, H.R. 1983. The fauna of Jarmo, with notes on animal bones from Matarrah, the Amuq, and Karim Shahir. In R. J. Braidwood, L. Braidwood, B. Howe, C. A. Reed and P. J. Watson (eds) *Prehistoric Archaeology Among the Zagros Flanks*. Chicago: Oriental Institute Publications 105, 431-84.

Tafuri, M.A., Bentley, R.A., Manzi, G. and di Lernia, S. 2006. Mobility and kinship in the prehistoric Sahara: strontium isotope analysis of Holocene human skeletons from the Acacus Mts. (southwestern Libya). *Journal of Anthropological Archaeology* 25, 390-402.

Trotter, M., 1970. Estimation of stature from intact long bones. In T.D. Stewart (ed.) *Personal Identification in Mass Disasters*. Washington DC: Smithsonian Institution Press, 71-83.

Varoutsikos, B. and Chataigner, C. 2012. *Obsidatabase*. http://www.mom.fr/obsidienne (to be released at http://www.obsidatabase.com/ in 2013).

Verhoeven, M., 1999. *An archaeological ethnography of a neolithic community : space, place and social relations in the burnt village at Tell Sabi Abyad, Syria.* Istanbul: Nederlands Historisch-Archaeologisch Instituut te Istanbul.

Verhoeven, M., 2004. Beyond Boundaries: Nature, Culture and a Holistic Approach to Domestication in the Levant. *Journal of World Prehistory*, 18, (3) 179-282

Vigne, J.-D. 2011. The origins of animal domestication and husbandry: a major change in the history of humanity and the biosphere. *Comptes Rendus Biologies* 334, 171-81.

Vigne, J.-D., Carrère, I., Briois, F. and Guilaine, J. 2011. The early process of mammal domestication in the Near East: new evidence from the pre-Neolithic and Pre-Pottery Neolithic in Cyprus. *Current Anthropology* 52 suppl. 4, S255-71.

Wahida, G. 1981. The re-excavation of Zarzi, 1971. *Proceedings of the Prehistoric Society* 37, 19-40.

Wallace, M. and Charles, M. *In prep.* What goes in must come out. Towards a method for the interpretation of dung-derived plant remains on archaeological sites: survival of cereal and wild plant material in experimental sheep feeding.

Watson, P.J. 1979. *Archaeological ethnography in Western Iran*. Tuscon: Univeristy of Arizona Press, for the Wenner-Gren Foundation for Anthropological Research Inc.

White, T.D. and Folkens, P.A. 2005. *The Human Bone Manual.* London: Elsevier.

Wilk, R.R.and Rathje, W.L., 1982. Household Archaeology. *American Behavioral Scientist*, 25, (6) 617-639

Wright, H.E. Jr and Howe, B. 1951. Preliminary report on soundings at Barda Balka. *Sumer* 7, 107-118.

Zeder, M.A. 2005. A View from the Zagros: New perspectives on livestock domestication in the Fertile Crescent as viewed from the Zagros Mountains. In J.-D. Vigne, J. Peters and D. Helmer (eds) *The First Steps of Animal Domestication: New Archaeozoological Approaches*. Oxford: Oxbow Press, 125-46.

Zeder, M.A. 2008. Animal domestication in the Zagros: an update and directions for future research. In E.Vila, L.Gourichon, A.M.Choyke and H.Buitenhuis (eds) *Archaeozoology of the Near East VIII*. Travaux de la Maison de l'Orient et de la Méditerranée 49. France : Lyon, 243-77.

Zeder, M.A. 2009. The Neolithic Macro-(R)evolution: Macroevolutionary theory and the study of culture change. *Journal of Archaeological Research* 17.1, 1-63.

Zeder, M.A. and Hesse, B. 2000. The initial domestication of goats (*Capra hircus*) in the Zagros mountains 10 000 years ago. *Science* 287.5461, 2254-7.

Zeder, M.A. and Lapham, H.A. 2010. Assessing the reliability of criteria used to identify post-cranial bones in sheep, Ovis, and goats, Capra. *Journal of Archaeological Science* 37, 2887-905.

Zeder, M.A. and Pilaar, S.E. 2010. Assessing the reliability of criteria used to identify mandibles and mandibular teeth in sheep, Ovis, and goats, Capra. *Journal of Archaeological Science* 37, 225-42.

Zimmermann, W.H. 1999. Why was cattle stalling introduced in prehistory? The significance of byre and stabale and of outwintering. In C. Fabech and J. Ringtved (eds) *Settlement and Landscape. Proceedings of a Conference in Aarhus, Denmark.* Aarhus: Jutland Archaeological Society, 301-18.

Zohary, D. and Hopf, M. 2000. *Domestication of Plants in the Old World: The Origin and Spread of Cultivated Plants in West Asia, Europe and the Nile Valley*. 3rd edn. Oxford: Oxford University Press.