



Qatar Islamic Archaeology and Heritage Project

End of Season Report : 2013-2014

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2013 - 2014



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acknowledge and appreciate the perceptive leadership and considerable support of:**

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CONTENTS

1.	Introduction	1
1.1	Qatar islamic Archaeology and Heritage Project	1
1.2	Archaeology and Conservation in Al Zubarah	1
1.3	Archaeology and Conservation in Freiha	4
1.4	Specialist Analyses of Freiha Material	5
1.5	Survey	5
1.6	Finds and Object Conservation	5
1.7	Outreach	6
2.	The <i>Souq</i> and Date Processing Area (ZUEP02)	7
2.1	Archaeological Investigations	7
2.2	Conservation Work	23
3.	The Palatial Compound (ZUEP04)	26
3.1	Archaeological Investigations	26
3.2	Recovery of Collapsed Arches	38
3.3	Assessment of Plaster Fragments	43
3.4	Consolidation and Conservation Work	44
4.	The Fortified Compound (QMA4)	50
4.1	Archaeological Investigations	50
4.2	Consolidation and Conservation Work	55

5.	The Outer Town Wall (ZUEP10, ZUEP11, ZUEP13)	60
5.1	Archaeological Investigations - ZUEP13	60
5.2	Consolidation and Conservation Work - ZUEP13	62
5.3	Consolidation and Conservation Work - ZUEP10 and ZUEP11	67
6.	Al Zubarah Fort (ZUEP12)	69
6.1	Introduction	69
6.2	Al Zubarah Fort Visitor Centre	69
6.3	Building History	74
6.4	Conclusions and Further Work	77
7.	The Freiha Mosque (FREPO1)	78
7.1	Archaeological Investigations	78
7.2	Consolidation and Conservation Works	85
8.	Freiha Pottery Report	90
8.1	Introduction and Methodology	90
8.2	Gulf Glazed Wares	93
8.3	Far East Fine Wares	106
8.4	European Glazed Wares	111
8.5	Modern Porcelain from Europe and the Far East	111
8.6	Unglazed Gulf Wares	111
8.7	Conclusion	130

9.	Freiha Archaeoichthyology	131
9.1	Introduction	131
9.2	Analysis of Fish Bone from Freiha	131
9.3	Relative Importance of Fish throughout the Stratigraphic Sequence	131
9.4	Conclusions and Further Research	141
10.	Archaeozoology - Freiha	144
10.1	Introduction	144
10.2	Research Questions and Methodology	144
10.3	Species Distribution at FREP04	144
10.4	Species by Phase	148
10.5	Conclusions and Recommendations	149
11.	Archaeobotany - Freiha	151
11.1	Introduction	151
11.2	Flotation	151
11.3	Heavy Fraction	151
11.4	Botanical Analysis	152
11.5	Quantification Indices	152
11.6	Conclusions and Recommendations	156
12.	Archaeomalacology - Freiha and Al Zubarah	158
12.1	Introduction	158
12.2	Summary of Work	158

12.3	Conclusions and Recommendations	159
13.	Geomatics & Regional Survey	163
13.1	Introduction	163
13.2	Al Zubarah Town	163
13.3	Sites in the Unesco Buffer Zone	164
13.4	Conclusions and Recommendations	168
14.	Special Finds	169
14.1	Introduction	169
14.2	Glass Bottle - ZUEP02	169
14.3	Bone Inlay - ZUEP04	171
14.4	Pearls - Freiha	172
15.	Field Object Conservation	173
15.1	Introduction	173
15.2	Summary of Materials	173
15.3	Main Conservation Issues	174
15.4	Desalination of Ceramics	174
15.5	Conservation of Metals	176
15.6	Desalination Experiment and Results	178
15.7	Conclusion	179
16.	Outreach and Site Presentation	180
16.1	Introduction	180

16.2	Site Presentation	180
16.3	Audience Development	181
16.4	Educationd and Outreach	182
16.5	Visitor Numbers	183
16.6	Archaeological Site	183
16.7	Cooperation with Maersk Oil Qatar	185
16.8	Conclusions and Recommendations	185
17.	Summary	186
17.1	Archaeology	186
17.2	Heritage Conservation	187
17.3	Outreach	187
17.4	Recommendations	187
18.	Selected Bibliography	189

1. INTRODUCTION

Sandra Rosendahl

1.1 QATAR ISLAMIC ARCHAEOLOGY AND HERITAGE PROJECT

As practitioners of archaeology and heritage conservation, we are frequently confronted with sites and architecture that are considered monumental, spectacular and historically meaningful to a country or an entire region; we always believe that sites are worth excavating and preserving, both in their own right and for providing tangible history to people near and far. Only rarely, however, are we privileged to witness such recognition in the form of an inscription on the exclusive list of sites considered World Heritage by UNESCO and its advising bodies. At Al Zubarah Archaeological Site, we have had that opportunity in the summer of 2013, when the historical town and its immediate surroundings were declared World Heritage.

Five years ago, before the first trowel broke the ground to resurrect the ruins of the late 18th and 19th century town of Al Zubarah from underneath the dunes of wind-blown sand, we dimly knew of its significance in the history of Qatar and the Arabian Gulf. All subsequent research, both at Al Zubarah and in the wider hinterland of the town in northwest Qatar, has only manifested that belief as a certainty, and ongoing work is creating a more in-depth record of archaeological, historical and building technological detail every season. We are learning about the people living and working in Al Zubarah - as part of the pearling industry, and even more as active participants in a local and regional community.

This work, together with the much-required consolidation and restoration work on the exposed architecture on site, has presented the Qatar Islamic Archaeology and Heritage Project and Qatar Museums with the opportunity to reveal the site to the public, and to introduce its history and its role in the building of Qatar to a wider audience.

The highly publicised opening of the site on December 12th 2013 was a milestone for the project. In the months leading up to the big date, the architectural icon that is Al Zubarah Fort, already under restoration for some time, had been converted into a Visitor Centre to introduce the history, archaeology and environment of northwest Qatar to an audience that until then had been largely unaware of the very existence of the historic town and its surroundings.

This report presents a summary of the work taking place in the two months prior to the opening, and the five months in the spring following it (Figures 1.1 and 1.2). It highlights how far archaeological and conservation work has come since those first trowel scratches - the first areas of excavation have been completed, with material and specialist studies now taking place of the vast assemblages of ceramics, bone (particularly fish) and shell. First results of these studies are presented here.

1.2 ARCHAEOLOGY AND CONSERVATION IN AL ZUBARAH

Chapter 2 summarises archaeological investigations in ZUEP02, an area south of the previously excavated and restored *souq*, that have been taking place since spring 2009. Since then, at least five phases of occupation have been distinguished, and in particular the two major phases of town occupation known from historic sources. Over an area of 0.2 hectares, archaeologists have now exposed (and partially backfilled for protection) a large warehouse and specialised industrial quarter for the storage of dates and production of date syrup (*dibs*). At least 21 date presses have been uncovered, with more likely still buried under nearby deposits. The date presses show a high degree of individualism, as well as frequent modification and repair. Similar



Figure 1.1: Plan of excavation and conservation areas in Al Zubarah in 2013/2014.

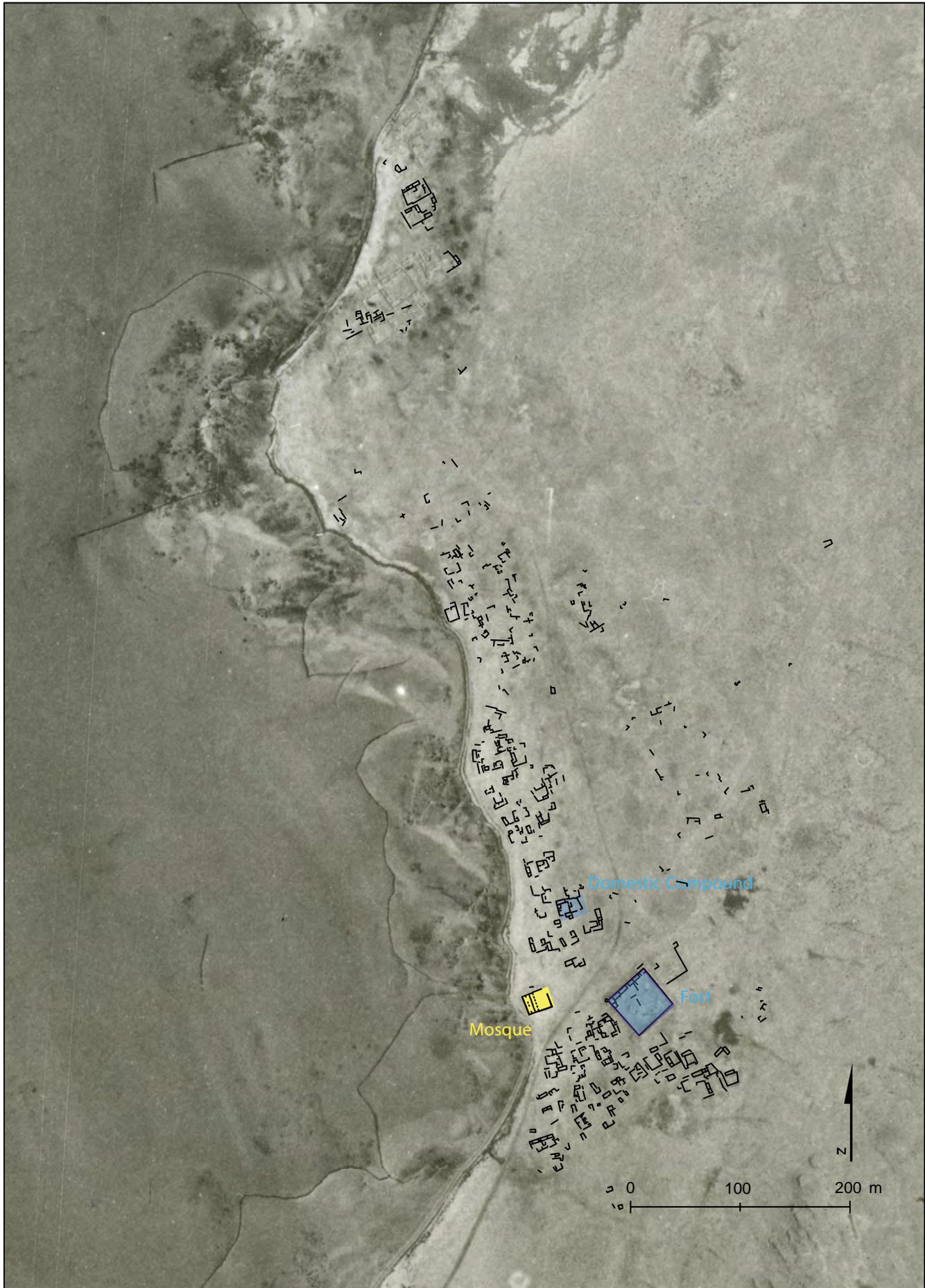


Figure 1.2: Plan of excavation and conservation areas in Freiha in 2013/2014.

centres of storage and distribution, and maybe even production, of other products may also be found in the vicinity, taking advantage of the beach front close to the harbour, and may give an indication of the scope that the market area might once have encompassed. Material culture from ZUEP02 includes vast quantities of ceramics, including entire (but unfortunately broken) vessels lying on shop floors.

Work in the palatial compound (ZUEP04), which has been taking place since spring 2010, focused on the completion of excavations in the southwest compound section and made significant progress in the uncovering of the next courtyard immediately to the north, as reported in Chapter 3. The excavations show the very first steps of building construction and material extraction, as well as the various sequences of repair and change of the building and its occupation levels. Investigations into the architecture itself have uncovered spectacular evidence of wall and arch constructions which, with appropriate recovery techniques and preservation, allow the reconstruction of the architecture in detail and up to ceiling height. The southwest compound has also now been consolidated and restored to a point that it can serve as the primary visitor point on the first tourist track through the site. Al Zubarah's environmental conditions make the conservation of walls and plasters a particular challenge; constant monitoring and maintenance are required to ensure walls remain stable for presentation while using authentic material.

Chapter 4 summarises renewed conservation work undertaken in the nearby fortified compound (QMA4) which had first been excavated and reconstructed in the 1980s. The predominant use of cement for reconstruction plasters had resulted in the near complete erosion of historic building stones while the cement cappings had survived, creating ghost walls. The area was cleaned up, with some additional archaeological recording, so that conservation could proceed. Although limited in scope, the archaeological work has shown that even already "completed areas" can still provide new insights, as sondages and a detailed study of architectural relationships have uncovered several phases of activity within the building as well as reconstruction and repair to the structure. The conservation work aims to provide an accessible section of this fortified compound as part of the tourist track, showing not only archaeological and architectural information but also the history of conservation on site.

Ongoing conservation works along the outer town wall revealed greater detail of the history of this demarcating line and its use in the late 18th and early 19th century as a defensive installation, as shown in Chapter 5. As a highly visual point of any tourist visit to the site, the town wall is being reconstructed in large sections in the south and north of Al Zubarah, making reconstructed towers accessible for great views over the site and the wider coastal region. Difficulties and limitations in the consolidation efforts differ significantly across the site, showing the variable rise of humidity and salt and their effects on the stability of architecture and the extent of necessary maintenance over time.

Chapter 6 describes the repair and restoration works in Al Zubarah Fort, installing the Visitor Centre, and preparing additional features to be completed in autumn 2014. This season allowed time to study in greater detail the building history of the fort, particularly in regards to plastering and repair works on the facades and staircases. In the course of the work at the entrance gate, a dhow mast was discovered in use as a lintel; this had to be removed and can now be found as the centrepiece in the artefact exhibition associated with the Visitor Centre.

1.3 ARCHAEOLOGY AND CONSERVATION IN FREIHA

Much work this season has been undertaken in and, particularly, on previously recovered material from the nearby village of Freiha. While major excavations of a courtyard house and its surroundings were finished in spring 2013, the mosque required some further investigations to illuminate the complicated building history and usage phases prior to consolidation and presentation as part of the touristic development. Chapter 7 summarises this fieldwork,

highlighting a number of features not previously identified, such as a well-preserved *mihrab* from the building's early phase and a possible wash room annex. In addition, the chapter describes the consolidation work on a majority of the walls so far exposed, making the mosque more resistant to the effects of time and the elements and allowing it to remain open and accessible for visitors.

1.4 SPECIALIST ANALYSES OF FREIHA MATERIAL

Analysing material culture from Freiha, particularly from the domestic area (FREPO4), was the focus of the project specialists this season. Extents of assemblages of ceramics, bone, shells and botanical material vary considerably both spatially and over the various phases identified in the stratigraphy; accordingly, so does the completeness of the analysis. Specialists were provided with a list of contexts of particular interest to the primary excavator due to their location both spatially and temporally (priority loci); a complete stratigraphic analysis of the material will aid considerably in the interpretation of internal and external spaces in FREPO4, their functions and usage patterns, and changes over time.

Chapter 8 summarises the ceramic assemblage in a catalogue of wares that can serve as a guideline for the identification of wares elsewhere in Qatar and the wider Arabian Gulf, and also provides an initial framework for dating Freiha as a whole as well as by architectural phase. Thus, even without any firm dating evidence as yet stemming from radiocarbon (C14) analysis or the dating of coins, and despite a paucity of historical documentation referring to Freiha as anything more than an observed spot on early maps of the region, ceramic analysis can locate the village to at least the early 18th century and throughout the 19th century; earlier dates are possible.

Chapters 9 to 12 address the significant assemblages of faunal and botanical material across the spaces and phases in FREPO4, showing the dominance of fish and rice in the diet of the inhabitants, but also highlighting a great diversity of exploitation of both desert and marine or coastal resources. In particular, analysis of the fish bone has been able to identify different fishing practices and changes within these across the lifetime of Freiha, showing a marked reliance of deep-water fishing in the site's earliest phase followed by a greater utilisation of specially constructed fish traps in the shallow waters in later times. Both the terrestrial hinterland and the wider seascape were expertly exploited, showing Freiha to have been a village well-adjusted to an existence between land and sea.

1.5 SURVEY

In Chapter 13, survey work shows not only that the UNESCO Buffer Zone was an active area of landscape exploitation throughout time, but that it was a particular focus of early Islamic occupation utilizing the presence of shallow underground water sources and the fertile areas of rawdah for grazing and plant use. Several of these sites, forming a palimpsest around a modern farm, have now been mapped in detail and can form the basis of further archaeological research into this time period.

1.6 FINDS AND OBJECT CONSERVATION

Finds and object conservation work is presented in Chapters 14 and 15. Conservation of objects has become a major activity, as many material types are strongly affected by the ubiquity of salts in the soil and air. This applies especially to metals, but ceramics are also threatened by irreparable damage due to salt efflorescence destroying the integrity of the fabric and slowly

decomposing the object. New methods for the efficient desalination of both metals and ceramics were experimented with, but final results are yet to be compiled and implemented into a consistent conservation methodology.

1.7 OUTREACH

Finally, Chapter 16 presents the project's active and popular outreach and presentation programme, responsible for the design and implementation of the Visitor Centre displays as well as the tourist track development in Al Zubarah town. The great success, visible in the ever-increasing visitor numbers to both Al Zubarah Fort and the site, can to a large degree be attributed to the work done here. Rising numbers of school groups attending tours as part of their history curriculum also highlight the prominent role the town now plays in the awareness of Qatar's population.



Figure 1.3: QIAH team in December 2013.

2. THE *SOUQ* AND DATE PROCESSING AREA (ZUEP02)

2.1 ARCHAEOLOGICAL INVESTIGATIONS

Michael House

2.1.1 Introduction

Al Zubarah Excavation Point 2 (ZUEP02) is located inside the Inner Town Wall of Al Zubarah, slightly to the north of centre and overlooking the beach. The area is situated about 50m southeast of the earlier excavations of the *souq* (hereafter referred to as QMA1); it consists of the Main Area and Western Area (40m²) and a linking trench dubbed the Northern Extension, connecting the *souq* and the Main Area (Figure 2.2).

Fieldwork in 2013/2014 was a direct continuation of the work of the last five seasons of revealing the 19th century (Phase 3) and 18th century (Phase 5) occupation of the beach front. The overarching goal remained to develop a better understanding of the area and its functions throughout the development of Al Zubarah. Focus this season was the Phase 5 *souq* in the Northern Extension, the understanding of its architecture and its relationship with the storage compounds in the Main Area to the south and the work carried out in QMA1 to the north.

A majority of the Phase 3 architecture had been removed in previous seasons. In order to reveal an entire block of Phase 5 rooms or structures in the western portion of the trench, the area was extended by 1m, requiring the removal of several wall features and their associated deposits and surfaces. These were likely part of the western boundary of the previously excavated Phase 3 compound (see House 2012, 2013). The architectural markers of several date presses (*madbasat*) were already apparent at the end of spring 2013; however, the remarkable extent of the date processing area was revealed only this season, with a total of 15 Phase 5 date presses now fully exposed in the Northern Extension and a further five as yet unexcavated in the eastern part of the *souq*.

This summary report highlights the most significant features of each identified phase.

2.1.2 Phase 6

Two street sondages were excavated down to the earliest Phase 6 between the two date press blocks, revealing a sequence of occupation horizons, ash mixed with marine sands, and cut features such as post holes, stake holes, waste pits, fire pits and *tanurs* reminiscent of sequences at both ZUEP01 (Yeomans 2012) and ZUEP03 (Collie 2010).

Catchment pits in the date press rooms show the level of natural beach sand below the architectural horizon and, in the case of at least two pits, also the presence of Phase 6 activity in the form of a truncated *tanur* and its associated occupation horizon.

The Phase 5 exterior surface identified in Sondage 3 (Space 99) sealed the mixed Phase 6 sands which also contained cultural waste, including a fractured and worked haematite stone (likely part of a diving weight), and a small, round stone (probably part of a gaming set). Below this layer were three cut features in the natural beach sand formed by driven posts.

In Sondage 1 through the northern end of the street, two finds of interest were recovered from the mixed sand occupation layer: a lead musket shot showing mould detail and trimming of excess lead, and a single human molar possibly usable for DNA analysis.



Figure 2.1: End of Season kite photograph of the Northern Extension. (QF-0125)

2.1.3 Phase 5

Phase 5 represents the first of two major architectural phases identified across Al Zubarah and consists of well-constructed and finely plastered walls of beach- and limestone and many plastered surfaces. This phase is divided into three major sub-phases of construction, development and abandonment.

The Northern Extension contains three Phase 5 structures: a western and eastern *souq/date* processing block, and the Central Courtyard Compound extending to the south into the Main Area and east beyond the current limit of excavation. These elements are separated by two main streets and two smaller alleyways (Figure 2.2).

The date presses consist of two distinct components: firstly, the date press superstructure formed of stone-built and plastered ridges alternating with channels, sloping slightly in one direction. The syrup or *dibs* would flow along these channels to a low, plastered kerb wall where it would be redirected through several bridged tunnels or culverts into one corner; here it would drain from the structure through the kerb wall into the second major component of a *madbasa*, the catchment room, and be collected in a large storage vessel set into the ground. The *dibs* would then have been decanted into smaller vessels for transportation.

Western *souq/date* processing block

This large structure was fully exposed this season and all of the rooms within the structure excavated to the abandonment surfaces. The block is constructed along a N-S-oriented arterial wall, with six larger rooms located to its east all functioning at the time of abandonment as date presses. It is, however, apparent from some of the architectural detailing and some later intrusions that this was not always the case, and that several of the rooms had originally had a function other than date storage. To the west of the main arterial wall, the rooms were less than

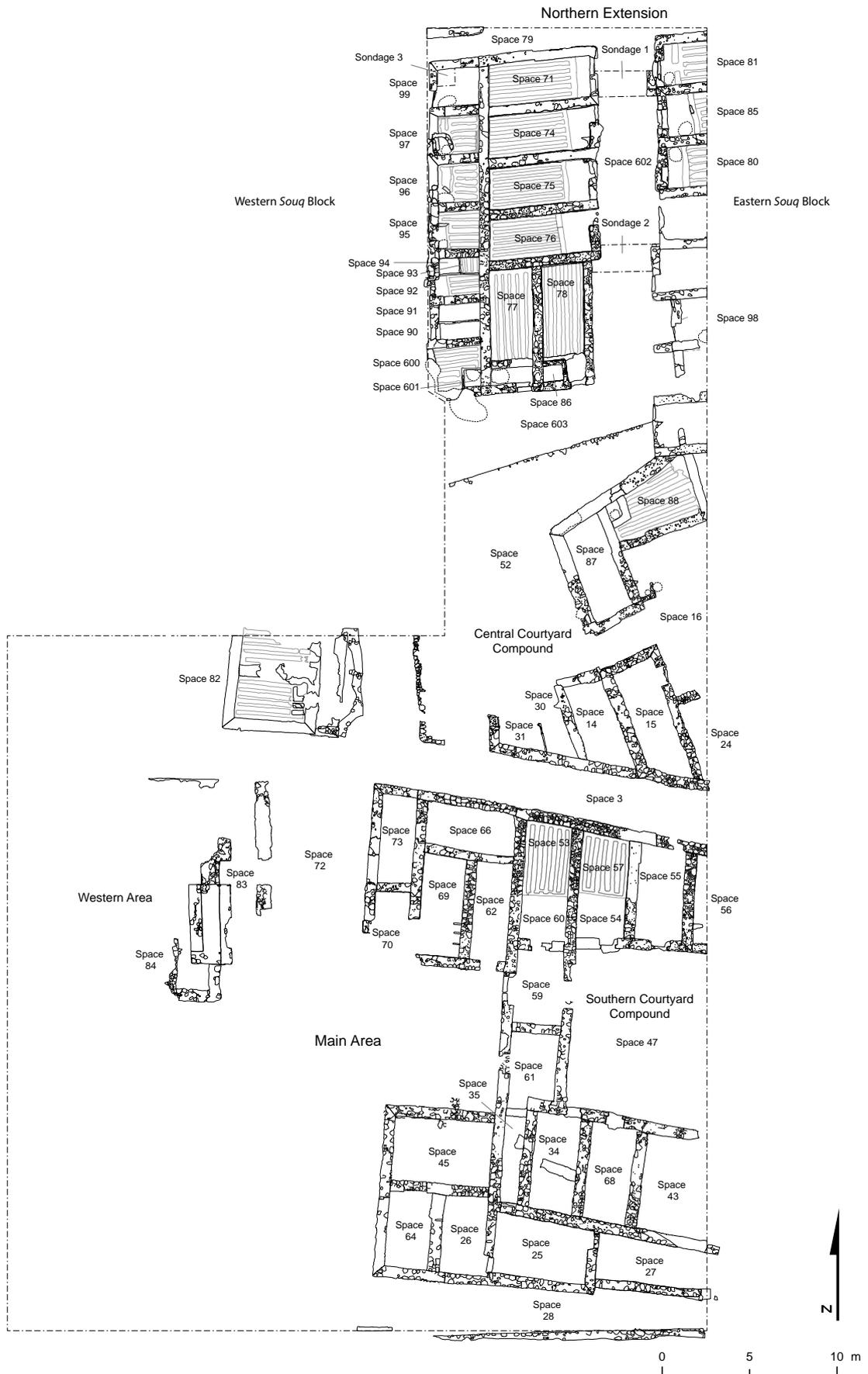


Figure 2.2: Overview plan of Phase 5 architecture in ZUEP02.

half the size of those to the east and showing greater sub-division, thus forming 11 functioning spaces of which five were date presses. All of the date presses show slight yet significant variations in construction techniques, which may represent individual operation rather than fully centralised production.

All 11 spaces located to the west of the main arterial wall were subject to major restructuring, with the entire range of spaces extended to the west by just over 1.00m – 1.20m during their lifetime. It would appear that the function of these rooms changed considerably from small, cellular open-fronted rooms (possibly with large double wooden doors) to enclosed square spaces of which some were later sub-divided, with standard doors and thresholds set into masonry walls. Five of these rooms functioned as date presses after the spaces were extended, four as dry storage spaces or hoppers, and one remained plain and showed no discernible function at first glance.

Space 71

Located in the NE corner, this large rectangular space (5.80m x 2.30m) was accessed from the east from the N-S aligned street (Space 602) (Figure 2.3).

A ceramic vessel was still present within the catchment pit, although an attempt had been made to remove it prior to abandonment. This, however, failed – breaking the top of the vessel which was subsequently abandoned. The floor of the catchment room was covered in a hard grey plaster and the pit covered with a plaster cap.

Of particular interest in Space 71 were the changes evident in the structure's façade, with the original ingress being a wide opening spanning the entire frontage with two plastered, curved columns either side. This appears to be reflecting an earlier function of the room prior to the conversion to a date processing structure, possibly as an open shop frontage together with adjacent rooms. Surfaces can clearly be seen within the catchment pit here and in other rooms, predating most of the date presses.



Figure 2.3: Date press Space 71, looking west. (KF-0541) The inset shows a detailed view of the date syrup catchment vessel *in situ*. (KF-0426)

Spaces 74, 75 and 76

These three date presses, of similar dimensions as Space 71, are aligned E-W and accessed from the main street (Space 602). They show slight variations in the size and depth of internal features such as the kerb wall (which in Spaces 75 and 76 had a small, shallow threshold) and the length, depth and profile of the date press superstructure. The gypsum plaster in all the rooms varied in both colour and consistency; in Spaces 75 and 76, the plaster was particularly weak and crumbled on touch, and repairs were evident on the walls in both rooms. In Spaces 71 and 74, the plaster was much more robust, and although repairs and adjustments had been made, they were less extensive. All of the rooms had their catchment vessels removed prior to abandonment. Interestingly, Space 76 had a rounded stone stopper placed within the channel between the date press and the catchment room (Figure 2.4), its function likely to halt the flow of date syrup whilst the collection vessel was being decanted. Several similar ball-shaped stones had been found within other date press rooms but their function, until this discovery, had been unclear.



Figure 2.4: Overview of date press Spaces 76, 75 and 74 (left to right), looking west. (KF-0766) Inset shows the stopper *in situ* within the channel. (BE-0573)

Spaces 77 and 78

These final two rooms form the SE corner of the western *souq* block (Figure 2.5). Both were aligned perpendicular to the four northern spaces. The long rectangular rooms are, based on wall articulations, later in date than the other four. The spaces measured 7.00m (N-S) x 2.30m (E-W) and were both accessed from the south from the E-W aligned street (Space 603).

Space 77 produced the first complete glass bracelet found at Al Zubarah, a small miracle in itself as the fragile object was located within the building collapse among large stones and plaster fragments. This jewellery was likely intended for a small child.

Space 78 is of particular note as it appears to have been extended and remodelled several times, making it the longest press on site. This space was unique in two other ways: firstly, the catchment pit is located at the base of the entrance threshold unlike in all the other rooms,

where a dedicated space existed for the collection process; secondly, a small plastered inset of only 1m² (Space 86) was added later to the SW corner, having no obvious access. The function of Space 86 is unclear, but it may have been a hopper for storage of perishable goods. This feature has at least two distinct phases of construction.

Space 99

This small room measured 2.40m (E-W) x 2.14m (N-S) and is located in the NW corner of the western *souq* block.

This simple room had no wall plaster, and was likely mud-rendered, with a simple compressed earth floor (based on analysis of the primary collapse) and an entrance in the western wall allowing access to an exterior space currently below the limit of excavation (Figure 2.6). Based on structural evidence seen in the Main Area, the exterior space is likely a further street running parallel to Space 602, with another range of buildings (possibly more date presses) to the west.

Three coins were recovered from the primary collapse. The room surface was covered in fish bones and scales and several large bowl fragments belonging to three or four vessels; this may be indicative of its function prior to abandonment, possibly as a processing space. Other surface finds include half a faience button, a fist-sized green stone with one worn side, three large dolomite and one haematite boulder. The boulders were strewn across the surface; two were partly covered with bitumen, one had several holes drilled into its surface, maybe for use as a game board, and the fourth may have been a diving weight or anchor blank.

Removal of the occupation deposit, rich in fish remains, revealed two cut features: a small pit and a single post hole. Below this lay a compact sand surface that contained five coins (Figure 2.7) and at least two small weights, bringing the total to 11 coins from this one small space. This could give an indication as to the function of the space, maybe as an administrative room for commerce linked to the trade in dates. This sandy occupation deposit sealed a coarse plaster floor which had been laid by hand, the finger marks clearly evident in the surface (Figure 2.8).

A small sondage was cut through the surfaces and occupation deposits to investigate the depth of stratigraphy and reveal any earlier Phase 6 activity. As in the two street sondages, the Phase 6 horizon was sealed below a compact trample surface rich in lime and gypsum likely associated with the main construction of the Phase 5 architecture; however, in the NW corner of Space 99, the surface clearly predated the northern and western walls of the room, with a layer of sand above, thus representing the construction horizon for these two walls. This suggests the rooms in the western part of the western *souq* block were likely constructed or modified at a later date. The compact surface identified in the sondage was most likely an exterior space functioning with a then smaller *souq* block consisting of just the eastern range of rooms (Spaces 71, 74, 75 and 76, and possibly 77 and 78).



Figure 2.5: View, looking north, of Spaces 77 and 78. (KF-0552)



Figure 2.6: View of Space 99 looking east. Sondage 3 can be seen in the NW corner. (KF-0461)



Figure 2.8: Detail of coin *in situ* in Space 99. (PF-0601)



Figure 2.7: Detail of finger smears on plaster surface. (KF-0395)

Space 97

Located to the south of Space 99 and of similar dimensions, this small square room, in its latest incarnation, housed a well-formed date press with a particularly nice curved kerb wall separating the press superstructure from the catchment pit (Figure 2.9). Above the finely plastered date press were the remains of an articulated cat skeleton – something seen in several buildings across the excavation area at the end of the Phase 5 occupation and clearly representing a prolonged period of abandonment prior to structural collapse or demolition.

Space 96

This small, square date press (2.34m x 2.20m) is located to the south of Space 97. It varies from the other surrounding rooms primarily due to having been subject to extensive fire damage (Figure 2.10); its infill was also rather unusual as the burnt date press structure was covered with a layer of sand and bitumen. The initial construction techniques of the date press appear, when compared with others nearby, somewhat primitive, as even before the fire the walls were only mud-rendered, although it is possible that the fire may have powdered the plaster. All of the bitumen was sealed below the primary collapse which also contained very little plaster, and this could indicate usage of the room after the fire as a bitumen processing space, or indeed that the fire was a result of the bitumen processing and the deposits covering the date press surface protected it from the worst of the heat.

The primary collapse included a mix of beach stone, sand and mud mass. The latter appears, like in most rooms, to be derived from roof collapse/removal and here also from the walls. This material sealed an interesting deposit of bitumen covering the entire space and formed of lumps and chunks mixed with heat-affected sand; this contained some cultural waste including fish bone, four coins, a glazed bowl with a flower motif at the base (dating it to the early 19th century), an iron knife with infused organic material (most likely a sheaf or handle), and a spectacularly well-preserved basket base which was block-lifted and is



Figure 2.9: View looking west of Space 97 with its curved catchment pit kerb wall. (PF-0384)



Figure 2.10: Overview, looking east, of the burnt date press Space 96. (PF-0281)

currently being conserved (Figure 2.11). The origin of the bitumen and its relationship with the burning event remain unclear. The layer sealed a thin ash deposit located at the western end of the date press, which is likely all that remains of the fuel or accelerant of the fire.

Removal of a large element of structural collapse from within the entrance, originally believed to be a blocking event, revealed a threshold with a limestone pivot door socket. Just to the north of the catchment pit, a spread of ash was identified covering three post holes and a small pit formed by curved plaster – probably the original limit of the catchment room. A small cannon ball was found impacted into the plaster surface here (Figure 2.12). Together with the burning of the room, this may be evidence of the documented attack on Al Zubarah in 1811. A larger cannon ball had already been found in the street Space 28 south of the Main Area in 2010.

Space 95

In the small room to the south of the burnt Space 97, a further date press was revealed. Similar in size, this press was far more robustly constructed, with well-defined channels and a clearly demarked catchment space. The infill followed the sequence that is seen elsewhere in ZUEP02, and several coins were found on the plaster surface of the date press: three from the top of the superstructure and two in the occupation build-up in the catchment room.

Spaces 92, 93 and 94

Located between Space 91 (south) and Space 95 (North), these rooms have similar dimensions to the others in the row (2.26m (E-W) x 2.14m (N-S)). However, at the time of abandonment, the space was separated into three distinct zones by plaster screen divides. The roughly square Spaces 94 and 93 (1.00m x 0.90m) appear to be hoppers or bins for dry storage, and both contained the articulated remains of cats, again suggesting a prolonged period of abandonment prior to demolition. A thin occupation/abandonment deposit was found in each room; in Space 94, this deposit contained a complete faience button, two coins and a bead.



Figure 2.11: Burnt basket base and iron knife found within the infill of the burnt date press room Space 96. (PF0239). The inset shows the conservation team lifting the basket base. (KF-0095)



Figure 2.12: Small iron cannon ball found in Space 96. (KF-0332)



Figure 2.13: Post-excitation view, looking east, of date press Space 92 , clearly showing the crushed haematite in the catchment room. (KF-606). The inset shows the *in situ* catchment pot and stone stoppers. (PF-0508)

Space 92, located to the south of Spaces 93 and 94, is a small plastered rectangular room (2.50m x 1.20m) which turned out to be a very small date press. This was an exact miniature of its large counterparts in the rest of the Northern Extension, even down to a small catchment room at its western end (Figure 2.13). The surface of the *madbasa* was strewn with ceramics and stained with a red powder as well as some fragments of the pigment itself, and mixed with the ceramics were another intact faience button, a single coin, some iron brackets or buckles, and a small spherical copper alloy earring or bell (Figure 2.14). A disturbed area against the northern wall of the space (possibly an animal burrow) contained a fine stone bead and a faience button, but these can likely be attributed to the usage phase of the room. The ceramic fragments of the catchment vessel were removed, including the fill of the *in situ* base and the partial body.



Figure 2.14: Detail view, looking south, of the ceramic spread on the date press surface in Space 92. (KF-0039)

The red pigment was originally believed to be related to the textile or paint industry, possibly red ochre. The mineral was, however, haematite in its finest form, with a very small crystal structure, easily crushed between thumb and forefinger – quite unlike the solid material for diving weights. Its presence with the ceramics may be indicative of its function (possibly for pot decoration), but this is as yet unclear; most of the ceramics at Al Zubarah were imported. The haematite may have been imported from somewhere like Iran, together with the ceramics it was mixed with.

This space was very complex in its development; the original date press had been a very unusual L-shape, utilizing both the main body of Space 92 and a small channeled space below Space 93, the channels running perpendicular to those in Space 92. This part of the date press was later

plastered over and a thin screen wall erected, forming the three spaces seen at the time of abandonment.

Spaces 90 and 91

This small square room (2.30m E-W x 2.00m N-S) was divided in two by a plastered screen wall along its E-W axis. The two spaces were covered on floors and walls with a hard, fine, grey gypsum plaster, and appear to be a dry storage area with no signs of drainage. Both spaces contained coins in the occupation deposits above the plaster floor, two in the southern Space 90 and a single large coin, roughly 3- 4cm in diameter, in Space 91 to the north. The plastered screen wall restricted access to Space 91, but it only stood to a full height of 0.78m, suggesting that items could easily be passed over from the adjacent Space 90. This room was, in turn, accessed through an entrance in the west.

Spaces 600 and 601

Located in the SW corner of the western *souq* block, Space 600, with a thin, high-sided plaster kerb wall, was actually the catchment room for another date press. This presents yet another variant in building techniques of the date presses. The space was filled with the usual mix of rubble above primary collapse which sealed the pot retrieval pit. The pot was absent, and no sherds were found.



Figure 2.15: View, looking east, of date press and catchment Spaces 600 and 601. (KF-0770)

In the main room of the *madbasa* (Space 601), the channels of the press were well constructed, and the light grey gypsum plaster was crisp and clean (Figure 2.15). The southern wall had been completely robbed of stone in antiquity, leaving only a small portion of the threshold intact (located in the catchment room). The room was similar in form and dimension as the other spaces in this row. However, the entrance was located in the southern wall, and on closer inspection of the robbed western wall, it was clear that the room was once larger, with the wall being constructed over the date press structure which would have extended further to the west below the current limit of excavation.

Phase 5 Abandonment Deposits within Rooms

The sequence of collapse seen in most rooms is of the latest surfaces and associated cultural material being sealed below degraded mud mass containing plant and timber impressions, usually representing roof collapse, this in turn being sealed below mixed layers of aeolian sands and demolition deposits, quantities of which differ based on the time-scale of the building's degradation and final collapse.

These deposits have produced structural material (plaster, stone and mortar from the walls, and silt/clay with timber and plant impressions from the roof), but only small quantities of the typical *souq* artefact record (ceramics, animal bone, shell, and fragments of metal objects).

Larger architectural elements, predominantly located at entranceways, have been recorded and removed in conjunction with building archaeologists for a better understanding of the history of the structures. Several decorative plaster elements have also been retrieved, often showing etched lines reminiscent of the etchings in ZUEP04. Several cut features belonging to the Phase 4 occupation, consisting of both post holes and robber trenches, have been seen to intrude on the earlier Phase 5 wall lines.

Eastern *souq* block

Only the first three of these rooms have been excavated down to the abandonment surfaces: Spaces 80, 81 and 85, all of which were functioning as date presses. The three rooms have not been fully exposed due to their location on the eastern limit of excavation (Figure 2.16). They mirror their counterparts across the street (Space 602) in width and, based on photos from the 1980s excavations of QMA1, likely in length. All were accessed from the street to the west. The size of the catchment rooms varied, and the catchment vessel had been



Figure 2.16: Kite aerial photograph showing the eastern *souq* block in the top of the image, as well as the location of the street sondages. (QF-0119)

removed prior to abandonment. The date press superstructures are well-formed and thick-set with squared-off edges and deep channels; in Space 85, some of the plaster had fallen away to expose fibrous timber (date palm) used in bridging the channels.

The northern-most date press (Space 81), like its counterpart across the street (Space 71), had undergone extensive remodelling during its lifetime, as was clearly visible within Sondage 1 and in the wall plans. The room originally had a less utilitarian façade with two engaged pillars and a large central opening; this was later blocked and a smaller entrance established, likely when the room's function was altered to the storage of dates. Surfaces visible in section are clearly reaching beneath the date press structure but not the walls of the rooms on both sides of the street.

Street Spaces 602 and 603

The *souq* street (Space 602) runs N-S (22.70m x 3.20m), separating the western and eastern *souq* blocks, and connects with its contiguous E-W return Space 603 (11.90m x 3.00 – 4.00m), separating the western *souq* block from the Central Courtyard Compound to the south. It continues west beyond the limit of excavation. The post-abandonment collapse that covered both of the streets as well as portions of the eastern *souq* block was recorded as Space 89.

Street Sondages 1 and 2

Two 1.50m-wide exploratory sondages were cut through the street surfaces in Space 602. Sondage 1 in the north was positioned between Spaces 71 and 81, and Sondage 2 was located 8.50m further south between Spaces 76 and 78 in the west and a currently unexcavated room to the east.

These interventions were designed to demonstrate the depth and complexity of the Phase 5 architectural development either side of the street, and to investigate



Figure 2.17: North-facing section of the *souq* street Space 602, Sondage 1, showing the depth of deposits in this compressed archaeological sequence. (KF-0646)

the depositional sequence of successive road surfaces, repairs and drainage cuts within the street's soft deposits (Figure 2.17). The sondages provided a sample of the activities and a view of the Phase 6 deposition below.

Both sondages showed a Phase 5 construction horizon, a surface mixed with chunks of lime and gypsum associated with the construction and rendering of the walls. This was located directly above the dirty mixed occupation sands that indicate the Phase 6 occupation build-up in ZUEP02.

Below the upper street surface (Sondage 1), a shallow drainage channel filled with crushed limestone had been cut into an earlier surface (Figure 2.18), designed as a soak-away to stop water pooling after heavy rain or flooding; a broken carved bone pin was found within this fill. This system of water management was also visible lower in the stratigraphic sequence, with a second channel cutting an earlier street surface. Several more of these highly compacted street surfaces were removed.



Figure 2.18: Crushed limestone in the central drainage channel located in the *souq* street Space 602. (PF-0528)

At least six major resurfacing events, often associated with makeup layers and drainage cuts in the middle of the street, could be identified in Sondage 1. These surfaces have been accurately linked in with several adjustments made to the entrances to rooms on either side of the street (Figure 2.19). This is also reflected in Sondage 2, with slight variations based on small localised repairs.

Truncating the street surfaces were several cut features, including two post holes and a large robber pit which was later used as a waste pit – with a fill of ash mixed with sand and shell. The pit fill contained fragments of a clay pipe bowl as well as a dolomite pivot socket (displaced from a doorway). Most of these cut features can be attributed to Phase 4 activity.



Figure 2.19: Looking east within Sondage 1 (Space 602) – clearly visible are the changes made to the entrance and threshold of Space 81 in relation to surfaces within the *souq* street. (KF-0475)

A large ceramic spread was located at the centre of the street, comprising large sherds from a single storage vessel with applied decorative strips (similar to those used within the date syrup catchment rooms). Amongst this assemblage was a small glass scent bottle impacted into the street surface. A small glass stopper of similar size was recovered from a post hole fill only a few metres away.

Above the latest street surfaces and ceramic spread located on and around Sondage 2 lay a large post-abandonment spread, mainly derived from the slow degradation of wall plaster and mudbrick from the upper aspects of the buildings lining the street. This was sealed by a massive expanse of rubble collapse (Space 89).

Removal of the primary collapse and cleaning of the southern area has revealed a very ephemeral NE-SW aligned wall or kerb that appears to extend across the entire width of the working area (15m). This feature has been mostly robbed of stone, and only a single course remains; it was most likely a boundary wall separating the Central Courtyard Compound from the *souq*. It likely

relates to an equally degraded wall exposed in the Main Area in 2010, and the two are thought to connect somewhere below the unexcavated western baulk. The structure appears to only have its north face intact, suggesting that it could in fact be a kerb for a raised platform around the courtyard compound; more work is needed to understand this feature and its function.

Central Courtyard Compound

This structure is formed of nine extant spaces excavated to date, although it continues east beyond the current limit of excavation (Figure 2.20). The structure had a large walled entrance courtyard to the west (Space 52), with the rest of the structure positioned to the east of this wall enclosure formed of several rooms positioned around a square courtyard (Space 16). This compound was partly excavated in 2009 (see House 2010).

The compound is on a different alignment to the *souq* structures to the north and the massive Main Area to the south, and has undergone many structural changes particularly in the south. It abuts the southern wall of the eastern *souq* block, which pre-dates it. Its relationship with the compound in the Main Area is unclear, and more work will be carried out here in future seasons.

Space 87

This large rectangular room (5.40m NW-SE x 2.20m NE-SW) located in the northern part of the Central Courtyard Compound was relatively unremarkable. It had a simple compacted earth

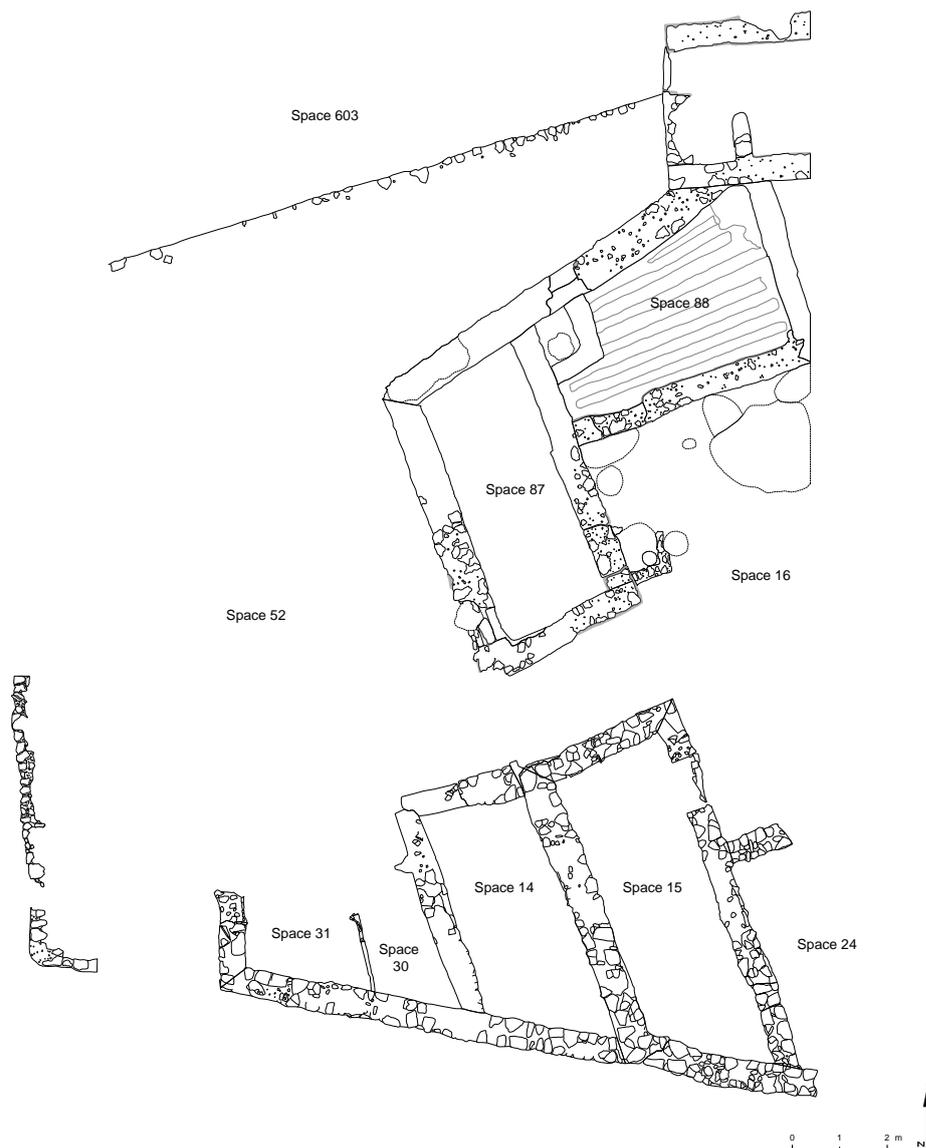


Figure 2.20: Overview plan the Central Courtyard Compound.

floor and, unlike its mirror opposite (Space 15) located to the south, very few surface finds. The main entrance was in the south of the western wall, allowing access to exterior Space 52. It had a blocked entrance in the eastern wall that once would have allowed access to the inner courtyard Space 16; the reasons for this restriction in access remain unclear.

Space 88

Located to the east of Space 87 lies a large, sub-rectangular room 5.00m NE-SW x 2.10m – 3.50m wide (wider in the east). This space is architecturally spectacular, due mainly to the form of the room dictating the unique fan shape of the date press. This unique room also had a small space in the NW corner formed by a low kerb wall, the location for the catchment pot for the *dibs* which was present *in situ*. Above the plastered surface of the press was a large, broken ceramic storage vessel, which may well have been used in conjunction with the press (Figure 2.21).



Figure 2.21: Looking west across the fan-shaped date press Space 88 and ceramic spread. (PE-0032). Inset is the *in situ* catchment vessel. (KF-0436)

Based on the archaeological remains visible in the truncation formed by several intercutting robber pits at the structure's eastern limit, it appears that the compound was constructed later than the *souq*. Its eastern and northern walls abut the southern wall of the *souq* structure. This suggests at least three major construction sub-phases within the now visible Phase 5 archaeology.

The room originally had two entrances: one in the southern wall may pre-date the room's conversion to usage as a date press and would have allowed egress between the internal central courtyard (Space 16) and the room. The original function of the space is unclear; the date press superstructure was constructed above a thick layer of ash which clearly respected the northern and eastern walls of the space.

The second entrance was located in the northern wall, allowing access between the date press room and the courtyard Space 52, which, based on the surviving height of the courtyard wall, may have gone out of use in the latter part of the building's life.

Space 16

This space was partly excavated in 2009 and much of it still remains obscured below the current eastern limit of excavation; the now fully exposed width is 8.93m. The compacted earth surface was covered by a substantial spread of broken ceramics: a mixture of large storage vessels and fine table wares from Iran, China and Bahrain (Figure 2.22). This assemblage provides some of the largest fragments of certain vessel types discovered at Al Zubarah and links well with the large ceramic spread discovered in 2009 in Space 15 in the same compound, demonstrating the town's wide trade connections.

Both entrances from the courtyard to the northern rooms (Spaces 88 and 87) were blocked prior to abandonment. The main entrance located between Spaces 15 (South) and 87 (North) continued to function, as did both of the entrances to the rooms (Spaces 15 and 24).

A small feature was constructed in front of the blocked entrance to Space 15, consisting of two rubble-built walls and pisé-like material forming a small space of less than 1m². The primary function (possibly storage?) was unclear, but it appears to have been used as a hearth pit in later life.

Superficial geological analysis of unidentified materials in this Central Courtyard Compound were of interest. The first was a hard yet brittle, bright yellow substance found in the courtyard and southern wing of the compound. Originally believed to be some form of glass waste, it is in fact sulphur crystal. This may have had a variety of uses, from the production of gun powder to use in textile dyes.



Figure 2.22: Looking west at the courtyard compound Space 16 showing the extensive spread of ceramics on the abandonment surface. (BE-0618) Inset shows a detail of ceramics. (KE-0252)

2.1.4 Phase 4

In all areas of ZUEP02 the bulk of the Phase 4 features consist primarily of small cut features: waste pits, fire pits, *tanurs* and numerous post and stake holes (in most cases forming no discernable pattern). Previous seasons have shown there to be at least seven major sub-phases of surfacing during Phase 4, and likely more across the entirety of the excavated area. Historically, these fit into the time of abandonment between the end of the first town after the 1811 attack on Al Zubarah



Figure 2.23: Half-sectioned Phase 4 pit cutting the southern wall of Space 601. (PF-0468)

and the re-establishment of a smaller settlement late in the 19th century (Phase 3).

Many of the larger pits excavated this season were robbing events above the Phase 5 walls, and several had a secondary function as waste pits. In the Northern Extension, most of the pitting was located along the eastern limit of excavation, truncating the walls of the eastern *souq* block and Central Courtyard Compound, and several intercutting pits also heavily truncated the southern wall of Space 601.

2.1.5 Phase 3

Most of the Phase 3 deposits and architecture had been removed in previous seasons; the only deposits identified and removed in 2013/2014 were related to an extension of 1m on the western side in order to expose the full plan of the Phase 5 western *souq* block. These additional excavations identified several wall fragments which were likely part of the western boundary of the Phase 3 compound and their associated occupation and construction surfaces.

2.1.6 Conclusions and Recommendations

The work finished this season in the Northern Extension provided vital information about the area and its development as a commercial centre. Work on the western *souq* block was finalised, while five spaces remain unexcavated in the eastern block to allow for full-scale excavation at a later date.

The number of date presses uncovered to date is 21, all but one belonging to Phase 5; the single outlier belongs to Phase 4 and continues in use until Phase 3. The five unexcavated rooms are likely also date presses based on clear architectural indicators. This will bring the total to between 23 and 26 within Phase 5 alone. Together with at least six exposed in the 1980s excavations at QMA1, the density of date presses in this small area of Al Zubarah is staggering.

Work in future seasons can continue in various directions. Options are outlined below, taking into account archaeological, building-historical and presentation requirements and interest.

- Expansion to the east of the Northern Extension in order to fully expose the eastern *souq* block.
- Expansion to the east in the Main Area in order to expose the entire southern courtyard compound.
- Continuation work in the Main Area in order to establish the relationship between the oddly

aligned Central Courtyard Compound and the large courtyard compound in the Main Area, with a sondage across the linking street Space 3; this can be achieved in conjunction with the above-mentioned extension of the Main Area.

- Reopening of the Main Area to finalise archaeological recording and to excavate the final floor deposits.
- ZUEP01 has provided an extensive, densely packed Phase 6 occupation comprised of a myriad of cut features reflecting temporary and possibly seasonal occupation similar to that of Phase 4 in ZUEP02. With the possible Phase 6 walls seen at the base of the robber pit over the Phase 5 Spaces 83 and 84 (House 2013), it would be beneficial to expand our understanding of this early phase within ZUEP02. This could be achieved as mitigation work ahead of conservation, with some targeted sondages within courtyards and streets to provide a stratigraphic view of the depth of surfaces and identifying earlier material culture. Quarter-sectioning the courtyard of the large southern compound in the Main Area (Space 47) is suggested to investigate this sequence.
- Continuation of work in the NW corner of the Main Area, referred to as the Western Area (see House 2013), focussing on the beach front structure (Spaces 83 and 84) and the double date press located to the north (Space 82). The surrounding midden could provide valued cultural information comparable to other parts of Al Zubarah and as yet unseen in ZUEP02, derived from waste that could be directly related to the area's function as a *souq*.

2.2 CONSERVATION WORK

Bernadeta Schäfer

2.2.1 Introduction

Conservation activities in ZUEP02 focused on two aspects in spring 2014 (Figure 2.24):

- recovery and documentation of masonry and plaster fragments, and
- initial preservation of the *in situ* plasters.

2.2.2 Recovery and Documentation

On several occasions during the ongoing excavations, members of the conservation team were called in to assess and document findings of plasters, walls and other architectural fragments. Several significant fragments were collected from Spaces 16, 80, 89 and 96 (Figure 2.25).

2.2.3 Initial Preservation

Monitoring

Visual assessment of the state of conservation was undertaken before the scheduled work. The historic walls were made of brittle, poor quality beach rock and mud mortar, and were covered with gypsum plasters. These plasters were applied to a layer of soil/clay make-up that does no longer provide sufficient support to the softened, cracked plasters. The plasters have suffered considerably from being exposed in the excavation process. It was necessary to carry out emergency treatment to provide protection during further research work, and most of all to protect the fragile plasters prior to backfilling of the area, which was expected to cause severe damage.



Figure 2.24: Areas of work for the conservation team.



Figure 2.25: Restorers preparing an arch fragment for recovery in Space 16. (DF-0106)

Consolidation Methodology

After visual assessment, battering of the plasters in some of the date press rooms was carried out (Figure 2.26). The usual gypsum plaster mix 3.8 (3:1:8 mix of local gypsum Sadaf : NHL5 St. Astier : fine desert sand and 0,1% tylose) was slightly modified and no tylose has been added. The rims of the plasters were cleaned, the softened and brittle parts removed, and rims watered and reattached with restoration plaster to the walls. Some of the voids in plasters on the date presses were repaired as well.

Plasters in some rooms show different thickness and differ strongly in their state of preservation. The plasters in Spaces 75 and 76 resemble slurry more than plaster, and are in the poorest condition that does not allow any treatment. These are likely going to be lost in the near future.

Treatment tests with barium hydroxide for the consolidation of historic plasters have been undertaken: on vertical wall surfaces in Space 71 and on a small fragment of the date press in Space 76 (Figure 2.27). Scientific evaluation of the test will be provided in the autumn.

At the end of the season, the rooms were backfilled to provide protection to the structures during the summer months and beyond.



Figure 2.26: Battering of the rims of the plaster in Space 78 with mix 3.8. (YF-0204)

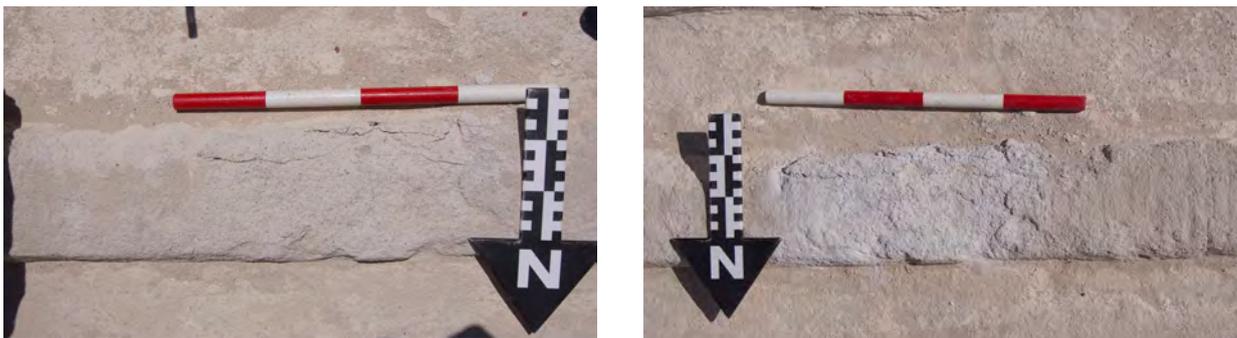


Figure 2.27: Barium hydroxide treatment test in Space 76. Left: before treatment (YF-0212). Right: Surface saturated with barium hydroxide (YF-0216).

2.2.4 Conclusions and Recommendations

For the sake of reliable long-term preservation of the fragile structures in ZUEP02, permanent backfilling of this particular area should be taken into consideration. The date presses cannot be adequately and permanently preserved by the currently available methods and materials; all tested procedures have failed.

Presentation of the date presses could be achieved by an exact copy of the date press rooms, made of traditional materials, erected on top of the backfilled historic architecture.

3. THE PALATIAL COMPOUND (ZUEP04)

3.1 ARCHAEOLOGICAL INVESTIGATIONS

Tom Collie

3.1.1 Introduction

Excavation Point 4 (hereafter ZUEP04) is located at the southern end of Al Zubarah and investigates a large compound enclosing rooms and courtyards supported by parameter walls with corner towers. This compound is divided into eight separate areas (Precinct Sections) surrounding a centralised courtyard area which was circumnavigated by streets and passageways (Figure 3.1). Work since 2010 has focused on two of these zones, namely Precinct Section 7 and Precinct Section 8 (hereafter PS7 and PS8) in addition to a long corridor running between them at an alignment of WSW/ENE. (Figure 3.2).

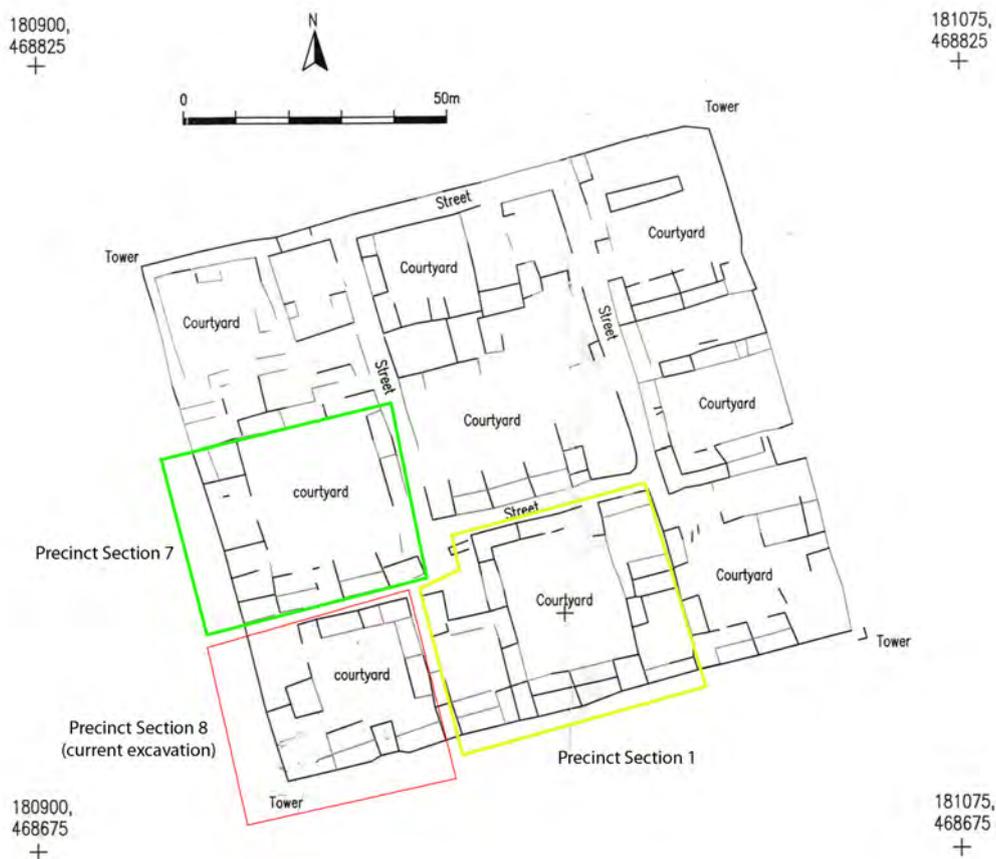


Figure 3.1: Overview of the Precinct Sections in ZUEP04.

Excavation work in season 2013/14 centred on four main objectives:

1. To prepare the eastern side of PS8 for conservation work by partially excavating rubble deposits in Precinct Section 1 (hereafter PS1).
2. To continue excavation of rooms in PS7. Work was initiated in season 2013 (see Collie 2013), but only rubble collapse and dilapidation deposits had been examined. Archaeological excavation aimed to fully reveal building architecture and any occupation deposits therein. Information gained would then be compared to and contrasted against PS8.

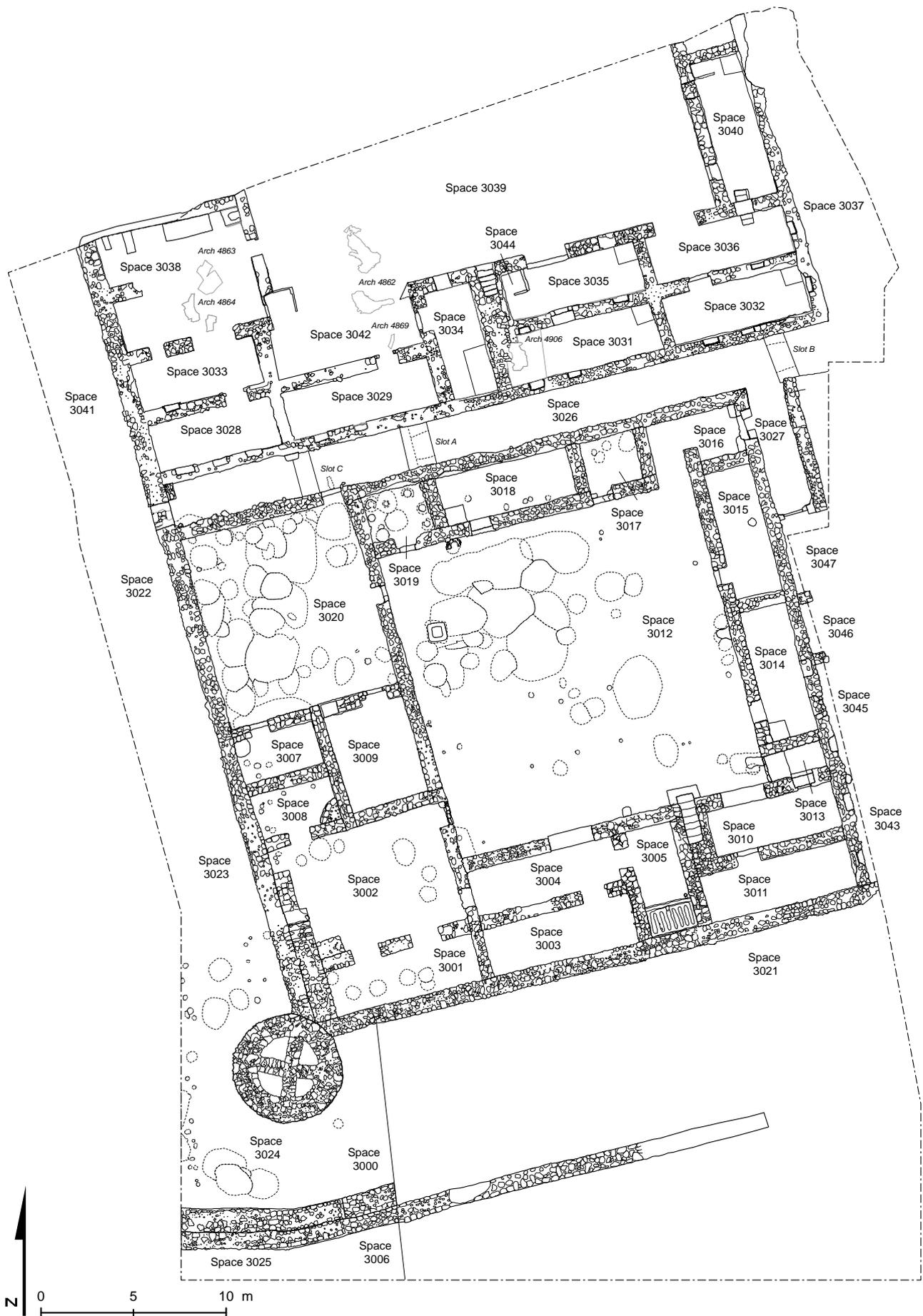


Figure 3.2: Plan of ZUEP04 showing PS8 at the bottom and PS7 at the top.

3. To finish work begun in season 2010/11 on Space 3020 situated in the north-western area of PS8. This resembled a mini-courtyard area and was believed to have been linked to the main corridor Space 3026 by a door in the northern wall. Work in 2012 had revealed surface deposits associated with the general decline of the building, but not yet evidence detailing the activities and occupation that had occurred there. Excavation aimed to rectify these issues by investigating stratigraphy down to the natural geological layers.
4. To complete the excavation of the corridors running between PS8 and PS7 and between PS8 and PS1. Only rubble collapse and overlying collapsed architectural features had hitherto been excavated (see Collie 2012), with no deposits or features detailing the nature and purpose of the corridor revealed. Artefact and data retrieval was important since this corridor space constitutes an example of an internal yet transitional space between other internal areas. The corridor represented a street within a building, and examination of the stratigraphy aimed to serve as a model for comparison with others found elsewhere in the compound and the wider town.

3.1.2 Objective 1 - Precinct Section 1

The majority of PS1 was left untouched apart from the far western side, where overlying rubble collapse had to be removed for the conservation of the eastern compound wall of PS8. This revealed the western extent of four more rooms. These rooms were not fully excavated and were left for future seasons.

Space 3043

This room measured 5.6m in length. Its eastern side remained beyond the limit of excavation, thus the total dimensions of this space could not be gained. Two east-facing niches were uncovered on the western wall, showing that this space shared architectural designs with many of the spaces in both PS7 and PS8.

Space 3045

Room 3045 measured 5.65m in length. Like Space 3043, its eastern wall was not revealed. One plastered niche was exposed in the western wall.

Space 3046

Room 3046 was the smallest room partially exposed in PS1 and measured only 2.7m in length. No eastern limits were exposed since they lay beyond the limit of excavation. No special architectural features were discovered.

Space 3047

Space 3047 measured 3.7m in length. Its eastern extent lay beyond the limit of excavation. This space was the most interesting in PS1 since it was believed to be the formal entranceway to the main courtyard further east. If this was the case, Space 3047 may have shared similar dimensions to Space 3016 in PS8, meaning that it could have run E/W for a few metres before turning south to join the central courtyard. It could have been an entrance passageway, typical of Islamic dog-legged entrance passageways, to preserve the privacy of internal domestic spaces. More work in a future season would help to gain conclusive answers.

3.1.3 Objective 2 - Precinct Section 7

This section summarises the architecture and occupation deposits of rooms first unearthed in spring 2013 and finalised in 2014. A full description can be found on the accompanying CD.

Space 3031

Work in Space 3031 was not finalised due to a collapsed arch that was left *in situ* for future removal by the conservation team. The fallen masonry feature was left lying upon a 2.8m x 2.6m supportive level made from the rubble deposits that had completely filled the room.

The room measured 8.3 x 2.65m. Its southern extent was also the main southern parameter wall of PS7 and held three plaster niches. Another niche was found in the north-western corner.

A small sondage excavated in the north-eastern corner provided an interesting insight into the construction of this room, which was repeated in most of the other investigated rooms in the southern part of PS7. The base of the sondage showed that walls had been constructed directly upon the natural geology and not within a foundation trench, which was not unusual since most of the architecture found at ZUEP04 had been constructed similarly. However, the sondage excavation showed that the main wall plaster was then applied to all the internal wall surfaces before the construction of the plaster floor. This fine, hard, mid-purple grey anhydrite plaster covered all the niches within the room. Signs of the plaster-rendering work were shown by a friable layer of plaster which overlay the natural geology. Initially, this was believed to be an earlier plaster surface. However, it was too friable, too uneven and far too degraded to be anything other than discarded plaster created when the walls were rendered. This was waste material from construction and not a formal surface.

The plaster work surface was then deliberately covered with a layer of moderately silty sand. This elevated the floor level and, more importantly, provided a level foundation for the subsequent overlying flag stone floor foundation and plaster skim. The flagstone floor foundation was formed by large tabular slabs. These stones were laid closely together to form a platform for the subsequent plaster (Figure 3.3). This method of making a beach stone foundation for the floor can be seen extensively in rooms throughout PS8 and PS7, particularly where the overlying plaster skim had been badly damaged and eroded away.



Figure 3.3: Flagstone foundation for plaster floor revealed in sondage in Space 3031. (HF-0777)



Figure 3.4: Game indentations found gouged into plaster floor. (KF-0457)

The very thin plaster skim overlying the flagstone foundation was the final part of the process of floor construction. Interestingly, this floor had two parallel lines of six small circular indentations gouged onto its surface. These were slightly reminiscent of similar features etched into stone outcrops at Bala'a (QNHHER 3615), approximately 1km to the northeast of Al Zubarah fort, and were interpreted as signs of a game or other social activity (Figure 3.4).

After the floor had been plastered, architectural features at the doorway were added. Excavation revealed a plastered stone step which had been truncated at each corner by post holes for a

subsequent door frame along with a plastered threshold. These features collectively made a formal entrance through to Space 3035 and also demonstrated that the room could be closed to the outside, thereby creating a cool and private domestic space.

No occupation deposits were found in this room. Instead, large plastered architectural elements were discovered. In addition to the collapsed arch fragment left *in situ*, a large plastered door post element was found lying near to the doorway to Space 3035 in 2013. Underlying rubble collapse layers were then investigated, but these too were not fully excavated since the western ends were left *in situ* to support the arch remnants. Two large chunks of fallen plaster and masonry were found sandwiched between these two layers. They lay at the base of the southern wall and were presumed to be part of the higher wall surfaces that had fallen down fairly early in the buildings collapse. Most interestingly, the remains of collapsed ceiling beams were discovered lying directly above the plaster floor (Figure 3.5). These consisted of dark brown to black, organic, degraded wood and were superb evidence of the roof that once covered the space.



Figure 3.5: Collapsed ceiling beams at the eastern end of Space 3031. (HF-0771)

Space 3032

This room measured 7.62 x 2.62m and was the furthest south-eastern space of PS7. It backed onto both the main corridor Space 3026 in the south and the corridor Space 3037 to the east. Work in season 2011/12 revealed that the southern wall was decorated with plastered niches. Further investigation in 2014 revealed another highly degraded niche situated in the eastern wall.

A sondage in the north-eastern corner revealed a sequence similar to Space 3031. A construction horizon deposit overlaid the natural sands onto which the walls were built, and butted against them. It was highly reminiscent of the horizon found in Spaces 3020 and 3012 and consisted of a grey-white, moderately coarse, compact silty sand. A plaster layer overlying a levelling deposit was uneven and friable and joined physically to the render on the wall. It was originally believed to be an earlier plaster floor, but was more likely a plaster work surface created when the internal walls were rendered. Another very thin levelling layer of silty sand was deposited

over the top which was the foundation for subsequent beach flagstones. The internal walls were then plastered showing that like Space 3031, they were rendered before the construction of the floor.

Two door-post sockets truncated this floor layer, and a plastered threshold was constructed on top to form the doorway through to Space 3036. Like Space 3031, this inner domestic space could be closed to the outside, creating a cool and private domestic space, which was well-decorated enough to suggest wealthy and socially important occupants.

Rubble deposits in this room displayed that the doorway through to Space 3036 had been decorated with a small arch. Stone remnants of the arch were recovered that were different to the standard beachstone found so commonly on site in addition to decorative plaster in a dog-toothed formation. Indeed, the western door jam of the entranceway at the top was slightly curved, representing the base of an arch-spring. This arch had collapsed over a main rubble deposit which had filled the space entirely. Beneath this were signs that a ceiling had fallen, since a small patch of silty organic material with indentations of reed matting was discovered at the eastern end.

Spaces 3028 and 3033

Time constraints did not allow the full excavation of these spaces, and they will be finished in a future season. However, even though Space 3033 still contained rubble collapse, more drawings were revealed etched crudely onto the plaster wall surfaces. Work in 2013 had already revealed several of these (see Collie 2013), but two more were found inscribed on the southern wall of Space 3033 (Figure 3.6) Directly east, an excellent etching of what resembled a large ship was inscribed into the wall plaster. These etchings had been inscribed on the plaster before the collapse of the building, but it is uncertain whether they were drawn during occupation or while the building fell into decline.



Figure 3.6: Dhows 12 and 14 in Space 3033 (drawing by Ann Andersson).

Space 3034

Room 3034 measured 6.04 x 2.46m and was located south of the main courtyard Space 3039, east of rooms 3042 and 3029, west of spaces 3035 and 3031, and due north of corridor Space 3026. Its northern extent included a window feature that allowed a view of the central courtyard and provided ventilation. It was linked to room 3042 by a doorway consisting of a threshold and a step, which had been truncated by small sockets that once held a structure for a door.

A sondage excavated into the south-eastern corner displayed similar construction sequences to Spaces 3031 and 3032.

This room displayed four occupation sequences which consisted of shell surfaces truncated by fire pits and tannurs/ovens. Occupation sequences were similar to those found elsewhere in PS7 and PS8 (see Spaces 3004, 3010, 3034 and 3040), where two surfaces covered an original plaster floor. The main difference here was that occupation surfaces were linked to replastering episodes on the internal wall faces.

The first sequence of occupation was characterised by a single fire pit located in the centre of the room which truncated the plaster floor. A second occupation sequence consisting of silty sand was then formed over the badly worn plaster floor (the flagstone foundations could be seen beneath) which contained a range of finds including pot, shell, bone, glass, iron objects and glass bracelet fragments. The third phase of occupation consisted of a shell layer and occupational build-up, fire pits and a wall-replastering episode which covered the internal walls, the window and the threshold. The fire pits were clay-lined, suggesting intense burning activities or cooking. The third sequence of occupational activity suggested that its primary focus was heating or cooking. The resurfacing layers and subsequent truncations hinted at a possible change of activity over time in this room, where originally a relatively empty space had changed to facilitate a far more practical purpose. The last sequence of occupation was marked by a shell surface and subsequent overlaying occupational build-up containing pot, bone, glass, shell and iron fragments. Both deposits demonstrated that the room had been revamped again after the fire pits had gone out of use. Space 3034 was a good example of the use and reuse of one room which had undergone renovations.

Space 3035

This room was located to the south of courtyard Space 3039. It was positioned to the east of Space 3036, to the north of Space 3031 and to the east of Space 3034 and measured 7.33 x 2.63m. A large entranceway with a very distinct threshold along with a window in the north-eastern corner suggested this room was left open to the courtyard and was well ventilated. Additionally, it had a plastered wall niche feature residing in the south-eastern corner.

The stratigraphic sequence revealed in the investigative sondage placed in the north-eastern corner of the room was very similar to those found in Spaces 3031, 3032 and 3034.

The total excavation of Space 3035 revealed the extant remains of a *hammam* in the north-western corner. It was comprised of an elevated platform with a thin plastered stone wall in the east and the south. Entrance to the *hammam* came from the south. The platform base had a very shallow channel which sloped and tapered down from a wider end to a narrower lower end, which then ran into a cavity built into the northern wall (Figure 3.7). The *hammam* drained into a soakaway pit either in the southern side of courtyard Space 3039 or indeed into a pit directly under the wall.



Figure 3.7: *Hammam* in Space 3035. (HF-1094)

The other significant feature to emerge from the total excavation of this room was the large plastered stone threshold at the entrance. This large horizontal bar physically separated it from the courtyard deposits to the north and was the first example of its kind to appear in ZUEP04. Other entrances from the courtyard to the interior spaces in PS8 were demarcated by small shallow steps (see Spaces 3004 and 3010). This threshold resembled a small plaster ramp and, in unison with the arch built over the entrance, would have provided a very impressive entranceway to the interior.

Occupation in this space mirrored the sequence found in Spaces 3004 and 3010 in PS8, where two shell occupation layers overlaid an underlying plaster floor. Both deposits were separated from the central courtyard surfaces by the large plaster threshold at the entrance. Overlying deposits suggesting domestic activity in this room were small spreads of charcoal situated in the centre and at the eastern end. One of these displayed evidence of *in situ* burning meaning that as opposed to a formal fire pit, material here was simply burnt quickly on the surface.

Occupation deposits were also revealed in the base of the *hammam*. Much of the deposit had been contaminated and mixed in with the overlying rubble collapse, but towards the base of the drain gully and in the tunnel-like cavity built into the northern wall, an organic dark brown grey silty sand deposit was revealed and was interpreted as detritus washed away by the building's occupants.

Significant excavation of arch remnants laying over the threshold occurred in season 2013 and this was completed in season 2014 (see Collie 2013 and 3.2 below). Subsequent removal of main rubble collapse elements that filled the room revealed a small pocket of roof collapse in the form of crushed and degraded dark brown wood and silt which overlaid the plaster floor.

Space 3036

This room was not fully excavated since extensive conservation work was taking place to rescue the arch laying over the threshold (Figure 3.8 and 3.2 below). This arch had been covered by and overlaid numerous deposits of rubble collapse, each representing architectural dilapidation events that had originated from different walls of the room. Signs of ceiling collapse were also present indicated by patches of brown, organic, degraded vegetation and wood with reed matting impressions, similar to that found in the east of room 3032. Rubble material was left *in situ* over the plaster floor to be excavated in a future season.

Space 3040

Room 3040 measured 7.85 x 2.60m and had two entrances: one through its western side leading to main courtyard Space 3039 and the other through to Space 3036 in the south. It was located to the north of room 3036, to the east of courtyard Space 3039, and to the west of corridor area 3037.

There were three notable features here. Two small steps led up and through to Space 3036. The second was a plastered *hammam* feature situated in the north-western corner. This was reminiscent of those found in PS8 in rooms 3014 and 3018. Further investigation displayed evidence that the *hammam* was a later addition and not an original feature. The third and last was a block of masonry used to deliberately

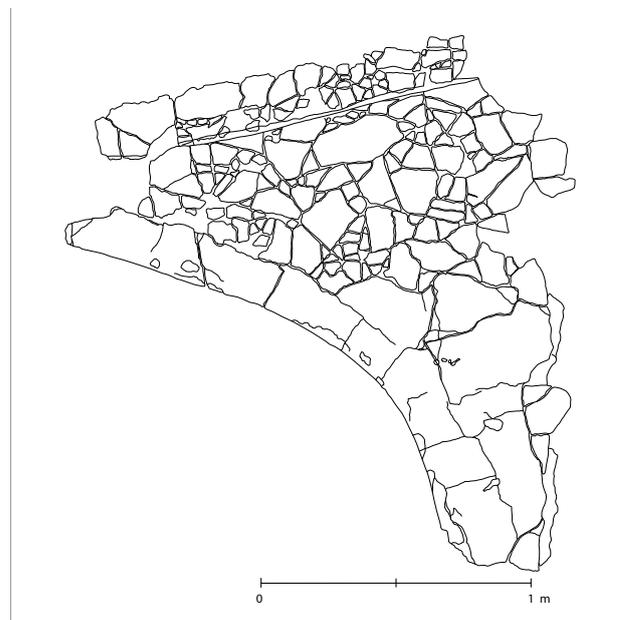


Figure 3.8: Drawing of rescued arch remnants at the entrance to Space 3036 (Drawing: Bernadeta Schäfer)

close up a window/doorway in eastern wall. Again this was believed to be an additional feature which had not been part of the building's original construction.

A small sondage was excavated in the north-eastern corner and displayed a similar construction sequence as other rooms described above.

Occupation in this room was limited to two sequences. The first included truncations constructed through the original plaster floor. These consisted of one irregular shaped pit and a clay-lined fire pit/tannur. The second included replastering episodes on both the walls and the floors. These episodes partially covered the blocking of a window/doorway in the north-western corner and the *hammam*, indicating these features were not part of the original building construction.

External Space 3041

Rubble collapse outside PS7 to the west consisted of typical beachstone and represented the deterioration of the outer compound wall. Beneath this layer were some interesting large plaster fragments, which in some cases lay 2m west of the actual wall. This suggests that the outside wall was both plaster-rendered and very tall: the fragments must have dropped from a great height in order to lie so far from the main architecture.

3.1.4 Objective 3 - Precinct Section 8

Space 3020

Stratigraphic sequences from this area were partially revealed in season 2010/11 (see Collie 2011). Excavations had uncovered a series of shell surfaces and occupation deposits which had been truncated by numerous post holes and pits. Work in 2013/14 uncovered more of these sequences interspersed with an abundance of deep pits.

Space 3020, like the main courtyard Space 3012, yielded archaeological features pre-dating the construction of the compound. A total of 13 pits cut through the natural geology, along with one deposit that extended under the wall shared with Space 3009 to the south. The most interesting of these was a large elongated pit which extended beneath walls to Space 3007 (Figure 3.9). This predated the construction of the building, thereby placing it stratigraphically in the main Al



Figure 3.9: Pit underlying the southern wall of Space 3020. (HF-0096)

Zubarah timeline of Phase 6. The pit was extremely large, measuring 4.5m long and contained two curious fills. The top fill was an organic, dark brown-green, sandy silt containing only a small number of finds. Beneath lay a similar deposit, but this time packed with abundantly large angular stone. This stone was unusual since it was not the typical beach stone found so commonly in the walls of PS8; rather, it resembled rock seen more commonly to the east of Al Zubarah at Murair. It was believed that this pit was related to a water basin in Space 3007 since its fill deposits appeared green and organic. The large unusual stone was considered as support for the overlying structures but also a means to aid filtration and subsequent water drainage.

Full excavation of Space 3020 revealed a levelling layer at its base which covered the soft natural geological sands below and provided a firm and stable surface for further activity. It had been massively truncated by features higher in the stratigraphy and thus was diffuse and thin in the centre. Interestingly, this layer resembled the construction horizon found in Space 3012, and both are thought to be contemporary. Another interesting fact was that this layer actually extended under the thresholds to Spaces 3009 and 3007, meaning that although the deposit respected the main architecture, it predated plaster threshold embellishments which were consequently built on top. Given the nature of the highly friable and loose surface of the natural geology, it was a necessity to have a stable firm surface on which to base further surfaces and occupation activities.

After the main construction horizon, archaeology within Space 3020 was organised into five main sequences, each one representing a main surface mixed with occupation tread which had been then truncated by features such as post holes and pits. Interestingly, this mirrored the number of occupation sequences found in the central courtyard to the east.

Sequence 1 included features that marked initial activity which occurred immediately after architectural construction. In most cases, these features truncated the construction horizon. In total, 4 postholes and 19 pits were uncovered. The pits at this stratigraphic level were numerous, intercutting and very large. Only a few contained rubbish deposits. Others contained large deposits of dumped building material which had probably originated from the construction of the precinct itself. It seems likely that the purpose of the pits was to yield shell and sand to be used elsewhere in the compound, possibly either for construction or for creating shell floor surfaces. This was a similar pattern seen in the central courtyard.

Sequence 2 included a major occupation surface which overlaid most of the truncations noted in Sequence 1. This in turn had also been truncated by more intrusive activity represented by 6 pits, 1 posthole, 1 soak-away and 1 gully. A number of pits had been backfilled with grey sand and little else. Others contained domestic waste containing interesting finds. One pit contained a glass case bottle dating from the 18th century and a mother-of-pearl inlaid decorative object (Figure 3.10). The primary purpose of the pits remained a mystery, although the idea that they were made for shell extraction remained persuasive. Only a few pits were backfilled with



Figure 3.10: Glass case bottle (catalog # 1561) and mother-of-pear inlay (catalog # 1564). (OF-3230 and OE-8605)

domestic refuse. It seemed that the soft surfaces of this space were, like those in Space 3012, continually used and reused for dumping and material extraction. However, it was at this level that proper occupational activity was encountered in the form of drain renewal and attempts at dealing with water overflow. The drain from the water basin of room 3007 was recut and thus renewed, and a small gully was found that had cut through the threshold to Space 3026 in the north and emptied into a large pit in the northeast corner.

Sequence 3 included a major occupation surface which overlaid the truncations noted in Sequence 2. This in turn had also been truncated by more occupation activity, some of which was excavated in season 2010/11. In total, 6 pits, 4 post holes, 2 deposits and 1 surface depression were revealed. Some of these pits had been deliberately capped to seal in contents containing domestic organic refuse. The sequence was characterised by far fewer but more regularly shaped truncations, indicating that the level was a more substantial and recognised proper occupation surface than its stratigraphic predecessors.

Sequence 4 consisted of remnants of a shell floor truncated by a pit and a post hole and overlaid by two small fragmented occupation deposits. These features were excavated exclusively in season 2010/11 (Collie 2011). The well-established shell floor was concentrated in the south and became degraded and damaged further to the north. Pitting activities was minimal here, which indicated that a formal surface had been reached that was satisfactory for occupation and also showed that the need for shell/sand extraction from this area had diminished.

The final sequence consisted of features excavated in 2010/11 and 2013/14. It consisted of a shell surface similar to that found in Sequence 4, situated in the southern end and a sandy layer in the north. Both were thought to be contemporary deposits. These main occupation surfaces were overlaid by seven distinct occupation deposits and were truncated by one pit. Sequence 5 marked the end of the occupation activity in Space 3020. It displayed evidence of real shell floor surfaces similar to those seen in central courtyard Space 3012 and the interior spaces of the southern wing (Spaces 3004 and 3010). Truncations were minimal; signs of burning were encountered, which were either evidence of the occupants who resided here during the time of Al Zubarah's occupation or evidence of the towns decline towards the end. Dilapidation deposits covered the archaeology from Sequence 5 and consisted of wind-blown sand and collapsed wall stone and plaster fragments.



Figure 3.11: Gutter feature on the southern corridor wall in Space 3026. (KF-0372)

3.1.5 Objective 4 - Corridor Spaces 3026 and 3027

Large-scale excavation of deposits within these areas began at the end of 2013. However, by the beginning of 2014, it was deemed necessary to abandon full scale excavation and instead focus on three sondages at strategic places, both to save time and to avoid the danger of damaging the surviving architecture. They spanned the width of the corridor and measured 1m in length (see Figure 3.2 for location).

Corridor construction was closely linked to the original building of both PS7 and PS8, since Spaces 3026 and 3027 shared architectural elements from both precinct sections. Space 3026 was formed in the north by the southern parameter wall of PS7 and in the south by the northern parameter wall of PS8. Space 3027 was formed in the west by the north-eastern corner of PS8 and the entranceway to PS1.

Some intriguing features were found to accompany the original construction. Gutters/down pipes formed from good, hard, high-quality grey-brown anhydrite plaster ran vertically up the corridor wall (Figure 3.11). These gutters were believed to take water off the top of the rooms in PS8, confirming at least that they were roofed. The western entrance to the corridor from the exterior was formed by a plastered threshold that had eroded heavily in the middle, presumably from constant traffic entering and leaving the building. This was accompanied in the north by a small wall which had a horizontal cavity built into the top. This was interpreted as a gap to hold a large door bar to lock the corridor from the inside. To the south of the threshold and directly opposite this wall remained a small cavity forming a door socket. All three features collectively formed a formal doorway that could be sealed from the inside. The far eastern entrance to Space 3016 in PS8 through to corridor Space 3027 was formed by a large stone horizontal beam and additional plastered stone embellishments. Entranceway to Space 3020 from Space 3026 was formed by a small stone threshold and accompanying plastered door jamb.

Occupation in these transitional areas consisted of three sequences which were characterised primarily by water drainage. In short, drainage seemed to have been an oversight in the corridor, and water running down the plaster guttering on the southern wall collected in the corridor so much that it necessitated the construction of a large drainage gully which ran the entire length of the corridor itself. Subsequent occupation deposits overlaid this feature, which then slumped downwards. This surface-level drop was also thought to have been caused by people-traffic, and the two processes compacted deposits, effectively forming a natural groove in the middle. At some point, additional plaster wall guttering was added to the northern wall and re-rendering of vertical surfaces also occurred. A last sequence of events consisted of the deposition of more sandy silt within the corridor coupled with additional renovations to the western entrance.

Rubble collapse episodes within the corridor have been discussed previously (see Collie 2011) but a brief recap here is provided. Large swathes of dilapidation and collapse consisting of stone, silt and plaster fragments filled the corridors and blocked the doorway to Space 3020. Three collapsed arches, along with remnants of collapsed plaster niches, were also found in the corridor area. All these features were linked to the architecture of PS7 and PS8 and were not, as had previously been thought, been part of the corridor architecture.

3.1.6 Conclusions and Recommendations

Work in 2013/14 finalised the excavations in PS8. No new work will occur in this precinct section in the foreseeable future. The only spaces that did not receive full detailed excavation were Spaces 3001 and 3002. Although partially excavated in season 2010/11, there is remaining stratigraphy yet to be examined. In view of the pitting activities in the courtyard Spaces 3020 and 3012, it is likely that more pits and postholes are present sandwiched between occupation layers. These spaces were left ready to be examined in the future.

Excavation of Space 3020 yielded a similar sequence of features and deposits to Space 3012. Large quarry pits were seen to truncate the natural geology possibly for the accumulation of clean sand and shell used for building activities. Other truncations seemed likely to hold storage jars and post holes. It seemed that any soft surface within PS8 was vulnerable to extensive excavation regardless of the nature of precinct section occupation. No more work will occur in this space in the future.

Despite the small revelations of four new rooms in PS1, work will no longer continue east in this precinct section. Instead, the emphasis on revealing more architecture and structures will continue solely in PS7 with a general aim of heading north and excavating a corridor leading to the main northern entrance of the compound. Excavation of the rooms in the southern wing yielded important structural information about the formation of the building. Moreover, it allowed a greater view of the lower occupation deposits that hitherto had not been investigated. These bore striking similarities to those revealed in PS8. Cooperation between conservation and archaeological teams allowed a more detailed examination of the large amounts of dilapidation material that filled the rooms of ZUEP04. The recovery and conservation of the arches (see below) is one of the core triumphs of the season. Work in the future, therefore, will excavate another full-scale precinct section akin to PS8. Certainly the east and west wings of PS7 must be examined first, along with clearance of rubble outside of the precincts western parameter wall. Particular emphasis will be placed on the excavation of the eastern wing. Since both PS7 and PS8 were similar in construction and layout, it is likely that the north-eastern corner will yield an entrance to the corridor running north to the main compound gate. Further work in this compound will undoubtedly yield more exciting results.

3.2 RECOVERY OF COLLAPSED ARCHES

Carsten Schneider and Knut Zimmermann

3.2.1 Introduction

In spring 2013, initial excavations in Precinct Section 7 uncovered the remains of four collapsed arches, which, if adequately documented and recovered, were believed to be able to aid considerably with the reconstruction of the architecture in ZUEP04.

The first arch thus recovered in autumn 2013 was located in Space 3035, which collapsed into the existing doorway and the courtyard Space 3039 (Figure 3.12). It was clear from the beginning that not all parts of the arch were present. Three large fragments could be recovered, including a nearly complete sequence on the right side from the impost to just before the arch rise (Fragments 1 and 2) and about a third of the left side showing the impost and the start of the intrados (Fragment 3).

The surfaces of the arch originally facing the interior of Space 3035 were exposed to weathering after collapse. No evidence of plaster could be secured.

In spring 2014, and building on the recovery experience and results from the work in the autumn, a second collapsed arch, located at the interface between the courtyard and Space 3036, was systematically investigated and partially removed (Figure 3.15). This investigation sought additional information on the design of the arch and the surrounding architecture.



Figure 3.12: Remains of arch 4860 prior to excavation. (CE-0321)

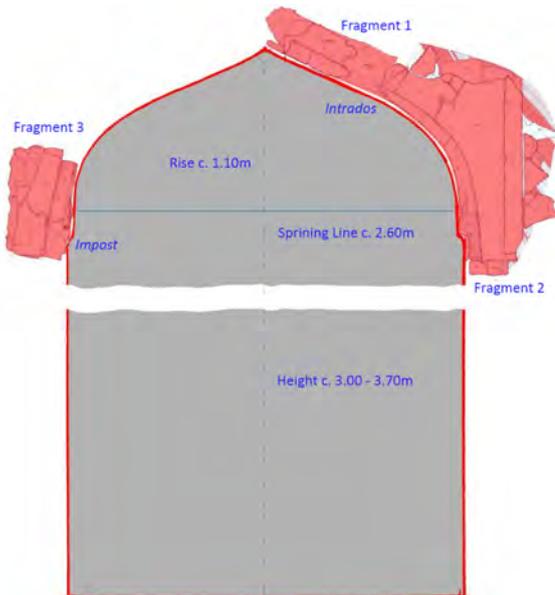


Figure 3.13: Reconstructed measurements of the arch showing large fragments.

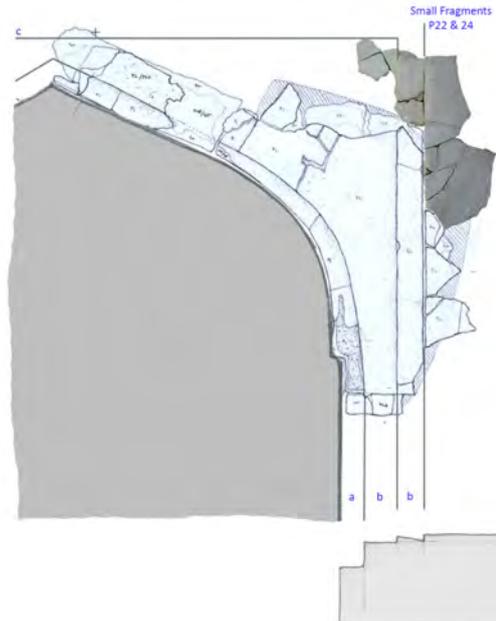


Figure 3.14: Design detail of arch opening showing rebates with small fragments.

3.2.2 Arch 4860 - Space 3035

Shapes and Measurements

The arch is a depressed pointed construction with a small reserve curve at the apex. Geometrically, it is similar to the form of a four-centred arch or ogee arch (Figure 3.13).

It has a rise of about 1.10m and a clear span of about 2.60m (springing line). The span of the reconstructed arch is about 30cm wider than the determined span of the wall opening at the base. The height of the entire door opening from threshold to apex could not be determined from the remains, but is estimated to be around 3.00 to 3.70m.

The arch has an outer jamb rebate with a width of about 10cm, two vertically ascending rebates of about 12cm width, and a reconstructed top horizontal rebate ca. 20cm above the rise of the arch (Figure 3.14). Fragments of a zigzag wall moulding could not be situated exactly, but its connection with a rebate suggests a relationship with the framing construction. One rebate fragment retains an imprint of the impost with a zigzag design underneath.

Materials

Fragments consist of irregularly shaped and roughly hewn stones, mortar and plaster, with plates of a firmer limestone, sometimes shaped, used for the area of the rebate. The masonry in the background (retaining wall) and parts of the rebate underneath the impost are built from the less resistant beach stone. Two mortars could be observed: a reddish-brown type around the rebate, and a grey-white type in the retaining wall.

Reconstruction

The shape of the arch - a depressed pointed construction with a slight elevation in the apex - could be reconstructed graphically. Part of this study were further observations about the arch and its surroundings, which at this point form suggestions for further work. Thus, for a physical reconstruction of the arch, the following points must be addressed:

- Height of the door opening from the impost to the threshold as well as height of Space 3035
- Transition from the podium zone to the intrados (explaining the difference in the span of the door opening to that of the arch)
- Accurate location of ornamental features
- Construction and design of the interior face of the arch



Figure 3.15: Working area of arch 4859 after superficial cleaning. The largest arch fragment is visible on the left. Any exterior plaster had deteriorated in the past. (DF-0178)



Figure 3.16: Front of arch 4859 showing the cornice. Compare drawing Figure 3.8. (WF-0395)

3.2.3 Arch 4859 - Space 3036

Shapes and Measurements

Evaluations to date identify the fragments of the arch to be similar to that in Space 3035, with minor deviations in measurements and execution. It is a depressed pointed arch with an overall height of 3.00 to 3.70m (Figure 3.15).

The courtyard-facing side shows remains of a rebate following the shape of the arch. Signs of a shaped impost are also present. Contrary to the arch in Space 3035, large contiguous plaster fragments could be recovered from Space 3036 showing a direct connection to the architectural design of the arch and the retaining walls, and particularly of the interior room.

Thus, fragments of a horizontal cornice located c. 30cm above the apex are a clear reference to the original ceiling height of the room, which is calculated to have been c. 3.50 to 4.00m. The upper end of the cornice shows remains of the ceiling (Figure 3.16). In addition, signs of artistic etchings up to the height of the impost suggest that the entire room was once covered in artwork, possibly with dhow graffiti or similar.

Materials

The investigation of the building technique demonstrates the use of building stones depending on statically more or less stressed areas, using beach stone in the area of the arch and the more stable limestone in relation to the curvature of the arch and the cornice, beginning just underneath the impost.

In the course of the arch recovery, further etchings were identified in the southwest corner of the room. These are remarkably similar to etchings found in Space 3033 (see 3.1.3 above).

Large fragments of the ceiling could be recovered in the rubble in Space 3036. These include remains of palm matting as well as mortar or soil fragments that likely belonged to the floor construction above the ceiling. Many different mortar and plaster types were identified in the rubble; further study of the materials and the order and type of their application in the

architecture may give further insight into the building phases and renovations or repairs.

Some fragments show remains or impressions of wood constructions in the masonry. These were palm trunks as well as very smooth and angular beams just underneath the plaster surface. No immediate function or location of the beams could so far be identified; it is likely that they were related to wall features such as niches or windows.

3.2.4 Conclusions and Recommendations

In order to verify, expand and, where necessary, correct the findings from this recovery and reconstruction effort, further studies of the excavated fragments and the immediate surroundings are required. The recovery of the remaining arches should be undertaken for comparative purposes, as well as comparisons between arches and other masonry fragments attempted.

The vast body of information thus collected raises questions regarding its presentation. Following suitable conservation efforts, it is technically possible to reconstruct the architectural feature with the historical material, or at least guided by it, to allow any visitor the experience of full immersion (Figure 3.17). This must form a discussion point in any presentation proposals for the entire compound.



Figure 3.17: Graphical reconstruction suggestion.

3.3 ASSESSMENT OF PLASTER FRAGMENTS

Christian Fuchs

3.3.1 Introduction

During the spring of 2014, it was possible for the first time to assess decorated gypsum plaster fragments retrieved in ZUEP04. The assessment concentrated on a row of fragments of a plaster band with a geometric pattern. These fragments originate from Space 3004 in PS8. As one piece of this plaster band has remained *in situ*, there was no doubt on its position in the compound. All fragments were described and a sketch was made; both were entered into a form particularly designed for this assessment.

3.3.2 Results

During this work, which took place in Zubarah Research Station, it was possible to reconstruct the comprehensive design of the plaster band (Figure 3.18).

A considerable amount of information could be gained from the assessment, summarised as follows:

- The band consists of four different, strictly geometric ornaments; three of them are based on a circular design and one on a square design. All ornaments are inscribed into a square compartment.
- The ornament as a whole is not symmetrical. A strict symmetry seemed to be of minor importance to the builders.
- The plaster band was applied on a first layer of plaster on the wall. It was furnished with incised raw lines as guidelines for the carving process. This was done with a compass, and its marks remain visible on the plaster. The carving was done into the dry plaster. The plaster was not pre-fabricated.
- The lintel was built with several palm beams; their imprint is still visible on the back of some fragments.
- This plaster band decorated the exterior of a doorway.

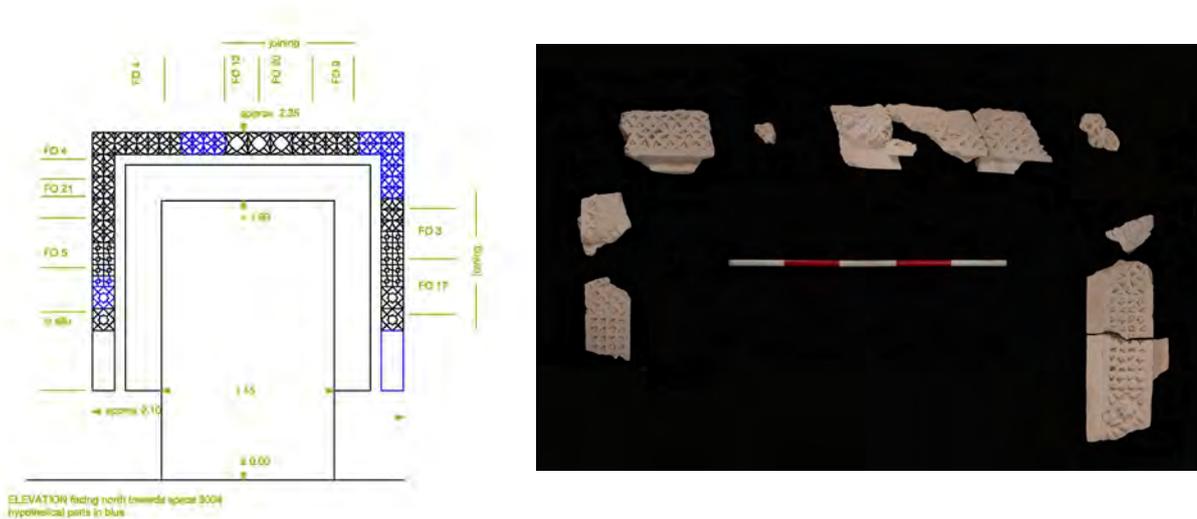


Figure 3.18: Reconstructed plaster band around the doorway facing Space 3004 (left), and original plaster fragments re-assembled in their proper position (right). (OF-6443)

3.4 CONSOLIDATION AND CONSERVATION WORK

Bernadeta Schäfer

3.4.1 Introduction

Conservation work in ZUEP04 consisted of the monitoring and documentation of the condition of previously consolidated structures, the consolidation of further walls, the application of make-up and fine plaster layers, and repairs to damage in the historic plaster (Figure 3.19).

In PS7, the discovered *dhow* etchings were documented with 3D photogrammetry and recovered for safe storage where possible.

3.4.2 Monitoring

Monitoring at the beginning of the season confirmed that the climatic conditions on site present a serious challenge to both the historic and the modern material. Damage patterns identified in spring 2013 proved to remain consistent.

The fragile, highly porous stones of poor quality (mostly beachrock) used for construction of walls in the palatial compound cannot withstand the pressure of salts crystallising inside and therefore swell and burst. The same applies for the soft mud and clay mortars. The increase of volume inside of the wall causes deformation and detachment of historic plaster, and leads to the appearance of small blisters on the plaster surface and spacious blisters as result of detachments (Figure 3.20). New restoration plaster layers crack and/or peel off. Salts crystallising inside the plaster cause sanding and peeling of the fine plaster surfaces. Furthermore, the humidity and salt efflorescence on the surfaces are leaving a negative impression for presentation.

Historic gypsum/anhydrite plaster in the lower parts of the walls suffer the most from the salts. The plaster on walls first consolidated two years ago had deteriorated in about 50% of the surface after exposure to the elements.

Plaster mix 1.56, applied in spring 2013 to the voids in historic plaster, performed well on the spots where brittle historic masonry has been removed at least 3-5cm deep. These fillings had mostly larger surface (at least 50cm²). Plaster that had been complemented only superficially (0.5-2cm deep) and on small surfaces did not show sufficient bonding to the masonry and to the surrounding historic plaster. Very problematic are the joints between the restoration plaster and historic plaster. Evidently, the overlapping of restoration plaster on historic plaster results in detachment of the overlapping area of the new plaster, regardless of the mix.

The newly applied fine plaster surfaces in spring 2013 were not covered for curing and produced hairline cracks on the surface. These cracks however seem not to influence the overall stability of the plaster and did not lead to any further damage over the summer months in 2013.

Deep cracks appearing on some walls demonstrate strong movements inside of the structures. These cracks cannot be avoided, but have to be observed and repaired at times.

Provisional barriers placed in front of some of the features that used to be subject to damage by visitors served their purpose very well – no further damage by stepping and trampling occurred.

3.4.3 Consolidation Methodology

Repairs on plaster were carried out throughout the season. The interior walls of PS8 were consolidated with mortar mix 1.2 (1:3 mix of NHL5 St. Astier: quartz sand). At the same time, a make-up plaster of the same mix was applied 3-4cm thick. This results in long-term protection



Figure 3.19: Conservation work in ZUEP04 in autumn 2013 and spring 2014.

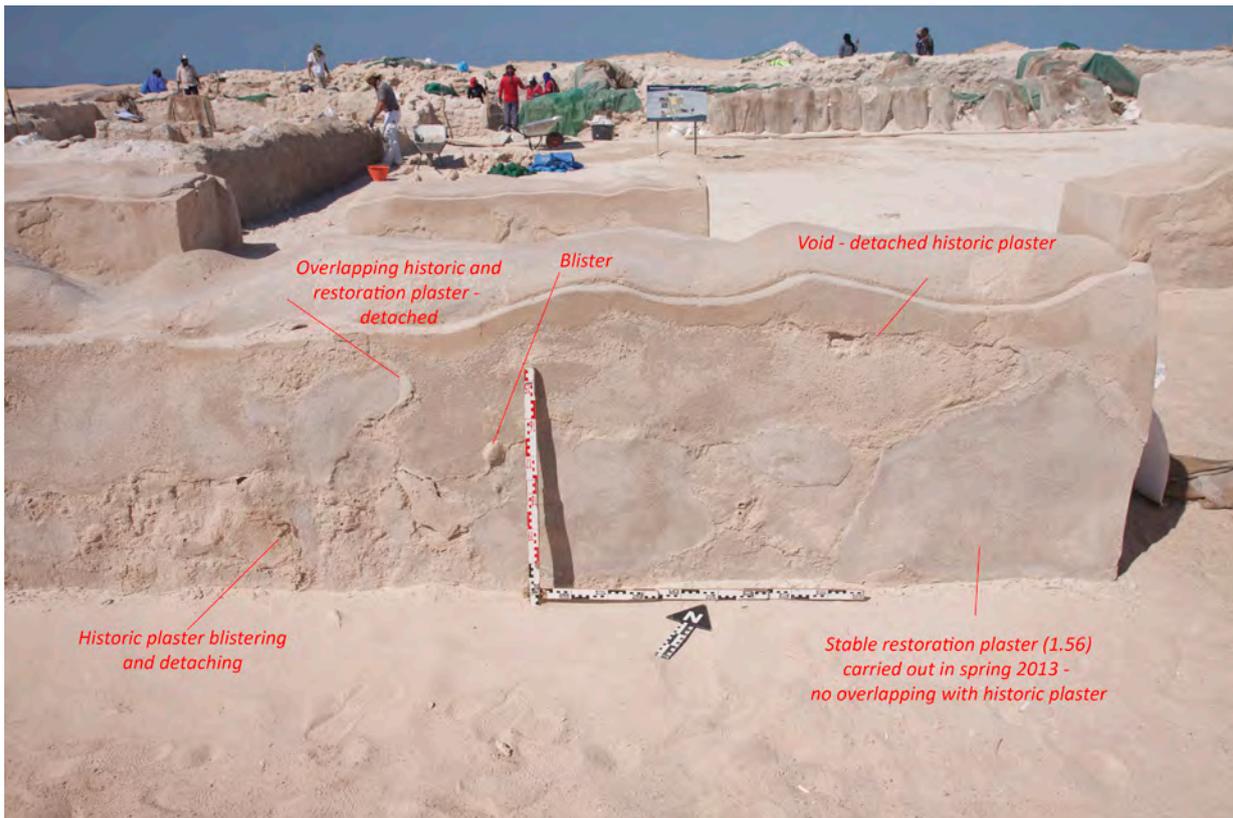


Figure 3.20: Wall 4090 in Space 3003, showing damage patterns on the plaster surface. (DE-0560)

of the stone masonry even if the finish layer cannot be applied in the same season. The surface of the make-up layer is very rough to provide good support for the finish. Time between the consolidation, including the make-up layer, and the fine finish was about four weeks.

The masonry of the western courtyard Space 3012 wall in PS8 was in particularly bad condition (Figure 3.21). Spacious voids appeared when vacuuming the masonry, which had to be complemented with dolomite stones.

Repairs on historic gypsum/anhydrite plaster were carried out mostly with gypsum plaster 3.8 (3:1:8 mix of local gypsum Sadaf: NHL5 St. Astier: fine desert sand). Particularly for thresholds, 1.56 mix (1:1.5:1.5 NHL5 St. Astier: desert sand: sieved quartz sand with a grain size of less than 2mm) was used as it is harder and more likely to resist damage due to visitors stepping on the surfaces. Walls in Space 3005 were replastered using solely the 3.8 mix (Figure 3.22).

The walls of corridor Spaces 3026 and 3027 were consolidated using mortar mix 1.74 (11:2:2:7 gypsum: desert sand: quartz sand: dolomite grit). The mix shows comparatively low value for capillary water uptake in comparison with NHL-based mortars. As most of the problems on masonry in ZUEP04 are the result of salts changing their state depending on humidity levels, this kind of mortar might positively influence the performance of exposed structures. The mortar has been applied in a traditional way by hand without other tools. The great advantage of this mortar mix is the fact that it does not require time for curing, and the consolidated wall can be covered with fine plaster finish the very next day.

The plastering of two door jambs in Space 3027 was carried out with gypsum mix 1.71 (2:3 mix of local gypsum Sadaf: fine desert sand). The surface was not smoothed but scratched with a sharp knife. This technique allowed to produce a plaster surface very similar in its structure to the historic plaster on the preserved jambs (Figure 3.23).

After the application of mortar mix 1.74, tests for application of fine plaster finish were carried out on the eastern wall of Space 3027 (PS1). The test area was divided in three fields: on the southern field, the plaster was applied in two layers; on the middle field, only the first layer



Figure 3.21: Spacious voids in the wall structure in Space 3012 after cleaning. (DE-0466)



Figure 3.22: Preparation of walls in Space 3005 for void repair. Detached plaster were removed. (DF-0378)

was applied; and on the northern field, the entire plaster was applied as a single layer (Figure 3.24). The application in two layers following each other in a short time span proved to be most practicable, as the surface did not crack as much as on the single-layer field. Craftsmen had to be encouraged to follow the irregularities of the wall surface as there was a strong tendency to level the surface with plaster.

The considerable number of *dhow* etchings and historic graffiti in PS7 was addressed in autumn 2013. Most of the etchings have been removed from the walls, as they would not have survived long-term exposure *in situ*. All were documented by photographs, drawings and 3D photogrammetry, and moulds were created (Figure 3.25). After removal, the etchings were conserved and stored at Zubarah Research Station.

All thresholds that could not be repaired during the season were carefully backfilled with sand bags and hessian cloth. The cuts on the eastern side of the excavation were backfilled with sand

bags, green mesh and covered with four layers of hessian cloth. Weakened backfills on cuts around Spaces 3024 and 3025 were replaced in autumn 2013.

3.4.4 Conclusions and Recommendations

Experience shows that walls cannot be covered on the day of plastering as it would lead to the appearance of coloured marks and/or imprints on the surface. Instead, this should happen on the following day, and for the duration of the curing period - ideally with transparent plastic sheet for about 30 days to prevent the appearance of hairline cracks on the surfaces. Observations over the period of about one year did not show any further damage resulting from hairline cracks, but it cannot be excluded for the future.

The knife-scratching technique is highly recommended for reconstructed surfaces of gypsum plaster elements like thresholds and door jambs or gutters.

Findings on the walls in Spaces 3020, 3026 and 3027 proved that the walls of open spaces such as courtyards and corridors were plastered with soil/clay mortars. Only door and window jambs,



Figure 3.23: Reconstructing the plaster surface on the door jamb, scratching the surface with a knife. (DF-1085)



Figure 3.24: Gypsum plaster test fields in Space 3027. (DF-1131)



Figure 3.25: Restorers recovering plaster with *dhow* etchings. (DE-1596)

and thresholds, gutters and building corners were covered with gypsum plaster. It is necessary to find a way of distinguishing the wall surfaces that used to be covered with gypsum/anhydrite plaster from those that were plastered with soil/clay. Preferably a suitable modern clay plaster should be developed.

The joints between restoration and historic plaster should be produced as a sharp edge without any overlapping. This will provide the restoration plaster with more durable bonding to the wall face.

Any conservation work in PS7 has to be postponed. Before executing any consolidation or plastering a concept on presentation/possible reconstruction of the arches leading to courtyard Space 3039 must be settled. Also the process of reintegration of the removed *dhow* etchings (or their mouldings) into the walls has to be considered. Structures excavated in previous seasons have to remain protected by backfill and regularly checked until decisions on these issues are made.

4. THE FORTIFIED COMPOUND (QMA4)

4.1 ARCHAEOLOGICAL INVESTIGATIONS

Daniel Wheeler and Marek Z. Barański

4.1.1 Introduction

During the 2013-14 season, a number of small excavations were focused on an area of approximately 40m by 25m, forming roughly one quarter of a large, fortified compound within the south east of Al Zubarah, designated QMA4, in combination with the continued preservation and re-conservation of the architecture exposed during earlier excavations of the 1980s (Al-Kholaifi 1987). Excavations and conservation work during the early 1980s had removed a significant amount of the upper stratigraphy across the bulk of the area whilst much had also inevitably fallen victim to the harsh extremes of the Qatari climate.

The principal archaeological aims for QMA4 were to:

- Remove all collapsed and degraded material from within QMA4 in advance of re-conservation efforts
- Record and draw elevations of all standing architecture prior to re-conservation
- Target small excavations on points of interest across the area
- Establish broad phasing from the individual stratigraphic sequence within each excavated area
- Collect any finds and environmental samples for future analysis

Excavations took place in selected spaces as well as small sondages where conservation work necessitated additional archaeological investigations. Work here was limited to cleaning and establishing the location of features; none of the deposits or structures were excavated in their entirety (Figure 4.1).

4.1.2 Space 10008

Space 10008, on the central western side of QMA4, was defined as a small area bordered to the north and south by walls, to the west by a blocked door frame and to the east by a thick layer of unexcavated collapse material. During the cleaning and removal of post-1980s material, this area appeared to be of particular interest due to the obvious amount of surviving stratigraphy. This space also initially seemed worthy of further excavation due to its already-prominent change of use over time. The space appeared to have been the main access way from within QMA4 into the next courtyard-based quadrant of the compound to the east. Potentially, this was once an open corridor used to move easily between two deliberately separated areas within the compound. Later it seems that the installation of a large door frame in the middle of this thoroughfare limits direct access as well as direct visibility. The later complete blocking within this frame then entirely prevents any direct admittance, effectively bi-secting this area and creating two separate spaces. The opening and blocking of entrance-ways and the re-working of areas of intervisibility and access suggest that these adjustments may be based on familial changes within the compound over time, opening and closing parts accessible to certain people within the building.

The aim of this excavation area was not to remove all of the deposits down to natural sand

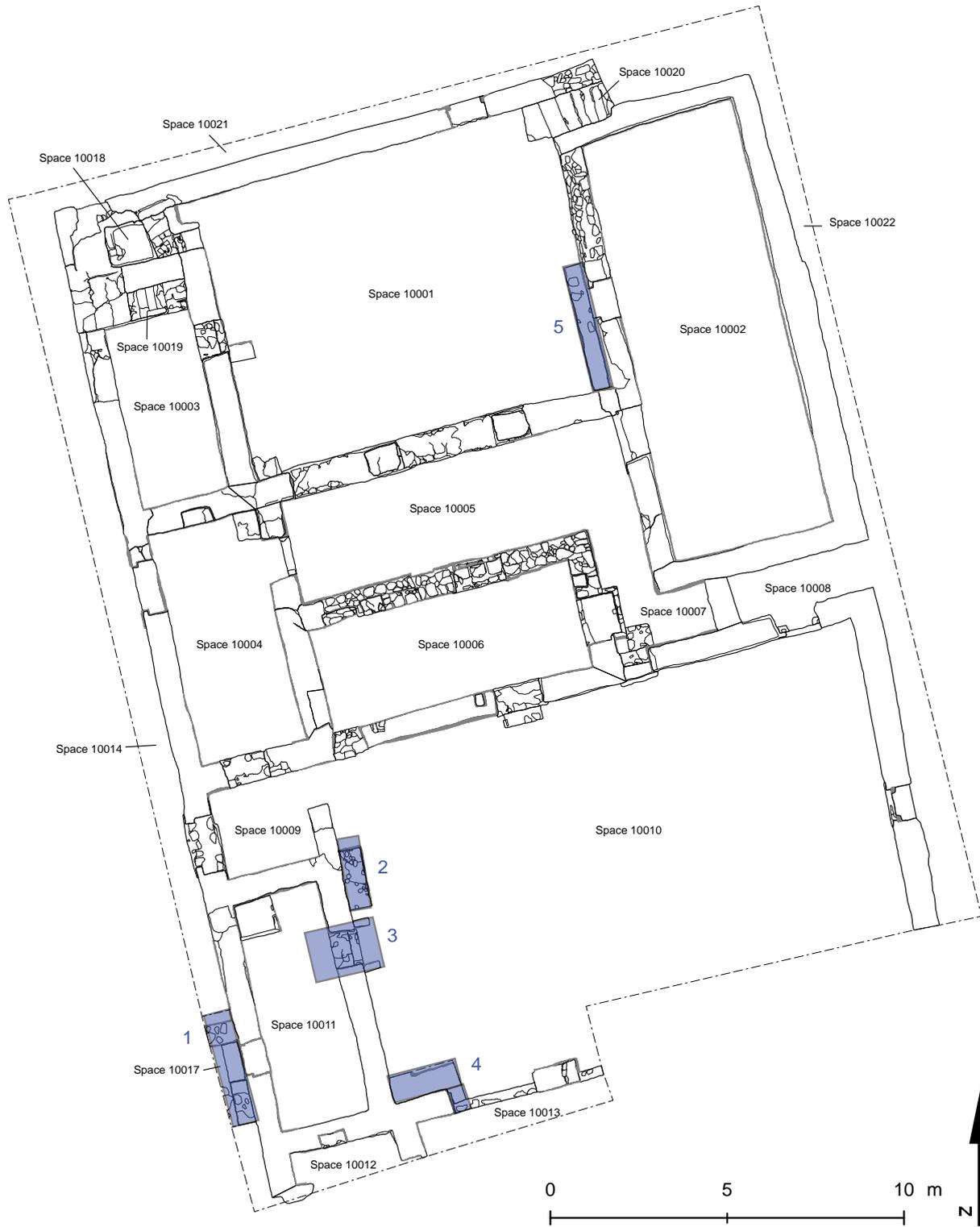


Figure 4.1: Plan of QMA4 showing excavated sondages.



Figure 4.2: Space 10008 showing gypsum plaster floor, door frame and blocking. (YF-0040)

but instead to gather as much significant information within a short time-frame. The earliest deposit reached was a hard gypsum plaster floor covering the majority of the area. This surface was unexcavated but seems likely to have been contemporary with the earliest construction in the area and was laid during the same major building phase associated with the earliest architecture in QMA4 (Figure 4.2). Above this lay a mud-based surface which became considerably thicker as it approached the northern and southern walls, where it blended into the joint mortar and patchy plaster used on these faces. It also contained a number of lenses of degraded imprinted straw or reed, seemingly trampled into the deposit. This may have been the result of either the installation or perhaps collapse and repair of the ceiling (Figure 4.3). Potentially woven reed material was used across the roof, with some falling to the ground and gradually becoming part of the accumulated surface. Another gypsum-based plaster floor then overlaid this deposit acting as both a newly-laid surface and a make-up layer for the installation of the door-frame. This marks the first

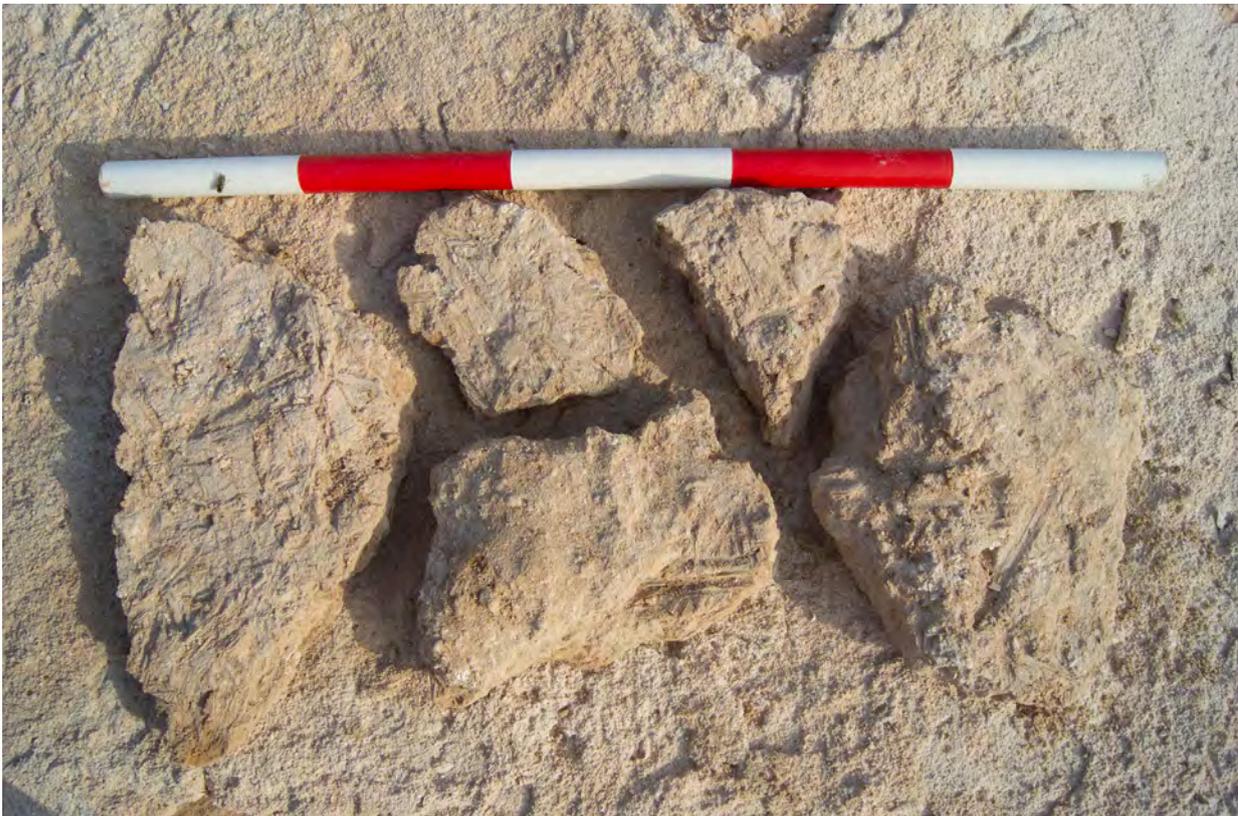


Figure 4.3: Reed impressions within mud-based floor. (YF-0044)

change of use of Space 10008 from thoroughfare to controlled access-way.

Thereafter begins a sequence of poorly-made and badly-degraded surfaces in this area. A number of small fire pits, pits and stake holes were then cut through and around these deposits, further indicating a change in usage of the space. This is further supported by the remodelling of the entranceway into Space 10008, signified by the introduction of twin door sockets/jambes flanking the threshold on the south side (Figure 4.4). The introduction of a door here, coupled with the blocking of the doorway on the western side, shows that there is a definite change of use of Space 10008 from open thoroughfare to a more observable boundary between areas. A number of fire pits were then cut into the corners of the area, possibly indicating the use of the space for short-term shelter, potentially in the early stages of abandonment of the building.



Figure 4.4: Entrance-way into Space 10008 with added door sockets. (YF-0043)

4.1.3 Spaces 10009 and 10014

A small excavation area was opened over the threshold in the main entrance-way into the compound on the western side of QMA4, with the primary aim being to establish whether this door-way had always been the principal access into the compound. A small number of deposits were removed, exposing the surviving threshold and a significantly burnt layer internal to the building. The inside face of the threshold was covered with an early degraded plaster suggesting that it may have once been a solid continuous wall and not an original entrance. This is supported by the addition of a later wall inside the first room which would block a direct line of sight from the outside street into the central courtyard.

4.1.4 Space 10017 (Sondage 1)

This sondage was opened to facilitate the consolidation of the western compound wall. The discovery of architectural features here came as a surprise, as it had been believed to be a street. Limited excavation area, erosion as well as partial destruction of the features - possibly during earlier work at QMA4 - makes the interpretation of the revealed features difficult.

The three identified features are located immediately adjacent to the blocked doorway into

Space 10011, with one constituting a step towards the entrance. Two walls or, possibly, benches to either side of the step have not been fully exposed. Their relationship to the compound wall and to each other is obscured by a uniform layer of well-preserved anhydrite plaster.

Space 10017 is tentatively interpreted as an open area, possibly another courtyard within the QMA4 compound due to the absence of a formal plaster floor. However, an expansion of the sondage may considerably change this interpretation.

4.1.5 Space 10010 (Sondages 2, 3 and 4)

A sondage was located along the western wall of courtyard Space 10100. A small architectural feature, possibly a bench or small platform, was found abutting the main wall from its northern corner and extending to the doorway to Space 10011, overlain by a series of later deposits. Traces of a horizontally placed mud-based make-up layer on the surface of the feature suggests that its original height did not exceed 20cm. Its faces were covered by an anhydrite and a secondary gypsum plaster, the latter surviving only in a few places.

A similar, likely contemporary feature was identified immediately south of the doorway to Space 10011, and again in the southwestern corner of Space 10010, where further sondages were located. This platform or bench was abutted by an ashy layer containing fragments of animal bone and pottery, which may suggest an episode of burning in this part of the compound.

The sondages also helped to define more clearly the nature of the thresholds to Space 10011 (Figure 4.5) and Space 10013.



Figure 4.5: Doorway between Spaces 10010 and 10011. (XF-0685)

4.1.6 Space 10001 and 10002 (Sondage 5)

This sondage investigated the doorway between Spaces 10001 and 10002 in the northeast of QMA4. This excavation identified the existence of door jambs integrated into the walls either side of the threshold facing courtyard Space 10001.

A highly degraded platform or bench feature reminiscent of the features in Space 10010 could be seen here as well. It survived no higher than 12cm and was covered by an anhydrite-based

plaster only surviving on the western face of the feature. Space 10001 and 10003

This sondage investigated the doorway between Spaces 10001 and 10003. A possible platform could be identified here as in the other courtyard spaces. The doorway's threshold was only partly preserved (Figure 4.6).



Figure 4.6: Badly preserved threshold between Spaces 10001 and 10003. (XF-0661)

4.1.7 Conclusions and Recommendations

QMA4 is remarkable regarding its complex history of spatial organisation. The surviving stratigraphy is characterised by changes in architectural design, seen in the frequent blocking of doorways, the setting of new division walls, laying of new floors and the construction of new features.

Archaeological work in the fortified compound was undertaken to aid the conservation and consolidation process. This additional research has, however, also identified new features and architectural detail not previously known, and further investigations might shed more light on the complex phasing of the structure. This work has also shown that even an already excavated and conserved area may still hold archaeological value that should not be ignored in future restoration and presentation efforts.

4.2 CONSOLIDATION AND CONSERVATION WORK

Bernadeta Schäfer

4.2.1 Introduction

The conservation team was engaged in QMA4 throughout the season, initially documenting the state of preservation through photographs, descriptive records and drawings. This was followed by the consolidation of the masonry and application of a make-up layer, and the repair and reattachment of historic plasters (Figures 4.7 and 4.8).

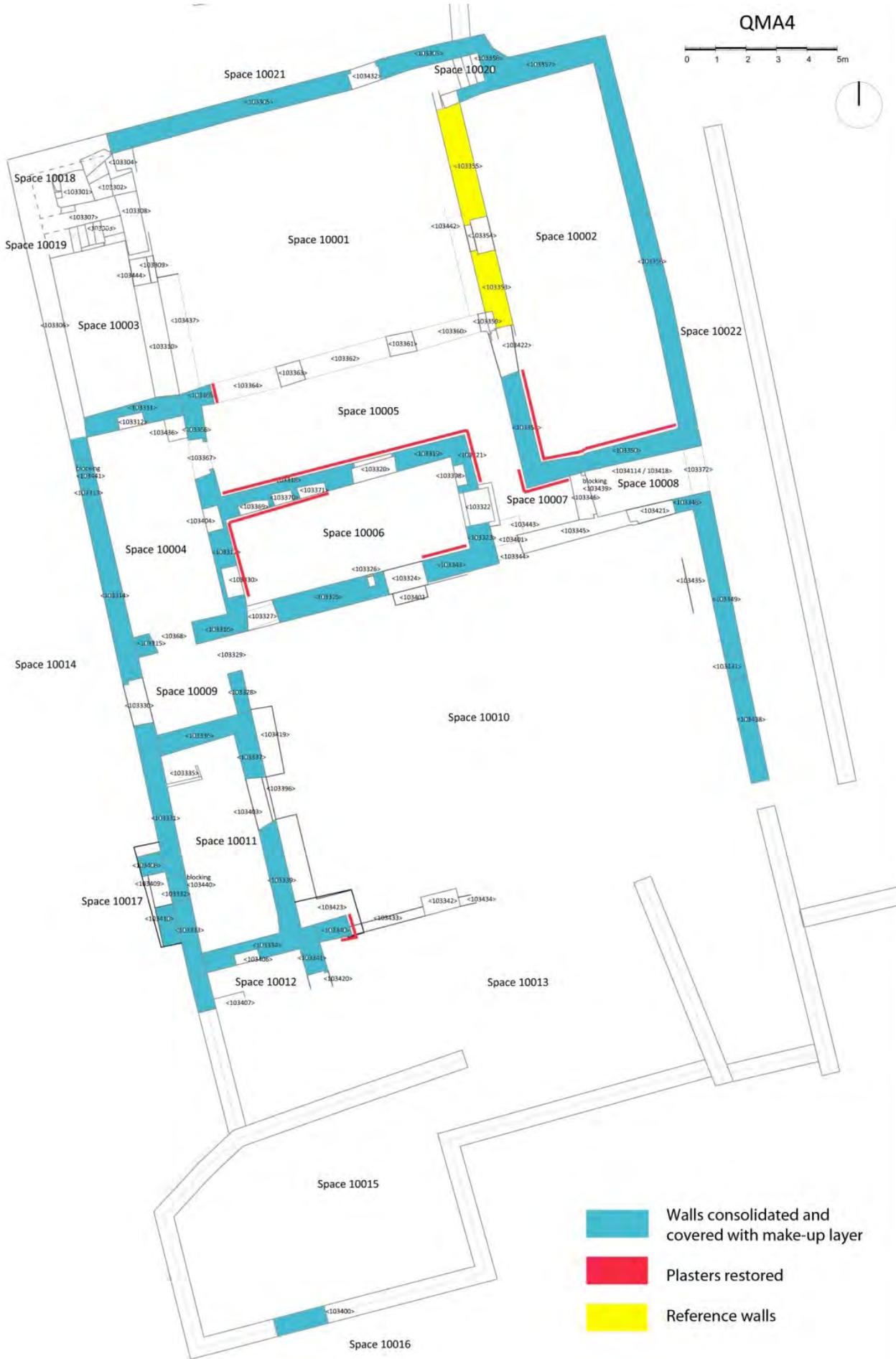


Figure 4.7: Schematic plan of QMA4 showing progress of work in 2013/2014.



Figure 4.8: Overview of QMA4 at the end of the season. (DF-1135)

4.2.2 Monitoring

The absence of maintenance since the original conservation work following excavations in the 1980s has resulted in greatly eroded structures largely buried under sand deposits and collapse. The original conservation efforts utilised cement mortars and plasters, while voids in the masonry were complemented with aeolianite stone slabs. Generally, cement cappings were kept flat, but in some cases the wall tops formed rounded slopes that resulted in an artificial impression of the ruins. Several niches and the staircases in the northern part of the compound (Spaces 10018 and 10020) were covered with a thin layer of plaster or slurry that provided sufficient protection to the surfaces to preserve them undamaged until this day.

The historic gypsum/anhydrite plasters were of very good quality, but the lack of maintenance after abandonment of the compound led to significant collapse. The modern cement cappings and plasters did not offer suitable protection to the fragile beachrock that were used to construct the historic walls. Plasters were only applied to the joins instead of the entire wall surface; strong winds, heavy winter rains and chemical processes between the cement mortars and historic building materials led to serious decomposition of the beachrock (Figure 4.9).



Figure 4.9: State of conservation of a hamam in Space 10006 after excavation in the 1980s (left) and at the beginning of the autumn 2013 season (right). (QM & YE-1230)

Drawing of the ground plans and elevations was supported by templates prepared via 3D scanning by Klaus Mechelke and team from Hafen City University Hamburg.

4.2.3 Consolidation Methodology

The aim of the conservation work was initially to stabilise the architecture without removing the cement cappings and plasters where possible. It became apparent that while the cement



Figure 4.10: Removal of the cement capping on a wall in Space 10006. (DF-0075)

fragments were often very stable, the masonry behind or underneath them was not, leading to difficulties in the consolidation of the walls. It was then decided to remove all cement elements which, even though requiring particular care in order to preserve historic elements, allowed much faster progress (Figure 4.10). The consolidation work used mortar mix 1.2 (1:3 mix of NHL5 St. Astier and quartz sand), while dolomite stones were used preferentially for any wall reconstructions. Historic gypsum/anhydrite plasters were repaired with the modified gypsum plaster 3.8 (3:1:8 mix of local gypsum Sadaf, NHL5 St. Astier and fine desert sand).

Plaster restoration presented a particular challenge, as in most cases the plasters were supported by only a small number of stones, the rest having eroded together with any mortar. It was occasionally necessary to remove the plaster, repair and consolidate the masonry, and subsequently reattach the historic plaster.

The most spectacular plaster feature survived in Space 10005 in the form of a dragon tooth decoration. Restorers and masons together reconstructed the particularly badly preserved wall where possible, and filled any remaining voids with a liquid plaster mix using small pipes and syringes. The historic plaster could then be reattached (Figures 4.11 to 4.14).

The singularly high-standing remains of a wall in the southern-most part of the compound, possibly part of a tower construction, was consolidated to prevent further collapse.

Two of the walls previously conserved in the 1980s campaign have been left without any renewed consolidation efforts in order to demonstrate to visitors the need for maintenance and repeated measures (Figure 4.15). Other as yet unconserved features have been protectively backfilled for future work.

4.2.4 Conclusions and Recommendations

A majority of features have now been conserved and prepared for presentation in QMA4, highlighting both the significance of the architecture and the necessity of continued maintenance and consolidation of the remains left to the elements.

Future work will focus on the finalising of the conservation efforts and the monitoring and maintenance of the now consolidated features. In addition, floors require to be cleaned, documented and backfilled with clean sand before opening the area for visitors.



Figure 4.11: Before conservation, with detached plaster fragments in front. (YE-1293)



Figure 4.12: Restorers filling voids in the wall with liquid mix. (XF-0213)



Figure 4.13: Reattaching the detached fragments of historic plaster. (YF-0091)



Figure 4.14: After conservation, with plaster reattached and voids filled. (XF-0710)



Figure 4.15: Two walls on the eastern side of Space 10001 remaining untouched to serve as reference objects for the conservation and need for maintenance. (DF-0022 & DF-0023)

5. THE OUTER TOWN WALL (ZUEP10, ZUEP11, ZUEP13)

5.1 ARCHAEOLOGICAL INVESTIGATIONS - ZUEP13

Daniel Wheeler

5.1.1 Introduction

Small-scale work continued in ZUEP13 at the beginning of the 2014 season with the intention of clearing and documenting areas for the continued preservation of the Outer Town Wall between Towers 16 and 17 in the south-east of the city. Excavation areas of arbitrary sizes around both towers aimed to expose the upper extents of the surviving archaeological deposits so that a full record of the surviving architecture could be made prior to conservation. When necessary, deposits were removed for further investigation, including those within the internal tower staircases. At both T16 and T17, an internal *banquette* wall was seen providing a walkway along the inside of the main city wall. This same feature was previously seen in ZUEP04, ZUEP10 and ZUEP13 and is clearly a city-wide defensive installation. Each tower also had a large ramped deposit covering both the *banquette* and the tower itself. These packing layers appeared to have been deliberately laid against the towers, perhaps to provide structural support and easier access once the towers fell into disuse.

5.1.2 Tower 17

An area measuring 3.2m by 3.8m on the western side of Tower 17 (Figure 5.1) began with the removal of a layer of wind-blown sand covering the entire area. This uncovered a backfilled slot from the 1980s dug through the surviving deposits banked against the *banquette* wall. This slot was emptied out to reveal the sequence in section (Figure 5.2). The *banquette* wall here was of slightly different form, with the main constituent being soft clay-based masonry roughly coursed and bonded by a gypsum-based mortar. The soft nature of this feature has led to a higher level of degradation than seen in other parts of ZUEP13. Likely to be contemporary with the construction of the *banquette* was the blocking off of the main tower entrance. This infill into the entranceway consisted mostly of irregularly-shaped mud or clay-based stones bonded with a mud-based mortar and would have levelled the entrance into the tower to the same height as the *banquette*. The earliest deposit here was laid against the *banquette* and was likely a washed layer of bond material that had gradually weathered from the upper sides. Sat on top of this was a thick ramped layer of silty sand packed with large clay-based stones. This deposit was tightly packed and deliberately laid seemingly to provide support to the inside of the tower. Its ramp-like shape also suggests the possibility that it may have been added to facilitate the use of a small cannon from the top of the tower. The area was then covered across the whole extent by a thick layer of wall and tower collapse which was mixed with wind-blown sand and backfill from the 1980s excavation.

5.1.3 Tower 16

A very small excavation on the western side of T16 revealed a similar sequence of deposits to those seen at T17. A substantial packing deposit laid against the inside of the tower appeared to have a similar function to that next to the tower to the north. Made up of a high proportion of large mixed stones stuck together with a sandy gypsum-mortar bond, this deposit had a pronounced 'stepped' effect. Whether this 'stepping' was part of the original deposit or due to over-excavation during the 1980s was difficult to tell. It does seem, however, that the installation of this deposit is a deliberate buttressing against the tower to support it structurally and provide

easier access. This may have been particularly beneficial during the abandonment of the outer extent of Al Zubarah in the early 19th century when many of the outer defences had perhaps begun to collapse. Tower 16 also saw the addition of an infill above the first couple of steps inside the entranceway, essentially blocking the way inside. This was a levelling deposit of sand and beachstone which brought the height of the entranceway into the tower flush with the height of the walkway. The uppermost deposit covering most of this area was a layer of wall and tower collapse containing a high proportion of degraded beachstone, and was set in a hard matrix of rain-washed mortar bond material.

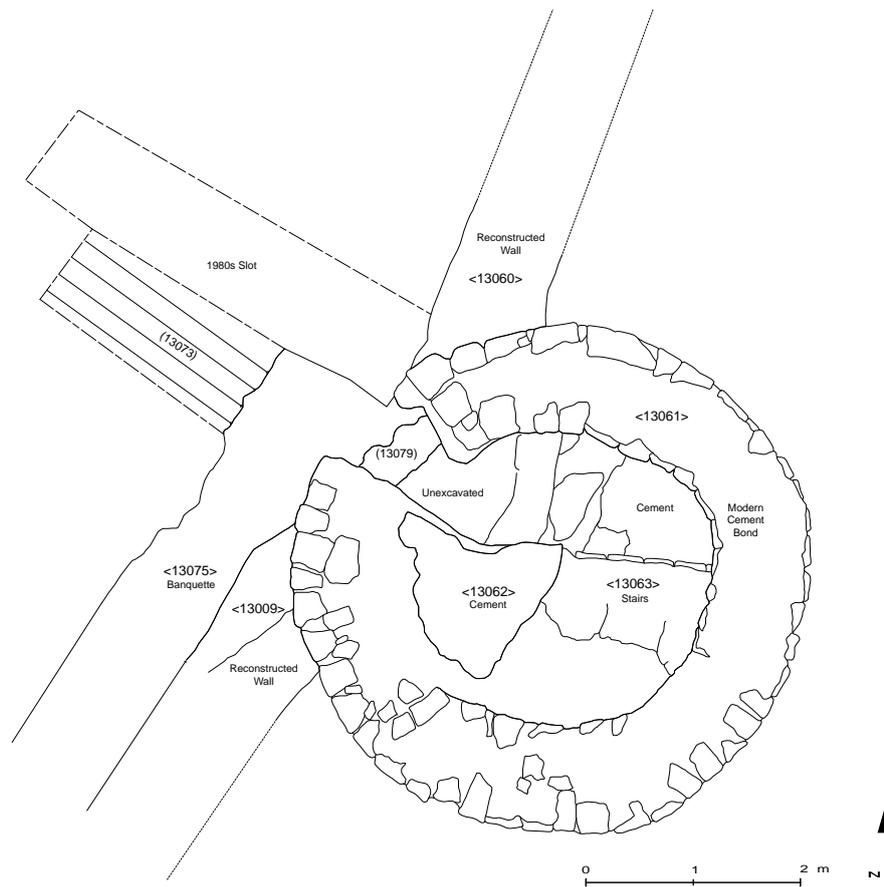


Figure 5.1: Post-excavation plan of Tower 17.



Figure 5.2: Cleaned section of 1980s excavation slot showing collapse and deposits. (YF-0229)

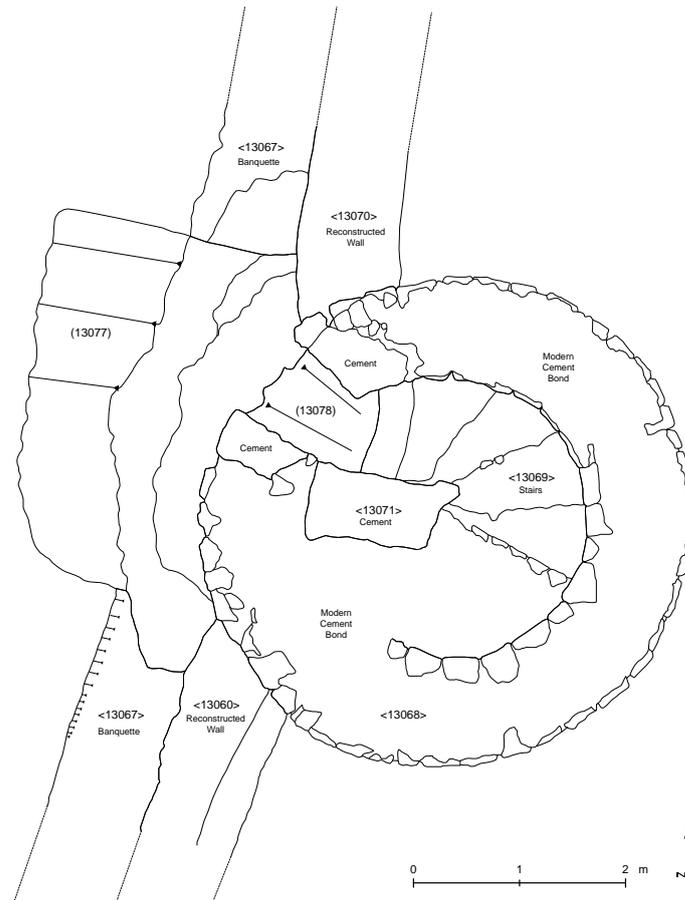


Figure 5.3: Post-excavation plan of Tower 16.

5.2 CONSOLIDATION AND CONSERVATION WORK - ZUEP13

Bernadeta Schäfer

5.2.1 Introduction

ZUEP13 consists of the three towers T16, T17 and T18 and the Outer Town Wall and walkways between them. Archaeological and conservation work was begun in 2013 (see Wheeler 2013). In the season 2013/2014, work carried out here included:

- Consolidation of T16, T17 and T18
- Plastering of T18
- Consolidation of Outer Town Wall and *banquette* section following on from work in spring 2013 (Fuchs et al 2013)

5.2.2 Monitoring

All town wall sections in ZUEP13 were found to be in very poor condition (Figure 5.4). Only poor quality beachstone and cement mortar were used for conservation of the town walls in the 1980s. In front of the preserved historic wall a completely new shell of about 30-50cm depth was reconstructed on top of one or two courses of historic stones. The cement mortar was laid solely in the horizontal; vertical joints were not properly filled with mortar. After being exposed for 30 years, the masonry of the reconstructed wall shell was strongly eroded, and spacious, deep gaps reached inside of the masonry. The top layer of stones was covered with thin, flat cement coating. Even gentle cleaning with brushes caused the stone material to crumble away from the wall face, so the cement capping could be easily removed from the top of the wall.



Figure 5.4: Condition of the outer shell of the Outer Town Wall before conservation. The brittle beachstone is extremely eroded. Hard cement mortar can be seen in horizontal layers. (YE-0229)

Tower 16

T16 was restored in the 1980s. The top courses were laid of aeolianite, the capping was very flat and consisted of a damaged grey cement layer. The lower part of the structure was left without intervention, likely due to its good condition at the time. The lower half of the tower still showed well-preserved original masonry built with soil/clay mortar (Figure 5.5). Only on the northern side had the masonry collapsed in the last 30 years. The tower was originally constructed of a great variety of stones, with mostly dolomite in the lowest courses.

Tower 17

Tower T17 was restored in the 1980s, with cement mortar used for joints, capping and stair construction. The stones were strongly eroded and the exterior wall of the tower destabilised.

Tower 18

T18 is one of the bigger towers in the Outer Town Wall, similar to T8. It has walls arranged in two rings: the tower was probably strengthened by the exterior, lower masonry ring. There is no indication of the initial height of this external wall. Originally there was no structural connection between the town wall and the staircase wall.

The tower was reconstructed to great extent in the 1980s. Cement mortar was used for joints, capping and the construction of the steps and platform. Several varieties of beachstone were



Figure 5.5: Original lower courses, upper courses consolidated in the 1980s, capped with aeolianite slabs. (XF-0165)

used as building stones. The cement mortar was applied to the joints only thinly, and the capping formed as flat surface. Two different mortars were used: white cement for the joints and steps, grey cement for the capping. In autumn 2013 the stones were strongly eroded, and there was often no connection between the joint mortar and the stones. Two walls were in such poor condition that they collapsed at the tower entrance during excavation in spring 2013.

All *banquette* walkways that have been exposed during the conservation work were constructed of clayey soil lumps bounded with soil/clay mortar. Exposed to the elements and to the mechanical damage that would inevitably follow due to visitors entering the structure, this kind of masonry would disappear in shortest time. However, only the walkway in front of T18 has been scheduled for permanent exposition and needed conservation.

The three blocking sections visible in the walkway prove that the initial entrance to the tower was at the base of the town wall and was in use even after the walkway was erected. It was blocked only at a later point (see Wheeler 2013) (Figure 5.6).



Figure 5.6: Walkway in front of T18 before consolidation. A blocking is seen behind the wheelbarrow. (DE-1339)

5.2.3 Consolidation Methodology

Only dolomite stones and NHL-based mortar mix 1.2 was used (1:3 mix of NHL5 St. Astier and quartz sand). Steps, platforms and capping of the walkway at T18 were built using aeolianite slabs. All wall surfaces and cappings on the towers were covered with a rough make-up layer of NHL mix 1.2.

It was not always possible to remove the cement mortar from the town wall without damaging the stones. The stones themselves were extremely eroded and thus needed to be replaced entirely. A new shell of dolomite stones and NHL mortar was applied to the remnants of the original structure (Figure 5.7)

The circular blocking at T16 was backfilled as it was not possible to preserve the fragile clay/soil lump construction in other way. The intact historic masonry of the tower's lower courses was left in place. Previously conserved joints were removed to provide a proper hold for the NHL



Figure 5.7: The new shell of the Outer Town Wall being constructed in front of the 1980s shell. (DE-0640)



Figure 5.8: T16 after finished consolidation. The rough capping allows better drainage (DF-1076)

mortar, and the flat capping was replaced by a more animated masonry structure (Figure 5.8).

Towers T17 and T18 received a completely new foundation layer of dolomite stones. All cement joints in the walls had to be removed. However, intact cement-joint masonry on the platforms and steps were not removed, only the cracks repaired.

Attempts to consolidate the walls only by application of a new mortar to the gaps were not successful. The mortars could not be applied deep enough and would not cure properly. During the removal of the cement joints, the 1980s preserved walls partially collapsed, as many of the stones were of poor quality and the masonry not stable. These voids were complemented with dolomite masonry. Flat cement cappings were covered with dolomite masonry to create more animated and better drainage surface. After the consolidation, a rough make-up layer was applied to the tower walls and capping.

The gypsum plastering of T18 was carried out to test how a large, continuous plaster surface will behave on an object that is, due to its round form, subject to substantial thermal stress. Positive reaction of this plasters over a one-year period will be helpful in the decision-making process about a widespread application of gypsum-based plasters on site.

The *banquette* walkway at T18 has been completely encapsulated by new dolomite masonry. This approach allows the presentation of the Outer Town Wall structure to visitors while preserving the original construction (Figure 5.9). The three blockings have been marked with nails that should be removed after the plastering is finished. The blockings will be made visible by producing shadow gaps in the plaster. The walking surface of the banquette and the steps of the tower will not be plastered.

5.2.4 Conclusions and Recommendations

The archaeological investigation proved that the towers were the first elements of the fortifications constructed, followed by the town wall itself. Initially, the entrance to the towers lay at the base of the towers and town walls. At some later point, these entrances were blocked and the walkway constructed in front of them. T18 shows another arrangement: although the walkway already existed, the entrance to the tower was still at the foot of the tower. Only after some time the entrance was blocked.

The gypsum plastering of T18 has to be carefully monitored and will deliver a solid base for a decision on the use of gypsum plasters for future plastering of exposed walls in Al Zubarah.

This season saw the completion of consolidation work at ZUEP13. Future seasons will only see monitoring of the new masonry and, if necessary, minor repair work.



Figure 5.9: T18 after conservation.

5.3 CONSOLIDATION AND CONSERVATION WORK - ZUEP10 AND ZUEP11

5.3.1 Introduction

ZUEP10 and ZUEP11 cover the area on the Outer Town Wall reaching from T8 to T10. These sections were originally excavated in 2011/2012 in anticipation of consolidation and conservation work (Wheeler 2012). The area includes a conservation test wall on which new mortar and plaster mixes are tested before application to the historic architecture.

Work in 2013/2014 focussed on the completion of the consolidation of T8 and adjacent wall sections as well as the initial documentation of the area around T10.

5.3.2 Monitoring

A comprehensive assessment of T8 has been completed. T8 was originally restored during the 1980s campaign using cement mortar for joints and cappings, and beachstone as building stone. A completely new ring of masonry appears to have been constructed around the lower part of the tower; this included the building or re-building of the *banquette* walkway.

Since 2011, mortar and plaster tests have been carried out on T8 and the adjacent town wall, leading to the development of conservation strategies for wider sections of the Outer Town Wall. Test fields have been observed for more than three years now, showing cement joints still in place, but stones and mortar having partially eroded and leaving voids. Some plaster surfaces were showing first signs of deterioration but did not require intervention at this time. Unconsolidated sections of the *banquette* walkway had eroded heavily since excavation two years previously.

T9 and adjacent town wall sections were originally conserved in 2012 using a hydrated lime-based mix 1.51 as mortar (1:2.5:12 mix of white cement, hydrated lime and quartz sand). This mix proved to be ineffective against deteriorating agents, as the mortar itself eroded heavily in just two years, particularly around soft and brittle beachstones. Mortar on the lower dolomite courses is in much better condition.

Work around T10 focussed on cleaning and 3D scanning for pre-conservation documentation. T10 and surrounding town wall sections were initially restored in the 1980s. The use of cement mortar for consolidation and rebuilding has caused heavy erosion of the beachstone, while aeolianite stones used in the tower itself show no signs of deterioration. Soft stones unprotected by plasters deteriorated, causing partial collapse of the restored town wall.

5.3.3 Consolidation Methodology

Cement joints in the northern sections of the town wall (ZUEP10) were replaced by NHL-based mortar mix 1.2. Strongly eroded beachstones have been replaced by dolomite stones. The consolidated wall surfaces were covered with a make-up layer made of the same mix. This will ensure that the stones in the masonry stay protected from external erosion agents.

The plastering of the southern sections of the town wall (ZUEP11) took place in two steps, applying first a make-up layer and then a fine finish, both using NHL-based mix 1.56 (1:3 mix of NHL5 St. Astier and quartz sand). After the application of the two phases of the make-up layer, the wall was protected by a strong plastic film for about four weeks to ensure proper curing (Figure 5.10). The fine finish layer was added by hand-tooling, providing a smooth finish to improve drainage of rain water (Figure 5.11).



Figure 5.10: Application of the make-up in two layers. (DE-1634)



Figure 5.11: Application of the finish plaster layer on the town wall. (DF-0307)

5.3.4 Conclusions and Recommendations

Unlike in QMA4 (Chapter 4), where it was agreed that all cement features should be removed, intact and well-performing cappings on the town walls are to be kept as evidence of past interventions and areas of observation of conservation techniques. Cracks on the cappings have to be repaired to prevent rain water ingress. Finally, the walls should be covered with the plaster finish.

The experience of eroding stones inside of consolidated but not plastered masonry shows the importance of prompt plastering for long-term protection of the walls.

On a length of c. 100m, the finish plaster on the town wall in the area of ZUEP11 was not covered for curing after application, as covering of the fresh plaster would have resulted in irreparable marks. However, this in turn caused the appearance of a dense network of hairline cracks on the plaster surface, although these might also have been caused by rising tension in the smooth, highly compacted surfaces. The capping plaster will require careful monitoring in the upcoming season, and if necessary be repaired. It is advisable to refrain from employing smooth capping surfaces if this increases hairline cracks.

6. AL ZUBARAH FORT (ZUEP12)

Christian Fuchs

6.1 INTRODUCTION

This report summarises the restoration and consolidation works at Al Zubarah Fort (Figure 6.1), covering the time from October 2013 to May 2014. Additional work was undertaken in the building archaeology of architectural features in the Palatial Compound (ZUEP04), which is presented in Chapter 3.

6.2 AL ZUBARAH FORT VISITOR CENTRE

A variety of restoration, consolidation and maintenance works taken place this season. The first segment of works from October until the end of 2013 was dominated by preparations for the opening ceremony of the Visitor Centre (VC) in Al Zubarah Fort on December 12th. Subsequent restoration efforts had to be carried out while the VC and the exhibition was in full use and attracted a high number of visitors (see Campbell this volume).

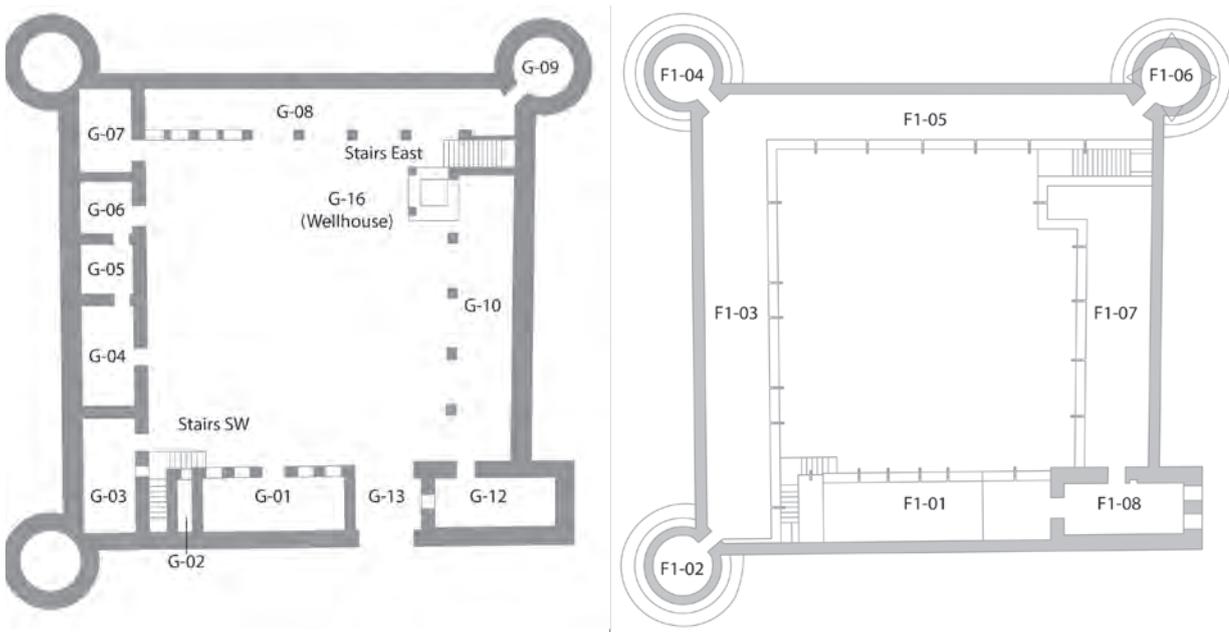


Figure 6.1: Ground (left) and first floor (right) plans of Al Zubarah Fort. Room numbers will be referred to throughout the chapter.

6.2.1 Flag Pole

One of the major issues tackled in the autumn was the replacement of the existing flag pole on the north-western corner of the rectangular tower F2-04 (above F1-08). The simple steel pipe was unattractive and leaning towards the southeast, with substantial vibrations causing damage in the masonry of the tower. Its base consisted of a large block of unworked natural masonry that was placed on the earthen roof, imposing additional weight on it. Three reinforced cement concrete elbow ties were inserted into the masonry of the north-western corner, two in F1-08 and one on the upper second floor level. The substructure of the new flag pole was to be bolted into these ties. In order to keep the Qatari flag flying during the replacement, the old flag pole was mounted onto a provisional wooden structure on the eastern side of the tower until the new pole could be commissioned (Figure 6.2). The removal of the base showed interesting features presenting an insight into the sequence of different flag poles in the history of the fort.

6.2.2 Main Gate

The repositioning of the main gate was handled in autumn 2013. The entire main gate had been moved upwards by approximately 20cm probably during the 1960s or 1970s as the fort was furnished with a southern annex. During this time, two metal pipes were placed beneath the threshold of the main gate in order to dispose of the rain water collected in the courtyard. A cement ramp was constructed to bridge the wooden threshold.

Aim of the repositioning of the main gate was to re-establish the original state seen in historic images. The process turned out to be substantially more difficult and time-consuming than initially expected. A substantial challenge was created by the discovery of a re-used dhow mast with a length of approximately 5.75m inside

the façade masonry above the gateway. It was heavily infested by termites, causing substantial loss of substance and attachment to the masonry. A removal and replacement of the mast was inevitable, which for structural reasons could not happen in one piece. The dhow mast was conserved and is now on display in the artefact exhibition (Figures 6.3 and 6.4).



Figure 6.2: New flag pole in the foreground, with the provisional old one in the background. (ZUTE-0651)



Figure 6.3: Exposed dhow mast above the main gate in October 2013. (ZUUE-0363)



Figure 6.4: Dhow mast on display in the artefact exhibition. (KE-0349)

Immediately after removal, the masonry was repaired and cavities closed. Despite all precautions, some cracks in the masonry above the main gate appeared. The cracks remained to be a hair line, but their course was clearly identifiable as a result of settling after the removal of the mast.

The mast itself was re-assembled and has become a central part of the artefact exhibition nearby the VC.

6.2.3 Visitor Centre

Core of the VC the exhibition on the history and environment of Al Zubarah and the QIAH Project research. The exhibition consists of several types of exhibition panels, some free standing, some requiring electrical wiring, others fixed to the wall, as well as electronic equipment for digital content. All panels and displays, as well as parts of the furniture, were produced in Europe and shipped to Qatar, with additional elements produced locally in the Zubarah Research Station workshop.

The pavilion located close to the car park was removed for the creation of the UNESCO monument to the southwest of the fort in early December. A re-installation is still in discussion in relation to the upcoming development of the parking area for the VC. A similar information pavilion has been constructed next to the car park by Al Zubarah town.

6.2.4 Electrical Installations

All cable conducts and aluminium rails for the light strips have been prepared in spring 2013 and needed to be finalised. These cables provide power for all rooms, the lit exhibition panels and the electronic displays. The interventions also included the connection of the electricity supply of the fort to the public power system and the replacement of the main board. Some minor works had to be completed in spring 2014, such as the lighting in G-09 and F1-06 as well as the insertion of a light rail in the north-western tower.

6.2.5 New Ceilings, Different Technologies

One of the aims of the consolidation and restoration works is to retrofit the fort to allow it to cope with an increased number of visitors. This applies for all rooms and spaces that are open for the public. For that reason, the existing earthen ceilings above the ground floor rooms in the north-eastern and south-eastern towers were replaced by limecrete slabs. As before, the traditional construction of *danshal*, *basjeel* and *manghrour* matting was maintained (Figure 6.5). Replacement of wooden parts was conducted if insect infestation was detected. As much of the encountered building material was retained and re-used.

In the areas not designated for public access, repairs on ceilings were conducted as non-invasively as possible. This applies for the ceiling above F1-06 and F1-08. Whereas in the north-eastern tower some of the infested *danshal* timbers were replaced without touching the ceiling, the repair of the ceiling in the rectangular tower was a rather elaborate task. The encountered problem was characterised by completely disintegrated *manghrour* matting and partly infested *basjeel* strips that required immediate replacement. This implied the removal and replacement of the earthen slab placed on top.

In coordination with the QMA it was decided that the new ceiling should be redone employing historic materials and techniques. Most of the earthen material was carefully removed, sieved and retained. After the replacement of the consumed *manghrour* and the damaged *basjeel*, the earthen material was mixed with new clay and sand in order to obtain a texture that approached that of the original slab. A white cement screed was placed on top of the ceiling in order to provide a waterproof surface.

6.2.6 Spiral Staircase

The spiral staircase in the north-western tower, easily the fort's most complex architectural feature, was begun December 2013.

It is designed to give access to an upper platform that offers an overview of the shoreline with the



Figure 6.5: Earthen roof on the rectangular tower renewed with traditional techniques. (ZUTF-0568)

ruins of Al Zubarah town. The work started with the documentation and removal of the existing floor in F1-04, followed by the removal of parts of the infill for a foundation to carry the load of the staircase and the laying of that foundation. The upper floor was then replaced by the new viewing platform. In early April 2014, the pre-cast steps of artificial stone were inserted, and finally in May, the torsion beam of reinforced concrete could be poured (Figure 6.6).



Figure 6.6: Staircase in the north-western tower under construction. (ZUTF-2048)

In autumn, both the lower and the upper floor will receive a screed, the torsion beam will be rendered and a metal railing needs to be inserted to finalise the work.

6.2.7 Façade Render

Tests of the plasters of the fort façade, undertaken in 2010 by Robert Sobott, proved that the original layers of plaster consist of gypsum, and therefore this material was chosen for the repairs, with further tests required to study thermal extension, and structural and thermal tensions in the masonry, as well as general reaction to weathering. A further test proposes to limit the new plaster to areas in which repair of the historic render is inevitable. As a logical consequence of ongoing repair works on the masonry, new render had to be applied in the affected areas with a gypsum mortar (2 parts gypsum, 3 parts desert sand plus lemon juice delaying the setting process of the gypsum). In order to obtain a brownish colour closer to

the existing historic plaster, the white pigments of the gypsum were brushed out of the upper surface during the curing process. The following surfaces were thus re-plastered:

- southern façade around the main gate
- lintels of all first floor tower rooms
- new crenellation and upper rim of south-western, north-eastern and south-eastern towers
- interior walls of south-western and north-eastern towers (crack repair)
- upper rim of western parapet wall (crack repair)

6.2.8 Courtyard Surface

The existing courtyard surface was removed in autumn 2013. It consisted of roughly compacted soil, stones and remains of a cement pavement. Its removal hinted at the historic development of the surface.

The new surface was to be a water-bound surface (see Fuchs et al. 2013). This was introduced in November 2013. The lower layer consists of large broken stones and a finer aggregate, the upper layer consisted of 1.5 part stone powder, 1 part sand, 1 part aggregate 2-8 mm (Figure 6.7).



Figure 6.7: Applying the two layers of the new courtyard surface. (ZUTE-0327 and ZUTE-0356)

While the surface appeared practical both in terms of aesthetic and practical aspects, its capabilities of handling and disposing of high volumes of water during the winter rains proved insufficient, despite the provision of drainage around the main gate. The next step for autumn 2014 is therefore the installation of a subterranean system of drainage pipes.

6.2.9 Maintenance and Repairs

A large range of repairs and maintenance works were conducted and can be summarised briefly:

- Cracks on the walkway surfaces were monitored and recorded; if necessary the cracks were opened and repaired with a limecrete mortar with the additive Cebex 100.
- Both external staircases were repaired by replacing older mortars. The substructure of *danshals* carrying the southern staircase was entirely redone as most of these joists were affected by termite infestation.
- Detached or disintegrated battlements were replaced on the south-western, north-eastern and south-eastern tower.

- Several wooden lintels had to be replaced due to insect or biogenic infestation.
- The roof access in the north-eastern tower and the south-eastern tower were repaired.
- All gargoyles of the towers were replaced.
- The plaster on the western courtyard façade was redone and cracks on the southern courtyard façade repaired.

6.2.10 Studies and Assessments

Investigations and studies were conducted to understand and resolve some recurring problems, such as cracks in the façades.

Crack monitors were installed on the interior façades in spring 2013 and controlled over a period of two months. One of the conclusions of this evaluation was that thermal extension does not cause the cracks in the façades and that a re-plastering is likely to produce good results.

An assessment of the structural condition of the masonry and the reasons of the crack patterns on the façades was conducted by Jaeger Structural Engineers. It aimed to clarify if wall consolidation by grouting with a clay suspension is a feasible way to retrofit the walls. Thus, grouting could be a useful approach to conduct careful strengthening of the masonry, but grouting would involve an elaborate process and has further implications it means for the historic plaster surfaces of the fort. Further studies to investigate the cause of the cracks were also suggested.

Two sondages were dug on the northern and eastern exterior façades to clarify if the fort was erected on a firm layer of anhydrite as earlier assumptions had suggested. If so, this anhydrite layer (especially its substantial volume enhancement in case of water contact) must be considered a possible cause for tensions in the masonry and thus for the encountered cracking. However, the sondages could not verify this assumption, as only blocks of anhydrite were discovered in the soil.

In February, nine monitoring targets were applied onto the façades and the towers of the fort. These were controlled and measured regularly every second day and, in May, three times a day for the duration of one week. Measurements reflect movements of the outer shell of the structure. Registered movements could either be of the plaster itself, they could be movements of the entire structure (masonry) or they could be combined movements of both.

The measurements were able to prove that possible deposits of anhydrite are not likely to be the reason for the cracks on the façade. Even though thermal stress is the most likely reason for the cracks, it was not possible to prove a direct impact of the climate on the movement in the structure. A second reason could be the quality of the masonry itself and its irregular load dissipation. In this case a grouting of the masonry could be a possibility to fill voids in the masonry and to reduce movements. Due to unpredictable side effects and the costs of such a procedure, grouting of the masonry is not in consideration at the moment.

6.3 BUILDING HISTORY

All practical works in the fort were continuously documented in images and description. Some of the interventions revealed interesting features that gave hints on the historic development and the building phases that the fort underwent. All spaces of the fort and their features are being described and interpreted in a "room book". Some of the most striking discoveries documented during the last season are briefly summarised below.

6.3.1 Courtyard Surface

The replacement of the courtyard surface gave a brief insight into the likely development. The encountered surface consisted of a compacted and arbitrary mix of soil, sand and stones. In some areas remains of a cement based pavement were encountered. At the same time the concrete gutter running along the courtyard façades shows a clear inclination towards the main gate and it can be proved that it was connected to a raised cement courtyard pavement. The two pipes that were located underneath the surface in the main gate area indicate that rain water was collected here and brought to an unknown area south of the fort. These features seem to indicate that the courtyard – possibly in the 1970s – was entirely covered with a concrete pavement.

6.3.2 South-Western Tower

The crack patterns in the upper segment of the south-western tower show a lower and older row of battlements. During the repair of the upper viewing platform in this tower, the inside view of these battlements was revealed.

The tower today is, at 9.28m above ground, the highest of all four. The older crenellation is located approximately 0.60m underneath the present one (Figure 6.8). The fact that the older crenellation is fully plastered and can be traced almost all along the tower indicates that the tower was planned and built with a lower total height than today. Yet both the upper viewing platform in the tower and also the highest row of loopholes are not consistent with the lower height of the tower. This leads to the assumption that the height of the tower was not considered to be sufficient at an early state. A historic image from 1958 indicates that the tower has already been raised at that time.

The process of raising the tower allowed the insertion of an upper viewing platform and thus the addition of a third floor from which the Fort could be defended (two rows of loopholes on the first floor, two rows of loopholes on the second floor and the crenellation on the top level). Both the orientation of the upper viewing platform – it is limited to an area facing south-west – as well as the desire to strengthen the defensive line shows that the main direction from which an attack was expected was the coastal line. At the same time the threat of an attack was considered to be real and vital. It also proves that the fort was much more than just a symbol. It has to be understood as a fully functioning building serving defensive purposes.



Figure 6.8: View of the south-western tower (top) and a rectified image of the opened interior wall with battlements partially revealed. (ZUTF-2120 and KE-0122)

6.3.3 Flag Pole and Dhow Mast - Connections?

In the course of the replacement of the flag pole it became obvious that the steel pole was preceded by a wooden pole with an approximate diameter of 15cm and probably furnished with reddish brown paint. The dhow mast retrieved in the masonry above the main gate also shows an approximate diameter of 15cm and some remains of a reddish brown paint. The upper end of the mast includes a hole for the insertion of a pulley to hoist either the sail – or in this case – possibly the flag. Furthermore, the mast had several large hand forged nails; a similar nail was also found in the masonry of the flag pole base (Figure 6.9).

It is probable that the retrieved dhow mast represented the first flag pole used in the fort. An attempt to date the mast by dendrochronology failed due to the texture of the wood and missing comparable graphs (attempt by the laboratory of the German Archaeological Institute DAI in Berlin). The fact that the wall behind the masonry block was not plastered furthermore indicates that the present flag location of the flag pole corresponds with the original position and dates back to 1938.



Figure 6.9: Left (ZUTE-0061): Masonry block for the flag pole during its demolition. The cement-based plaster shows a circular void with the impression of the texture of a wooden trunk (arrow). Right (ZUTE-0084): Hand-forged nail found in the masonry of the flag pole base. Similar nails were found in the dhow mast.

6.3.4 Northern Staircase

During the repair of the surface of the northern staircase, remains of a preceding repair job were removed. The historic plaster surface showed two interesting details. First, the shape of the original staircase of 1938 became visible. This staircase was shorter, had fewer steps and was considerably steeper. In a second phase, the entire staircase was redesigned with a lower gradient and thus more steps. The old steps were constructed with a thick layer of gypsum plaster whereas the new steps show a white cement cover.

A second discovery were the remains of a green paint on lesser-worn steps. The paint appears on a plaster that was used for maintenance and is thus definitely not part of the initial building construction. The repair plaster has a bright white colour and is likely to be gypsum based.

The staircase thus has five phases of construction and repair between 1938 and 2014.

6.3.5 Plaster on Parapet Façades

The assessment of the plasters on the parapet walls revealed details regarding the phases of restoration, but also raises new questions. All inner parapet walls on the first floor show three to four layers of render: The first and very likely original layer is a rather thick layer of gypsum plaster, directly applied onto the masonry of natural unworked stones. A second layer is a very thin gypsum plaster. This layer, bright white when freshly exposed, is characterised by little dents forced into the surface in order to make the subsequent layer adhere to the surface. It shows no signs of erosion or patina, indicating the subsequent layer was applied quickly afterwards. The third layer initially covered all parapet walls on the interior of the fort and is a very brittle plaster. Simple tests have surprisingly shown that it is lime-based. A fourth layer consists of not necessarily contemporaneous patches of repair plaster, some of them cement-based.

Several aspects are worth a more detailed description: The second gypsum mortar is applied only on the interior perimeter walls of the fort. Neither the dents nor the lime plaster can be found on the outside façades.

The limitation of the lime plaster on the façades of the rectangular tower must be understood in the context of small one room extensions that had been added to both the northern as well as the western side of the tower.

6.4 CONCLUSIONS AND FURTHER WORK

Next to minor repairs, a number of major points will be addressed in the autumn:

- The façade of the fort needs repair. Areas with damaged plaster will be opened, the masonry consolidated and then re-plastered. The new plaster needs to be pigmented. It will be necessary to either define a suitable ready-mix-gypsum plaster product adjusted to local conditions or to refine the existing gypsum plaster with locally available pigments.
- The courtyard surface will be provided with drainage.
- The spiral staircase in the north-western tower be plastered and a metal railing installed. A design needs to be provided.
- The exhibition will be completed by putting up additional panels.

7. THE FREIHA MOSQUE (FREP01)

7.1 ARCHAEOLOGICAL INVESTIGATIONS

Dominik Petzold

7.1.1 Introduction

The Freiha mosque (FREP01), located 3.5km north of Al Zubarah, has been archaeologically investigated between 2010 and 2011 (Rees 2010, 2011). As part of the touristic development of the area, the building will be made accessible to visitors in the near future. In this context, upstanding architecture of the mosque was consolidated and conserved, and further archaeological work was commissioned to expose the exterior of the southern and western façades. This made it possible to address previously unclear issues of the building history of the mosque. These works were undertaken in spring 2014 by an archaeologist supported by six workers.

In summary, five aspects of the building could be investigated:

1. The Building:

- Building phases in relation to an early phase *mihrab*, including plaster fragments, floor remains and other architectural elements relating to renovations and rebuilds of the mosque.
- A deliberate pile-up of stones west of the mosque as protection against encroaching sea water.
- An annex to the main mosque building in the southeast, possible a washroom.

2. Exterior Findings:

- Deposits on the exterior of the mosque that can be correlated with structural building phases.
- A double-chamber oven for the burning of gypsum nodules dating to the late major phase of the mosque.

7.1.2 Building Phases

Two major building phases, divided into several sub-phases, can be distinguished in the mosque (Figures 7.2 and 7.3).

The distinction between these two phases is based on several factors:

- A horizontal construction joint throughout the exposed masonry visible on the building's exterior at a height of 0.7-0.8m
- Various steps and offsets
- Changed alignments of walls
- Significantly different mortars in the upper (later) and lower (earlier) parts of the masonry.

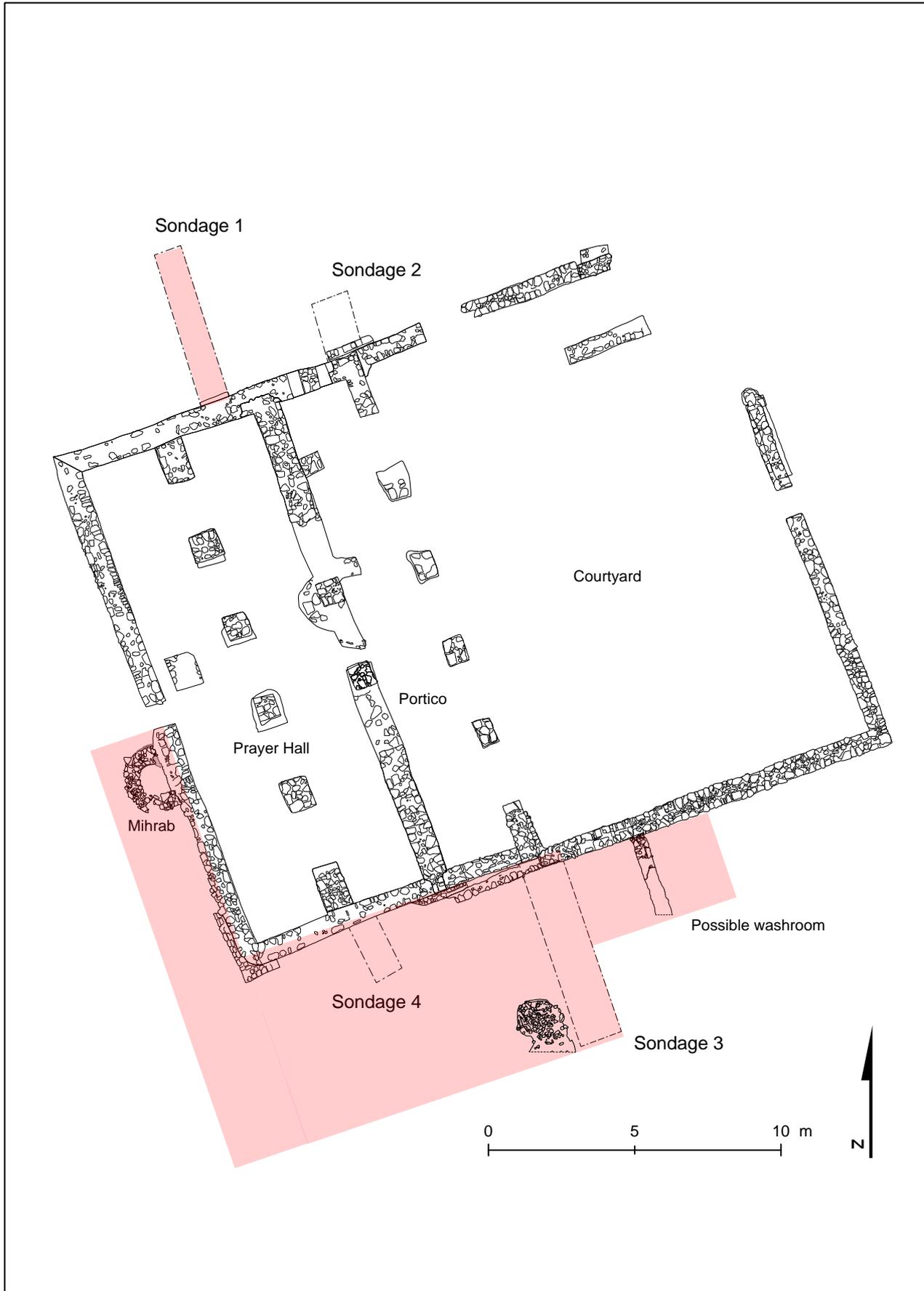


Figure 7.1: Plan of the mosque showing re-excavated sondages, newly revealed architecture and the areas of investigation on the exterior of the mosque (shaded red).

These phases are not currently fully correlated with those established by Rees (2011), and further investigations are required to align these conclusively. Building phase terminology, therefore, remains preliminary here.



Figure 7.2: View towards the north on to the western part of the southern facade of the mosque, showing construction joints in red. Visible are the early and late phase (1B/2B) of the prayer hall (left), the early and late phase (1A/2A) of the portico (centre), and the early and late phase (1A/2C) of the courtyard. (CF-0233)



Figure 7.3: Southwest corner of the mosque, highlighting the two major building phases. (CF-0479)

The Early Phase (1A, 1B)

The lower, older masonry shows a vertical construction joint on the southern side, dividing the portico and courtyard (1A) from the prayer hall (1B). The alignment of the thus constructed walls is slightly different, with the southern wall of the prayer hall being offset to the north by one stone course. It could not be conclusively clarified which of the features was built first.

A newly discovered *mihrab*, found in the course of the excavations along the western exterior of the mosque, also belongs to this early phase. The *mihrab* forms a half-oval and is only bonded to the wall masonry on its north end (Figure 7.4). This suggests that the western wall of the prayer hall was built in two phases. It also shows the presence of two different plasters with a height difference of c. 0.3m, which had resulted in the need for backfilling the interior of the building by that difference and necessitating a secondary plaster on the remaining upstanding masonry as part of renovation work.

The location of the *mihrab* off-centre to the south of the building suggests that the mosque was



Figure 7.4: Southern part of the western wall showing the early phase wall and *mihrab*.

somewhat smaller in this early phase.

The Late Phase (2A, 2B, 2C)

In this later phase, the mosque was first built back to an even level. The material removed for this purpose was likely used in a wall-like accumulation of large stones which, at a distance of 2m from the west wall, could be exposed for 11.3m (Figure 7.5). Preserved on its eastern face were the remains of the exterior shell of an old wall. The stones are of different sizes, but the remnants of mortar still stuck to the rocks suggest that they came from the masonry of the mosque and were removed to here in the course of the renovations. Further stones from the older building were used in the new mosque, as is indicated by the variety of stone sizes found in this younger phase compared to the regularity of material in the older phase.



Figure 7.5: View to the northeast showing the corner of the mosque and the stone accumulation towards the sea. (CF-0356)

In the upper parts of the south wall and the southern parts of the west wall, three sub-phases could be distinguished (2A, 2B, 2C). The south wall shows two vertical construction joints between the prayer hall (2B), the portico (2A), and the courtyard. In addition, the alignment of the later walls differs from the earlier ones, and the younger walls were offset to the interior in both the prayer hall and the portico by one stone course. This is displayed clearly in the creation of an apparent landing between the wall of the courtyard (2C) and the south wall of the portico (Figure 7.6).

The chronology of these three sub-phases is not yet entirely clear. The south wall of the portico with its interior bonded walls is likely the oldest part of the late phase, possibly followed by the prayer hall and finally the courtyard.

The renovations included an extension of the building by 2.5m to the north, resulting in the need to move the *mihrab* to the north as well. The floor was again backfilled and levelled, as the interior walls were partially located immediately on top of the old floor. Stones from the older building were reused, for example seen in the presence of stones and mortar from the old *mihrab* in the new masonry.



Figure 7.6: View to the north of the intersection between the lower wall of the portico and courtyard (1A, bottom), the upper portico wall (2A, upper left) and the upper courtyard wall (2C, upper right). (WF-0719)

7.1.3 Exterior Findings

Foundation and First Usage Phase

The mosque was built originally on a natural beach sand surface. Walls were set, one course deep, into foundation cuts. Dolomite stones were used for the first building course, followed by more diverse material for later courses. It is likely that the area was levelled first. An early floor surface survived in the southwest corner and along the western side of the building. Whether the sub-phases of the early building phase (portico and courtyard 1A and prayer hall 1B) can be chronologically differentiated in this context cannot be determined yet, as excavations have not yet concluded in this area.

During the first usage phase, the exterior of the south side was covered by wind-blown sand. A differentiation of layers, unlike at the southern side of the prayer hall, was not possible south

of the portico.

The raising of the floor level (see above in the description of the *mihrab*), can also be seen in the section of the robbed-out northeast corner of the building in the form of two subsequent shell surfaces (Figure 7.7). It was likely at this point that the old courtyard wall was offset to the east.



Figure 7.7: North-facing profile of the robbed-out corner of the minaret, highlighting shell surfaces. (CF-0328)



Figure 7.8: Remnants of an annex of a possible wash room to the southeast of the building.

Excavations immediately south of the courtyard are not yet finished. However, first investigations exposed a dolomite wall which ran perpendicular to the southern courtyard wall but was not bonded to it (Figure 7.8). It is likely that this forms part of an external wash room that was abandoned and backfilled in the later building phase; at this time, a well appeared inside the courtyard in its south-eastern corner.

Second Usage Phase

At the beginning of the second major building phase of the mosque, a pit was dug south of the portico and courtyard and filled with fragments of plaster, floor and roof decoration (Figure 7.9). This phase includes a trample surface which only appeared in this area, and which correlates with the mortar used in the masonry of this phase (2A).



Figure 7.9: Fragments of wall plaster, floor remnants and pieces of roof decoration. (CF-0320)

Third Usage Phase and Abandonment of the Building

A final trample surface is covered by a deposit of the same clay used in the mortar of the late building phase. This clay can be found along the entire southern side of the mosque. It is level with the top of the remaining older masonry and thus belongs to the younger building phase.

Into this phase also belongs a double-chambered oven, which was uncovered c. 4m south of the portico (Figure 7.10). This N-S aligned feature was fired from the south. The roof of the oven had collapsed into the interior; it used to be covered with bitumen and palm mats, and was used to burn gypsum nodules. Remnants of those could be found in a pit just north of the oven, where they were intentionally deposited when no longer useful.



Figure 7.10: Double-chambered oven after excavation of the collapse. (CF-0276)

Soon thereafter the collapse of the building set in, as evidenced by a deposit overlying the pit, consisting of weathered exterior plaster and mortar from the upstanding architecture. This deposit also contained a corner construction of the building masonry. Stones had been encapsulated in gypsum but had largely eroded. Since one of the gypsum fragments showed signs of both interior and exterior plaster, the original width of the wall can be reconstructed to c. 0.58cm in the upper courses.

7.1.4 Conclusions and Recommendations

The establishment of two major building phases was a significant development from this season of excavation. However, a full understanding of the minor phases of building history, including the chronological and structural allocation of individual architectural features such as the various *mihirabs*, requires further work.

For an upcoming autumn season, therefore, the following questions should be addressed:

- In advance of further consolidation work, the northern part of the west wall of the mosque must be exposed. This will hopefully clarify the relationship of the mosque's first building phase to the early wall found in the interior of the courtyard (see Rees 2011).
- Works on the southern side of the mosque must be completed by excavating the remaining deposits to natural.
- In order to clarify chronological relationships between the walls of the prayer hall and the portico on the one hand and a possibly earlier *mihrab* in the interior on the other hand, as well as the early-phase *minbar* and the building history of the columns, a sondage on the interior just south of the central axis of the mosque is suggested. This sondage would provide a section in the area of the *minbar*, one of the columns, the interior *mihrab* and any potential architectural features between the portico and the prayer hall.
- A further investigation of the possible wash room in the southeast of the mosque is recommended to determine its size and actual function. It is suggested to excavate to the top of any surviving walls and to any floor surface, which is suspected to lie around 0.5m below the current surface, in at least a part of the room

7.2 CONSOLIDATION AND CONSERVATION WORKS

Tobias Horn

7.2.1 Introduction

Consolidation works at the Freiha mosque were begun in November 2013 and will be completed in autumn 2014. These efforts form part of the ongoing development of Freiha as a tourist attraction, and are required to stabilise and present the upstanding architecture to potential visitors.

The objectives of this work are:

- To provide a detailed record of the state of the architecture before and after conservation as a monitoring tool for required maintenance.
- To create a beach enlargement along the west side of the mosque to prevent sea encroachment during high tides and further deterioration of the perimeter wall.

- To consolidate the remaining architecture in order to allow it to remain exposed throughout the year.
- To reconstruct the robbed-out northeast corner of the mosque both as part of a presentation concept and in order to protect more effectively the interior of the building.

Conservation work took place parallel and after archaeological work, and will be completed when the remaining architectural features have been adequately exposed.

7.2.2 Documentation

The recording of the state of conservation was undertaken in the same manner as at Al Zubarah, describing each architectural feature from all perspectives in regards to the visible damage and degree of survival of all types of stones, mortars and plasters. An assessment of the building stones of Freiha was made by Robert Sobott (Sobott et al. 2013), as these at times differ from the material used in Al Zubarah.

In addition, all exposed wall elevations were recorded photogrammetrically prior to consolidation (Figure 7.11).



Figure 7.11: Measuring photo targets on wall elevations.

7.2.3 Beach Enlargement

The mosque's west wall lies perilously close to the current high-tide line of the sea. Accordingly, one of the aims of this season was to enlarge the beach area to provide greater protection. A large dry-stone wall was built 10m west of the mosque, consisting of stacked stones up to 1.3m high and c. 1.5m wide at the base. The area between the wall and the mosque was backfilled with sand (Figure 7.12). Material for both was recovered from rubble of the previous excavations.

As archaeological investigations have shown (see above), the encroaching sea might have already been a problem during the usage phase of the mosque.

While the wall provides adequate protection from normal high-tide conditions, particularly strong winds are still able to push water through the backfill (Figure 7.13).



Figure 7.12: The mosque after the beach enlargement. (QE-0063)



Figure 7.13: Breach of the new beach wall after particular strong wind in spring 2014. (BF-0334-0342)

7.2.4 Wall Consolidation

The surviving architecture was found in varying conditions. Initial work, therefore, consisted of securing the masonry and plaster and to repair particularly serious voids. Dolomite stones were chosen for this task as it is the most resistant yet workable material available, as well as being immediately recognisable as restored material due to its limited usage in the original building construction.

For the reconstruction of the mortar, an NHL5 lime mortar using one part lime to three parts sand was employed. Plaster fragments were removed when too fragile and detached from the masonry, and backfilled with mortar and re-attached to the wall where possible. After an overnight curing period from the application of the repair mortar, the surfaces were scraped and repeatedly smoothed.



Figure 7.14: Dust, dirt and loose stones and mortar were removed with trowel and hand brush; eroded joints were scraped and cleaned with a blower before being repointed. (WE-0013 & WE-0040)



Figure 7.15: Voids in the structure and the capping were closed with dolomite stones and lime mortar. (WE-0100 & WE-0116)



Figure 7.16: Southwestern corner of the mosque before conservation (left), and after rebuilding (right). (BF-1005 & BF-1075)

7.2.5 Reconstructions

After the preliminary completion of consolidation works until the finalisation of the archaeological investigations, the robbed-out northeastern corner of the mosque was to be reconstructed. This corner, still visible on an aerial image from 1958, was subsequently dismantled; it may have contained a minaret, for which there is no structural evidence elsewhere in the building.

The reconstruction of the corner had two major objectives:

- To create a complete ground plan by closing the gap in the perimeter walls, and
- To protect the interior of the mosque from damage by visitors.

The work was done in a deliberately regular style in order to be able to recognise the newly added wall. The first layer consists of a fill of washed sand which prevent salts from directly migrating into the structure. The lowest course is built from dolomite stones in accordance with conservation standards also used in Al Zubarah. Other courses were built with fossil sand dune stones, which are very regular and easy to align. All stones came from the spoil of the previous excavations.



Figure 7.17: View of the mosque before restoration work, showing the robbed-out northeast corner in autumn 2013. (WE-0139)



Figure 7.18: View of the mosque after restoration work, showing the new corner as well as levelling of the exterior. (BF-1120)



Figure 7.19: Detail of the double-shell masonry of the reconstructed wall. (BF-1051)

7.2.6 Conclusions and Recommendations

Consolidation works in the mosque will be completed in autumn 2014 following the final excavations along the western and southern walls. An understanding of the building phases is an essential prerequisite of any future reconstruction work as well as for site management and maintenance of the architecture.

8. FREIHA POTTERY REPORT

Agnieszka Bystron

8.1 INTRODUCTION AND METHODOLOGY

This report presents a summary of work on the pottery assemblage from the excavations at Freiha. It lists the main classification of all recorded wares.

All pottery from this site was examined, with a full analysis of 58,165 sherds.

Analysis of material from all excavation areas has allowed a larger picture of pottery use across the site. Table 8.1 shows a summary of areas.

Excavation Point	Summary
FREP01	Mosque, with several building and usage phases
FREP02	Midden Sondage, northern settlement area
FREP03	Domestic Compound and Midden Sondage
FREP04	Domestic Compound in the main settlement area
FREP05	Midden Sondage, main settlement area
FREP06	Midden Sondage, east of main settlement area
FREP07	Midden Sondage south of the main settlement area

Table 8.1: Summary of Excavation Points in Freiha

Priority loci were chosen by primary excavator Gareth Rees, with additional loci examined visually and sorted into ware types. The ware type category is based on the Freiha Reference Collection Type Series, and listed in Table 8.2; the ware type code is used throughout analysis in Freiha and Al Zubarah.

Further recording was based on visual criteria of vessel form and the decoration type.

The numerical data comprises sherd count, estimated number of vessels and weight (Figure 8.1).

Every rim sherd was measured and the type of the rim described. Selected sherds and vessels were sent for conservation to prevent further deterioration (see Gelting this volume).

Remarkable sherds and vessels were kept in the Freiha Pottery Reference Collection. The Freiha Pottery Reference Collection consists of 476 entries. All sherds in the Reference Collection were described, measured, sketched, photographed; 67 were drawn.

Ware Code	Ware
<i>AlkGW</i>	Alkaline Glazed Ware
<i>BOSW</i>	Buff Orange Sandy Ware
<i>BSW</i>	Brown Sandy Ware
<i>BSWCoar</i>	Coarse Brown Sandy Ware
<i>BuffCoar</i>	Buff Coarse Ware
<i>BuffSand</i>	Buff Sandy Ware
<i>CCPW</i>	Coarse Cooking Pot Ware
<i>CHBatavian</i>	Chinese Batavian
<i>CHPorc</i>	Chinese Porcelain

Ware Code	Ware
<i>CHCeladon</i>	Chinese Celadon
<i>CHImari</i>	Chinese Imari
<i>CHPorcBaW</i>	Chinese Porcelain Blue-and-White
<i>CHPorcBlu</i>	Chinese Porcelain Blue
<i>CoarOSWSpec</i>	Coarse Orange Sandy Ware Speckled
<i>CSW</i>	Creamy Sandy Ware (Aali)
<i>CSWAlkGl</i>	Creamy Sandy Ware Alkaline Glazed
<i>CSWGl</i>	Creamy Sandy Ware Glazed
<i>CSWRedPt</i>	Creamy Sandy Ware Red-Painted
<i>DrkBrwnGSW</i>	Dark Brown Glazed Stoneware
<i>DKhunj</i>	Khunj Dark
<i>GrnGW</i>	Green Glazed Ware
<i>GrRdPtW</i>	Grey Red Painted Ware
<i>JUL</i>	Julfar Ware
<i>JUL1</i>	Julfar 1 Ware
<i>JUL2</i>	Julfar 2 Ware
<i>JUL3</i>	Julfar 3 Ware
<i>JUL4</i>	Julfar 4 Ware
<i>JUL5</i>	Julfar 5 Ware
<i>Khunj</i>	Khunj Ware
<i>KhunjInc</i>	Khunj Incised
<i>MangPt</i>	Manganese Painted
<i>OHW</i>	Orange Hard Ware
<i>OSW</i>	Orange Sandy Ware
<i>OSWCoar</i>	Coarse Orange Sandy Ware
<i>OxidCoar</i>	Oxidised Coarse Ware
<i>OxidCoarSandy</i>	Oxidised Coarse Sandy War
<i>PFW</i>	Persian Frit Ware
<i>PFWBaB</i>	Persian Fritware Blue and Black
<i>PFWBaW</i>	Blue-and-White Persian Fritware
<i>PFWGrnaW</i>	Persian Frit Ware Green and White
<i>PFWW</i>	Persian Frit Ware White
<i>PorcMod</i>	Modern Porcelain
<i>ReduCoar</i>	Reduced Coarse Ware
<i>RefW</i>	Refined White Ware
<i>Roulette</i>	Roulette
<i>RouletteGrnGpt</i>	Roulette Green Glazed Painted
<i>SPW</i>	Stone Paste Ware
<i>StoneW</i>	Stoneware
<i>Tabun</i>	Tabun Ware
<i>VietBaW</i>	Vietnamese Blue and White Stoneware
<i>YeIGW</i>	Yellow Glazed Ware

Table 8.2: Main ware codes used in the analysis of the pottery assemblage. Italics show wares further described below.

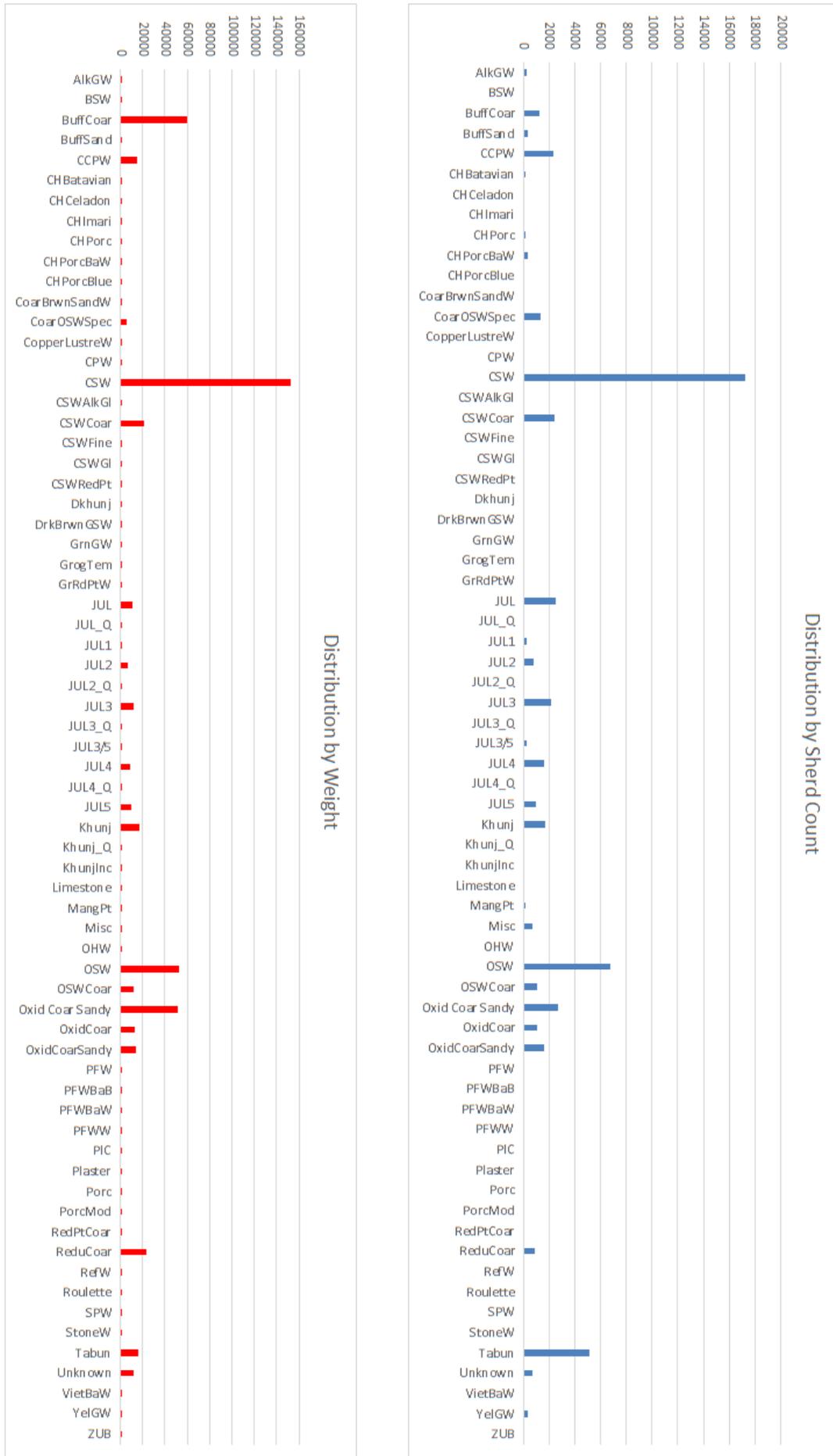


Figure 8.1: Distribution of wares in the Freiha assemblage by weight and sherd count. Total sherd count: 58,165. Total sherd weight: 529,968kg

8.2 GULF GLAZED WARES

8.2.1 Alkaline Glazed Ware

Only 307 sherds of this ware have been recorded.

The fabric of Alkaline Glazed Ware is very sandy and friable, and therefore breakage is high; sherds are small and residual. The colour of the fabric is yellowish-grey, and the glaze is clear or turquoise-green. The glaze is always badly preserved and poorly adhering to the surface (Figure 8.3).

Four forms are present: bowl, jug, oil lamp and small jar. The latter two forms are very rare.

The size of bowls can vary. Bowls are glazed internally and externally to just under the rim. Jugs are small with a rounded, ridged body and small loop handle.

The alkaline glazed small jar has a globular body and ring base. It could be used to store ointments, cosmetics or medicine.

Provenance: Iran

Dating: 18th century

8.2.2 Creamy Sandy Ware Alkaline Glazed

Only four sherds of this ware were recorded (Figure 8.4). These bowl fragments are made of a ware very similar to Creamy Sandy Ware from Bahrain ('Ali Ware), but they are decorated with incised lines under the alkaline glaze. The incisions are placed diagonally on the top of the rim and also occur as a wavy line on the external surface of the vessel. The alkaline glaze is light green to turquoise, very weathered, and covering the internal surface and partially (to just under the rim) the external surface. The rim is flat and everted.

Provenance: Bahrain (by ware) or Iran (by type of glaze)

Dating: unknown

8.2.3 Green Glazed Ware

Only bowls are known from this class. The ware is extremely friable, coarse and sandy with a pale yellow colour. Only small residual sherds were found (Figure 8.4).

Monochrome green glaze is poorly adhering to the surface of the sherds. Some of the sherds had combed decoration under the glaze and some have repair rivets.

The rim is plain and no full profile survived.

Provenance: most likely Iran, copying Chinese Celadon ware

Parallel: Monochrome Green Glaze (GMONO) (Kennet 2004: 43)

Dating: 18th century

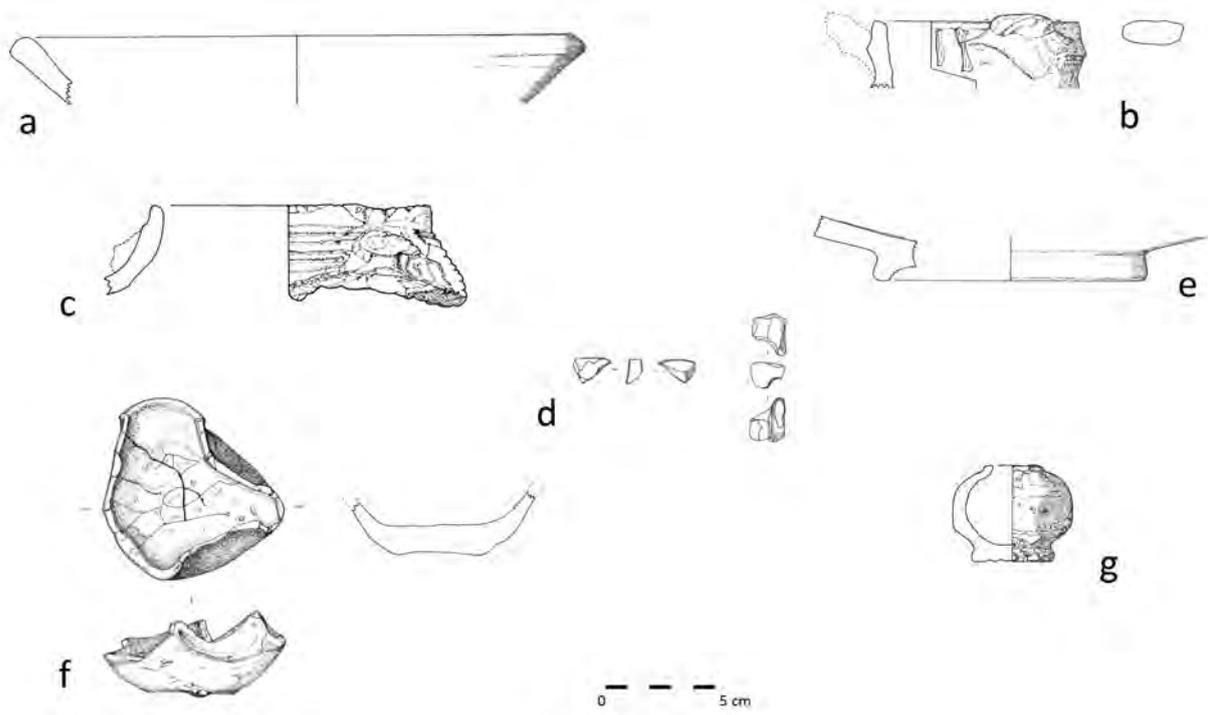


Figure 8.2: Alkaline Glazed Wares.
 a. Jug (pot cat 188) b. Jug (pot cat 350) c. Bowl (pot cat 470) d. Jug (pot cat 278) e. Bowl (pot cat 147)
 f. Oil Lamp (pot cat 229) g. Small Jar (pot cat 28)

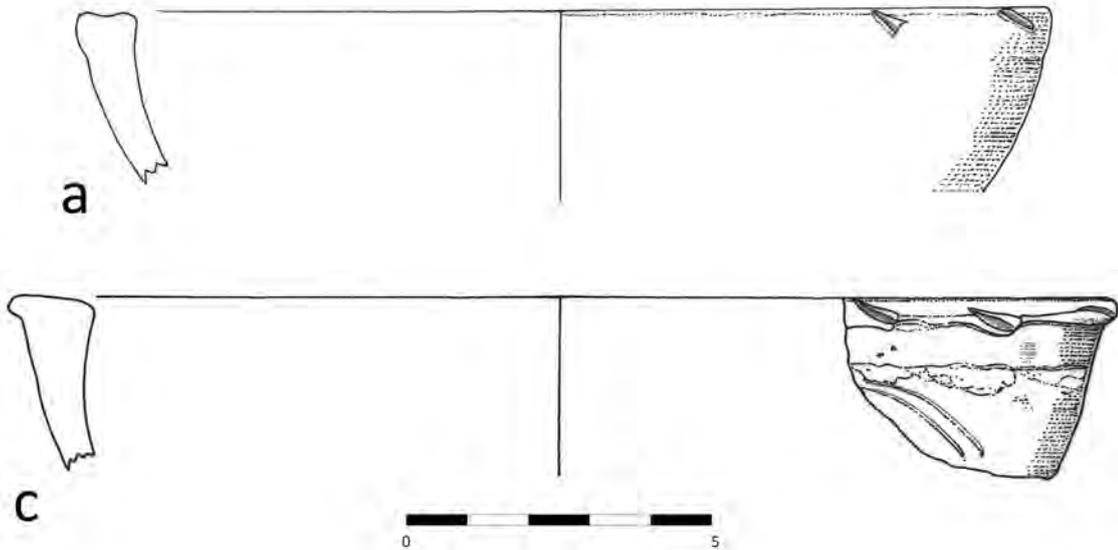
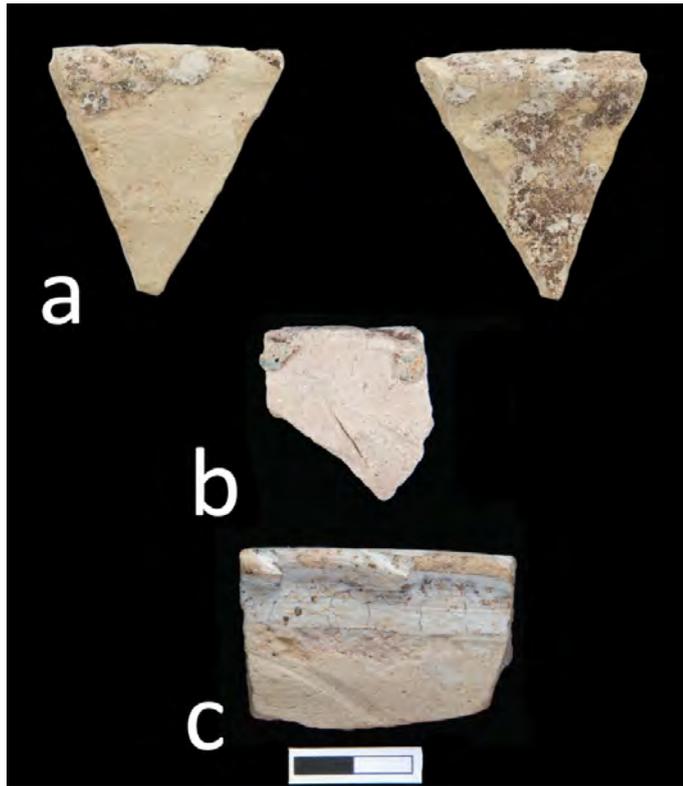


Figure 8.3: Creamy Sandy Ware Alkaline Glazed.
 a. Bowl (pot cat 38) b. Bowl (pot cat 39) c. Bowl (pot cat 327)

8.2.4 Creamy Sandy Ware Glazed

Only ten sherds of this ware were found and recorded. This is probably a jar made of a grey friable fabric covered with a dark brown, lead glaze (Figure 8.5). The vessel would have had handles.

The ware is easily mistaken for Khunj, but has a different colour, hardness and overall appearance.

Provenance: Iran?

Dating: 18th-19th century

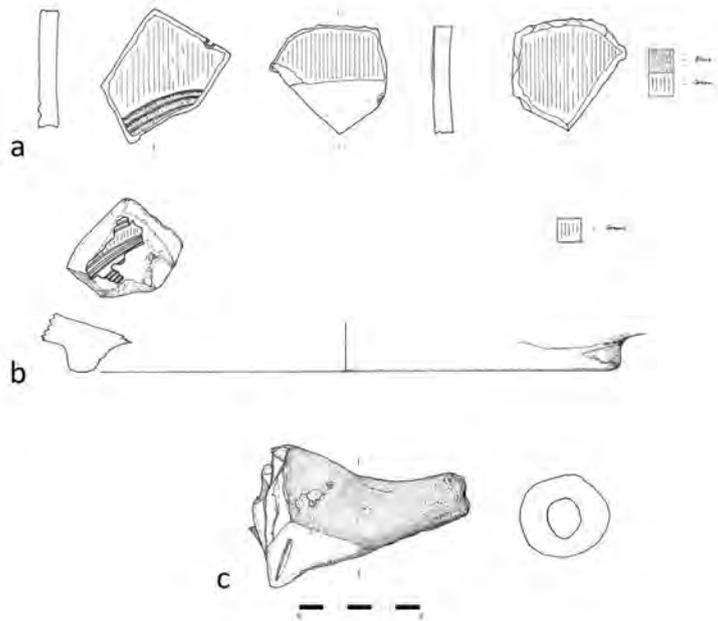


Figure 8.4: Green Glazed Ware.
 a. Bowl (pot cat 334) b. Bowl (pot cat 386) c. Bowl (pot cat 251)

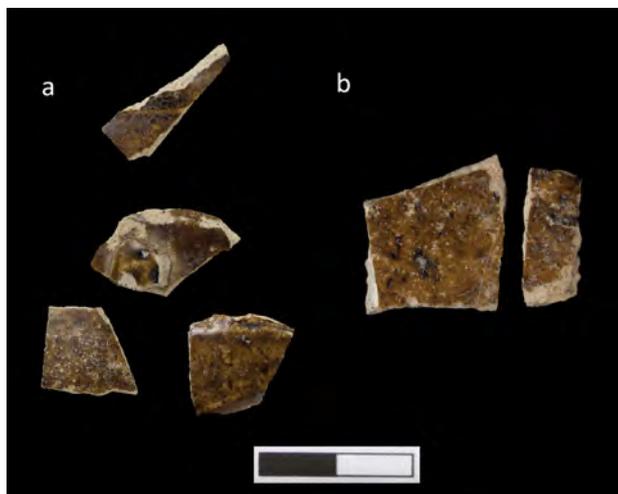


Figure 8.5: Creamy Sandy Ware Glazed. a. Jar (pot cat 17/26) b. Jar (pot cat 22)

8.2.5 Khunj Ware

In total, 1697 sherds were recorded and analyzed. Khunj Ware is well recognised within the Gulf region and reported from many archaeological sites. The ware is well represented at Al Zubarah and Freiha. It is named after a kiln site near the Iranian town of Khunj (south Iranian province of Fars). The site was found in the 1960 by Andrew Williamson, who also classified this ware (Hansman 1985, 52). Similar types of ceramic are reported from Oman, named Bahla Ware (Whitcomb 1975, 129); East Africa (de Cardi & Doe 1971); United Arab Emirates at Khatt in Ras al-Khaimah (de Cardi et al: 1994, 63, pl.XV); and Ras Abruk and Huwailah, Qatar (Garlake 1978).

Five classes of Khunj ware were established at Freiha:

- Khunj (a, b) (Figures 8.6 and 8.7)
- Dark Khunj (c, d, e, f) (Figure 8.8)
- Khunj with monochrome green glaze
- Khunj with alkaline glaze decoration painted over lead glaze (g, h, i, j) (Figure 8.9)
- Khunj with incised decoration (k, l, m) (Figure 8.10)

Khunj Ware is well-levigated, hard-fired, reddish-orange or grey in colour, often with colour variations.

The vessels are covered with clear lead glaze with brown or greyish-yellow hue. The colour of the glaze ranges in appearance and often the ware has bright orange colour patches just under the glaze. The green glaze decoration subgroup is present in Freiha, but extremely rare.

87% of Khunj Ware are bowls varying in size and rim form, from thinned internally with a groove immediately below the rim interior to rounded or beaded rim. These bowls mainly have a ring base; however, flat concave bases are also present.

There are no preserved full profiles of these bowls from Freiha.

Khunj bowls were often repaired, rivet repair holes are common (Figure 8.6).

13% of Khunj Ware sherds from Freiha are jars with a collared rim and small loop handles placed horizontally around the shoulders. The handles are round in section except where luted to the body. The glaze covers both the external and internal surfaces and, as with the bowls, they have a ring base. Two thin section samples were taken to establish the origin of the Khunj/Bahla Ware from Freiha (Figure 8.11).

Dating: 18th century



Figure 8.6: Khunj ware fragments showing rivet holes.

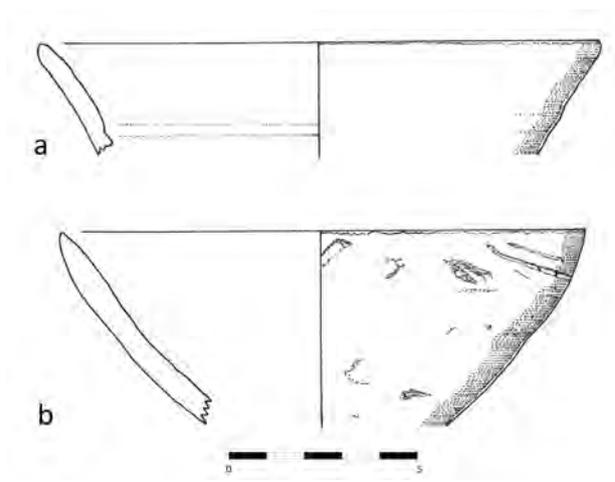


Figure 8.7: Khunj Ware.
a. Bowl (pot cat 231) b. Bowl (pot cat 242)

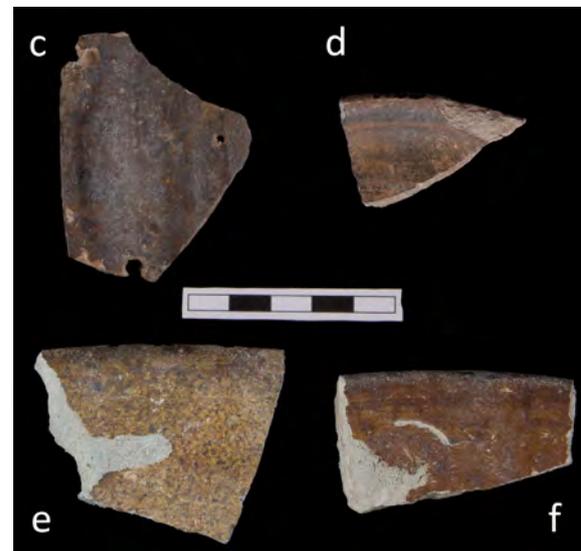
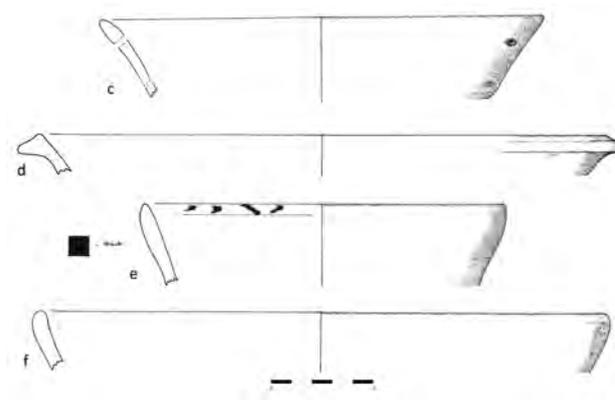


Figure 8.8: Dark Khunj Ware.
c. Bowl (pot cat 453) d. Bowl (pot cat 149) e. Bowl (pot cat 287) f. Bowl (pot cat 361)

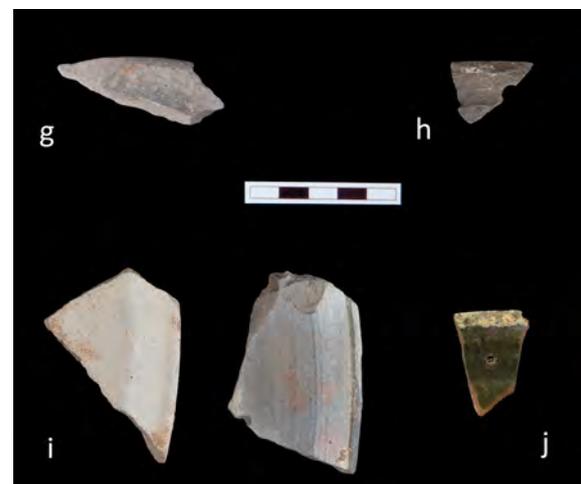
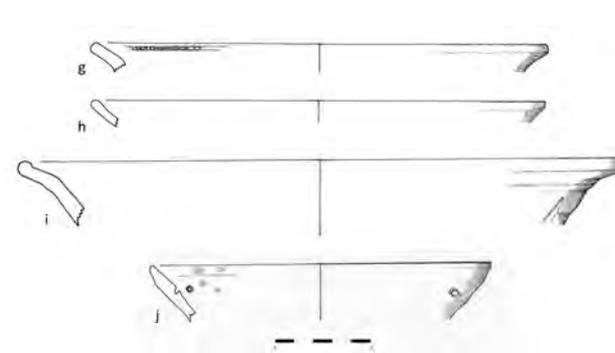


Figure 8.9: Khunj Ware with alkaline glaze decoration painted over lead glaze.
g. Bowl (pot cat 69) h. Bowl (pot cat 70) i. Bowl (pot cat 398) j. Bowl (pot cat 114)

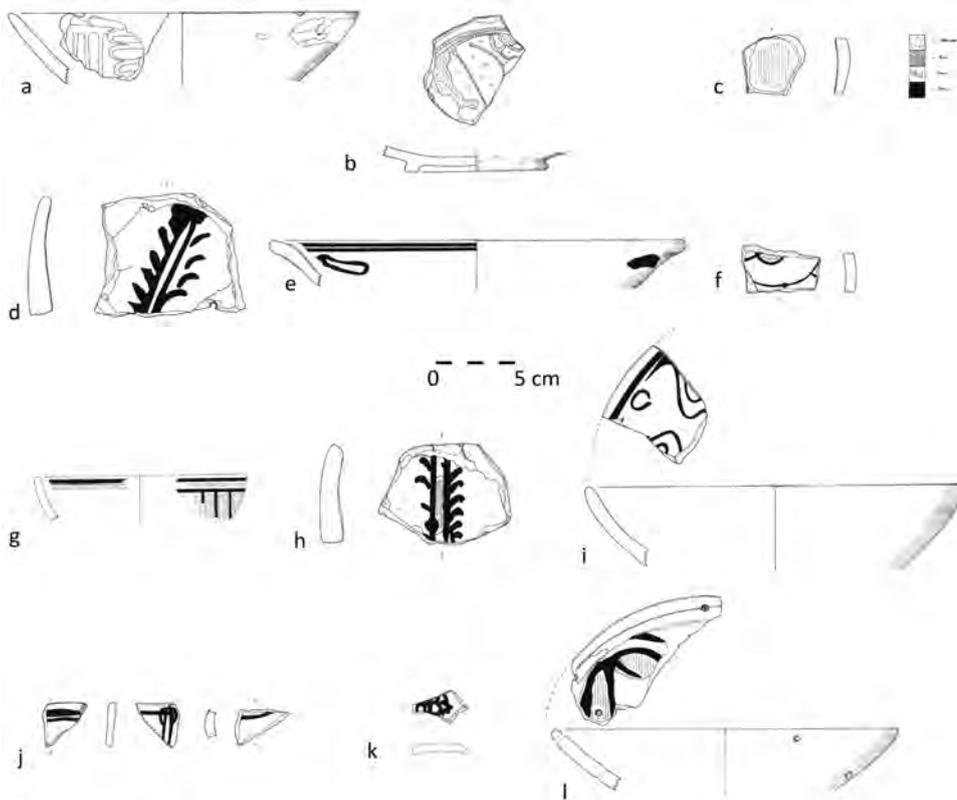


Figure 8.12: Manganese Painted Ware.

- a. Bowl (pot cat 210) b. Bowl (pot cat 146) c. Bowl (pot cat 218) d. Bowl (pot cat 220)
- e. Bowl (pot cat 273) f. Bowl (pot cat 292) g. Bowl (pot cat 300) h. Bowl (pot cat 307) i. Bowl (pot cat 311)
- j. Bowl (pot cat 324) k. Bowl (pot cat 342) l. Bowl (pot cat 387)

8.2.7 Persian Frit Ware

Persian Frit Ware imitates Chinese Blue and White porcelain. The fabric is friable, often with a deteriorated glaze. Persian potters could not reproduce the quality of Chinese porcelain, but they copied the decorative motifs.

The ware is very friable, light cream in colour and made of fused stone-paste. The glaze is clear and often very deteriorated. The main forms of this class are bowl, dish and small jar.

Sherds of Persian Frit Ware are rarely seen at Freiha due to their extremely friable nature, and only small sherds were recorded. The best examples were immediately conserved to prevent further deterioration.

PFW bowls are glazed on both internally and externally, with glaze covering the surface down to the ring base. The majority of the bowls are decorated with underglaze cobalt blue paint.

Five classes of Persian Frit Ware were recorded at Freiha:

- PFW Persian Frit Ware
- PFWBaW Persian Frit Ware Blue and White (Figure 8.13)
- PFWBaB Persian Frit Ware Blue and Black (Figure 8.14)
- PFWGrnaW Persian Frit Ware Green and White (Figure 8.15)
- PFWW Persian Frit Ware White

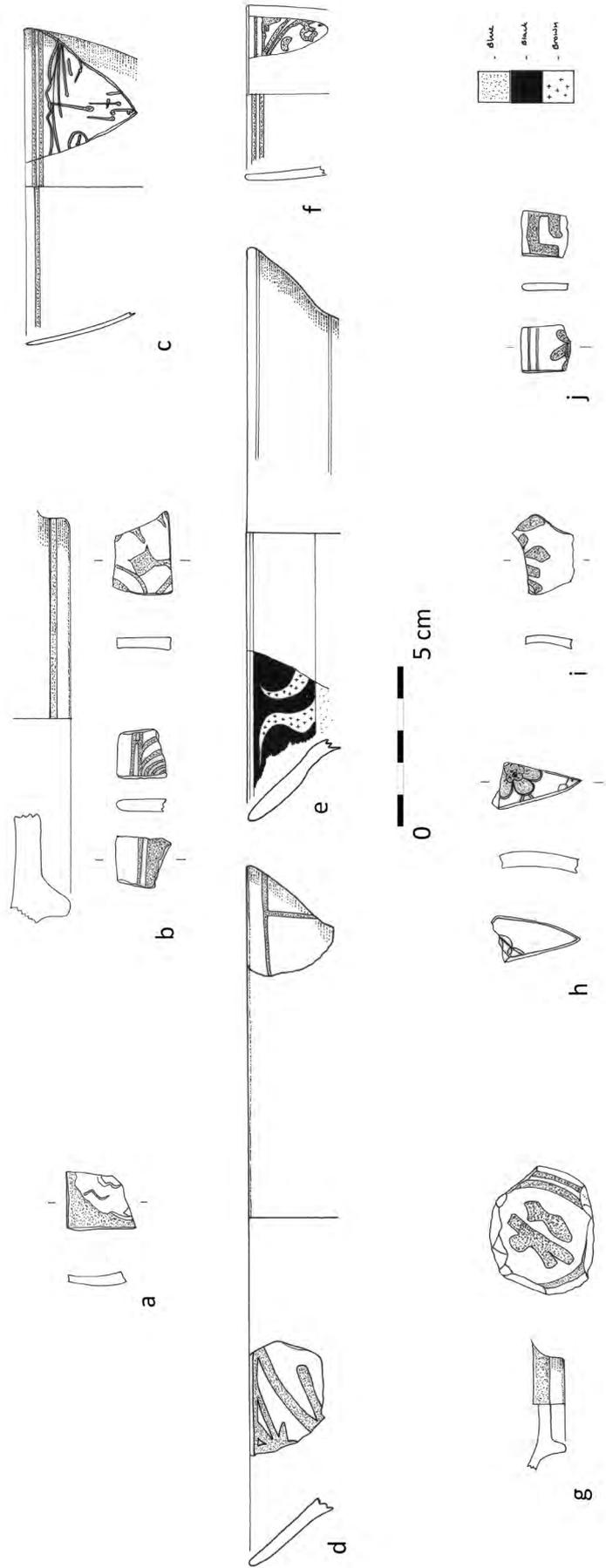
Provenance: Iran

Dating: 18th century



Figure 8.13: Persian Frit Ware Blue and White.

- a. Bowl (pot cat 166) b. Bowl (pot cat 167) c. Bowl (pot cat 129) d. Bowl (pot cat 208) e. Large Bowl (pot cat 309)
f. Bowl (pot cat 308) g. Bowl (pot cat 213) h. Bowl (pot cat 219) i. Bowl (pot cat 272) j. Bowl (pot cat 315)



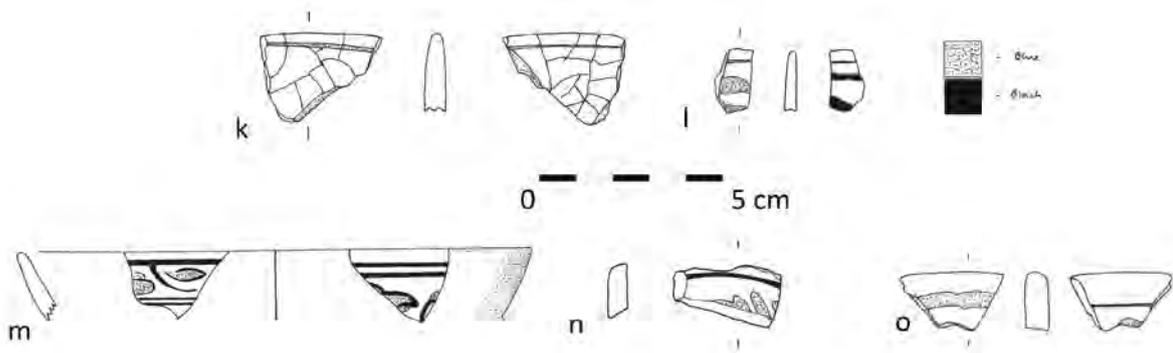
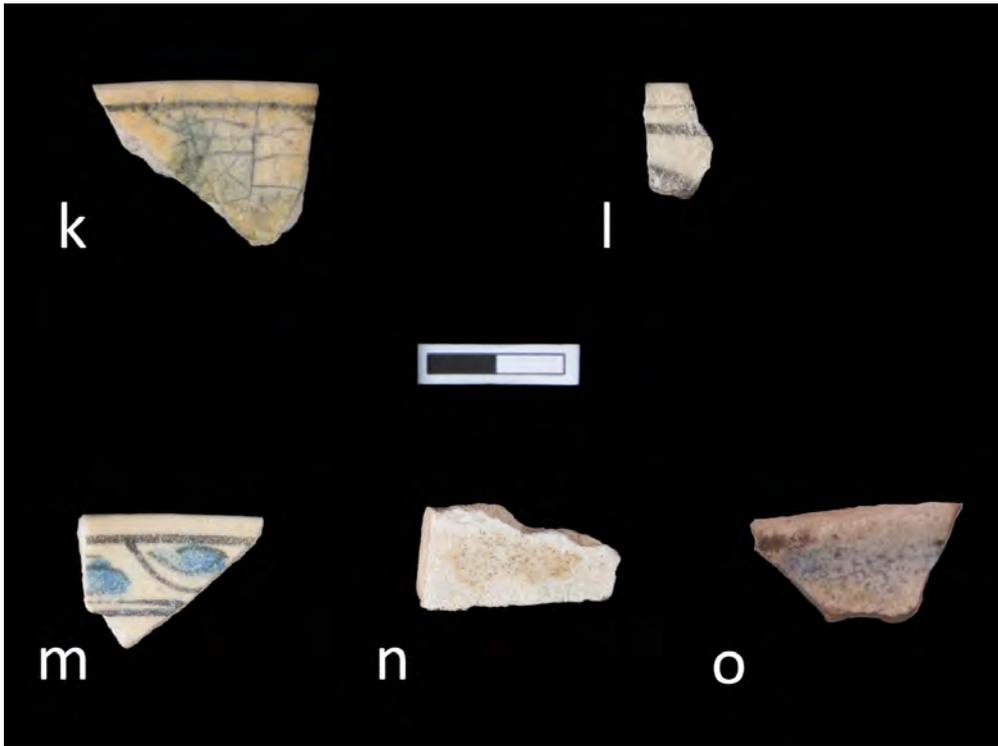


Figure 8.14: Persian Frit Ware Blue and Black.
 k. Bowl (pot cat 353) l. Bowl (pot cat 346) m. Bowl (pot cat 325) n. Bowl (pot cat 337) o. Bowl (pot cat 203)

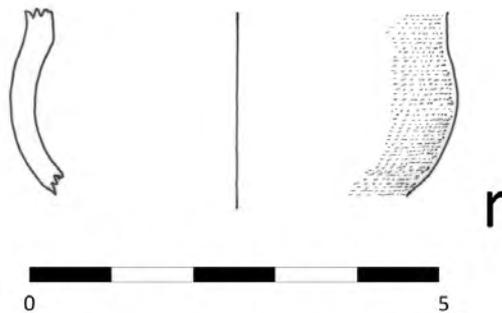


Figure 8.15: Persian Frit Ware Green and White (top left) and White (top right and bottom).
 p. Jar (pot cat 29) r. Bowl (pot cat 404)

8.2.8 Stone Paste Ware

Only one sherd of this type was found and recorded from Freiha (Figure 8.16). The ware is very friable, decorated externally by dark orange/red dots with black and yellow very thin lines. The yellow lines were probably originally blue. There are no glaze traces present. The ware probably originates from Iran and the sherd is probably part of a small bowl.

Provenance: Iran

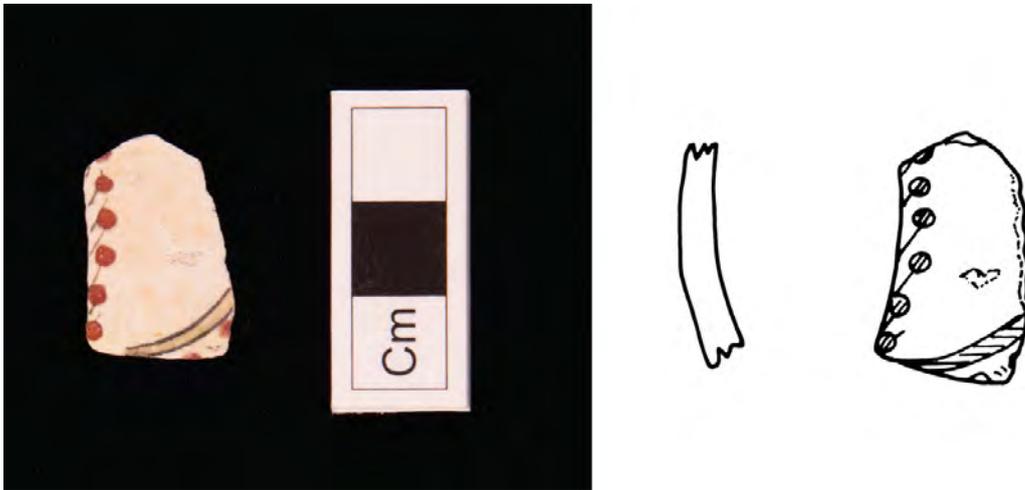


Figure 8.16: Photograph and line drawing of Stone Pasted Ware.
Small Bowl (pot cat 19)

8.2.9 Roulette Glazed Ware

This ware describes bowls made of a sandy, very friable, light yellow ware decorated with zones of manganese purple paint, with several bands of rouletting under a clear yellow glaze (Figure 8.17). The size of bowls varies and their rims are beaded, often with internal grooves with a ring base.

Provenance: Iran

Dating: 18th century

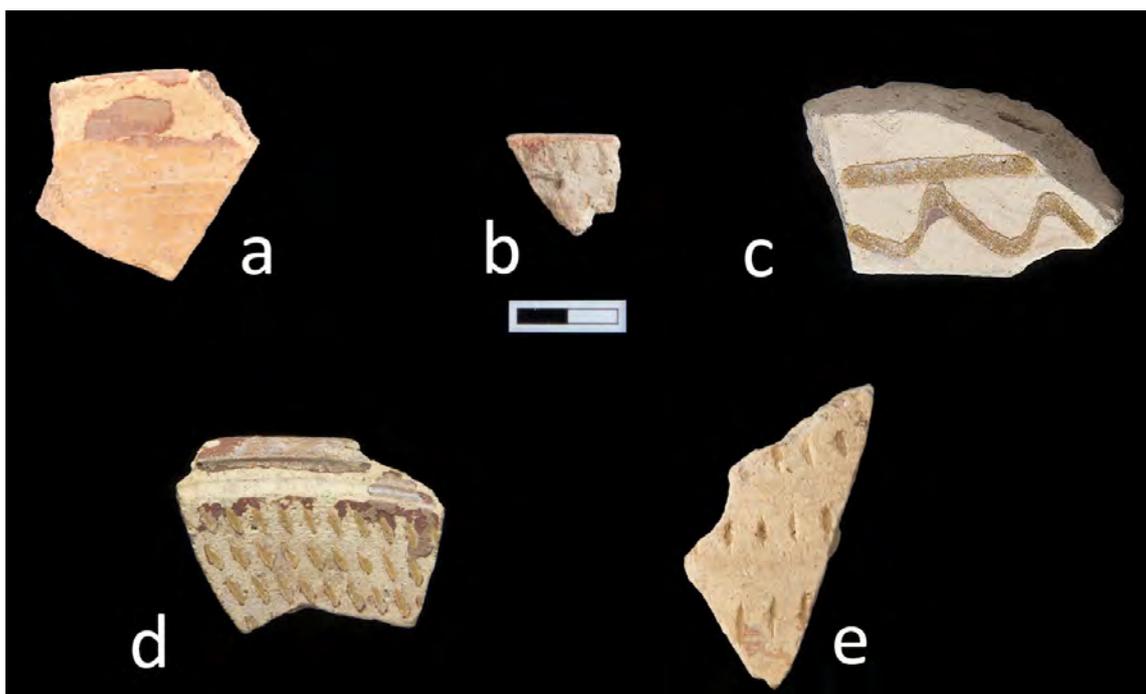
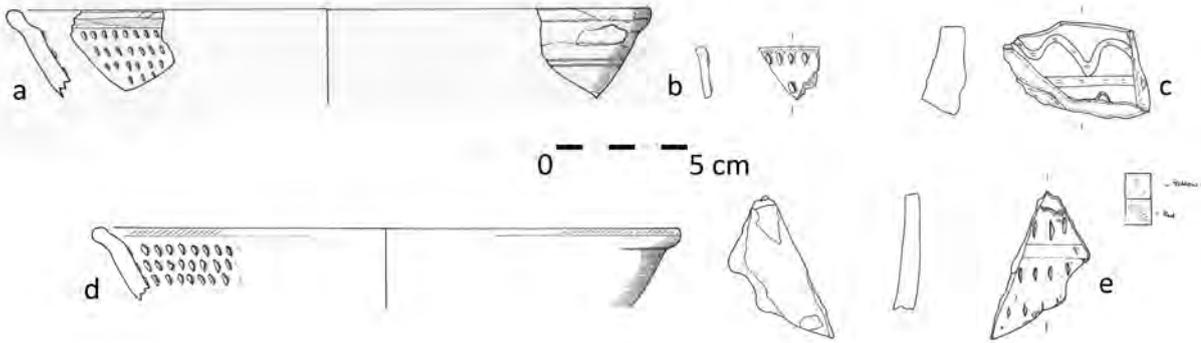


Figure 8.17: Roulette Glazed Ware (also opposite).
a. Bowl (pot cat 204) b. Bowl (pot cat 211) c. Bowl (pot cat 275) d. Bowl (pot cat 283) e. Bowl (pot cat 318)



8.2.10 Roulette Green Glazed Ware

This ware is seen in bowl forms decorated with mono green glaze and underglaze (placed on the top of the rim) maroon colour paint. The external surface is decorated with maroon colour paint and bands of rouletting (Figure 8.18).

It is very sandy and friable, pale yellow in colour. The rim is bevelled externally and the glaze is badly degraded.

Provenance: Iran?

Parallel: Red and Yellow Ware (RedYel) (Kennet 2004: 44)

Dating: 18th century

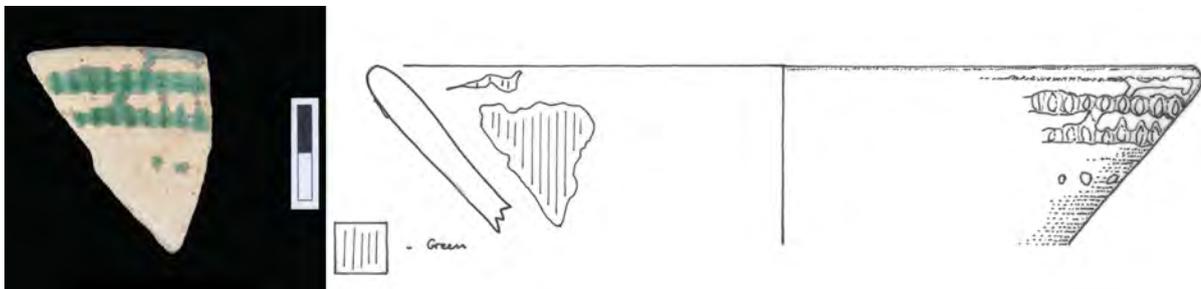


Figure 8.18: Rouletted Green Glazed Ware. Bowl (pot cat 377)

8.2.11 Yellow Glazed Ware

The main form of this ware is a bowl (Figure 8.19). Examples of Yellow Glazed Ware jars are very rare in Freiha. These are more common at Al Zubarah.

The ware is friable and light yellow, light brown or dark yellow in colour. The poorly adhering lead glaze covers both the internal surface of the bowl and external surface just to below the rim. Only residual fragments of Yellow Glazed Ware were found. In many cases, the colour of glaze resembles mustard colour glaze (Parallel to Mustard Ware 34 in Kennet (Kennet 2004: 4).

Provenance: unknown

Dating: 18th century

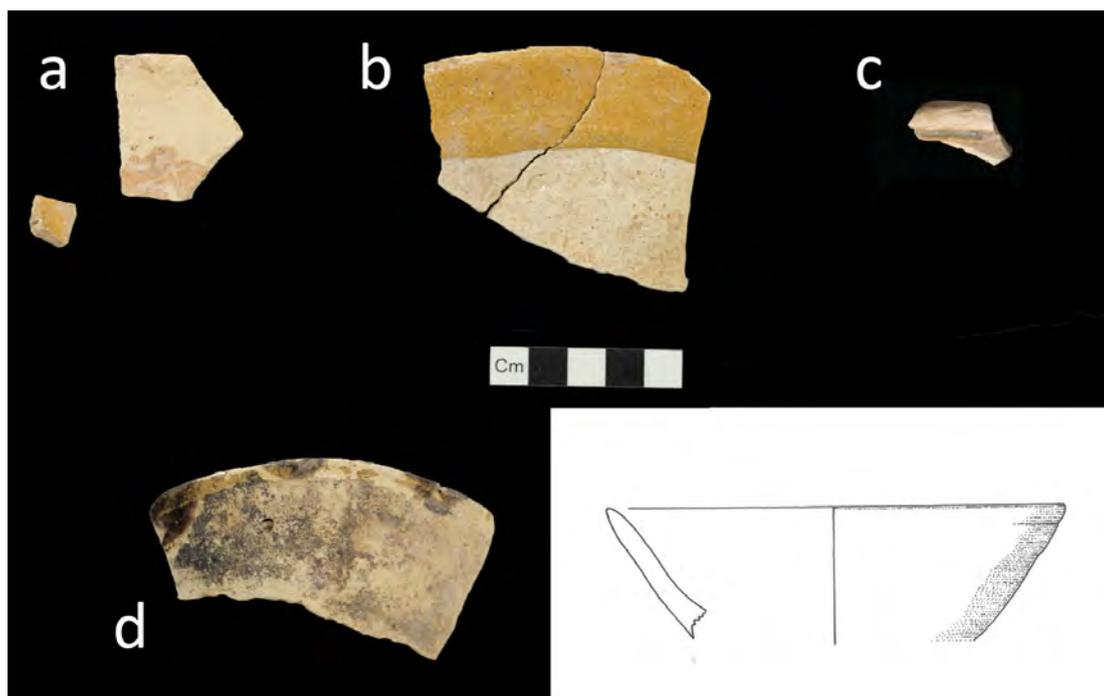


Figure 8.19: Yellow Glazed Ware.

a. Bowl (pot cat 61) b. Bowl (pot cat 63) c. Jar (pot cat 261) d. Bowl (pot cat 429)

8.3 FAR EAST FINE WARES

8.3.1 Chinese Blue and White Porcelain

This ware is common at Freiha and mainly dates to the 18th century.

Chinese porcelain table wares were exported for the Near East market. High quality porcelain originated from kilns in Jingdezhen province. Smoky grey-blue, low quality porcelain was produced in provincial kilns at Dehua. This pottery is also called 'Kitchen Ch'ing' (Willets & Lim 1981: 2-3). The fabric of less well-refined porcelain is defined by thicker body sherds with a blistered glaze.

The glaze is transparent with a painted underglaze decoration of deep cobalt blue (Figure 8.20).

The main recorded forms are a wide variety of bowls, coffee cups and plates.

Provenance: China

Dating: 18th - 20th century

8.3.2 Chinese Batavian

This type of porcelain dates to the 18th century (1720-1780). Forms include cups of various sizes and small bowls and lids decorated with chocolate brown or café-au-lait glaze with white panels with blue and white interiors (Figure 8.21).

Provenance: China

Dating: 18th century (1720-1780)

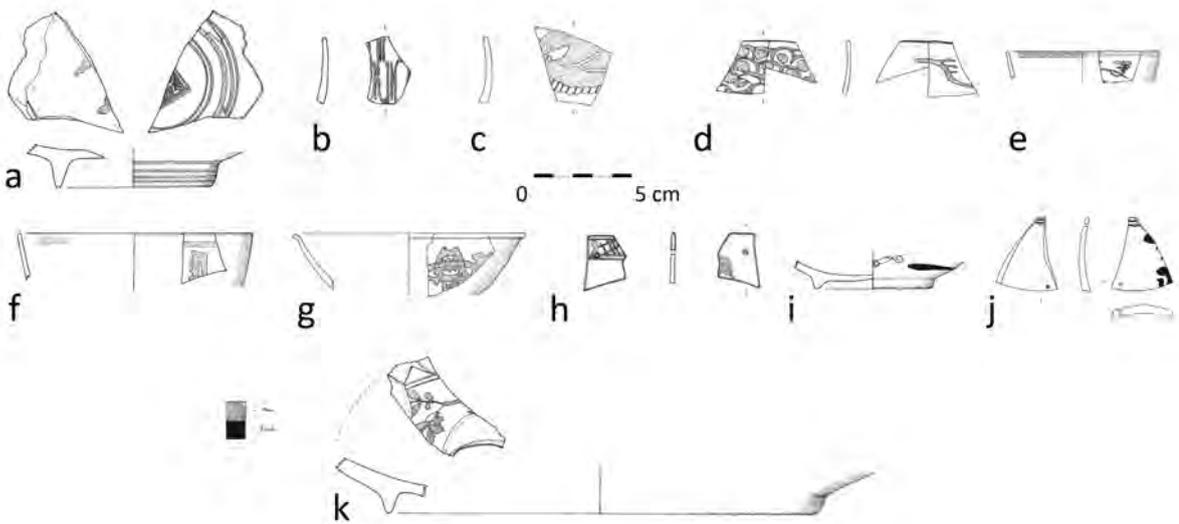
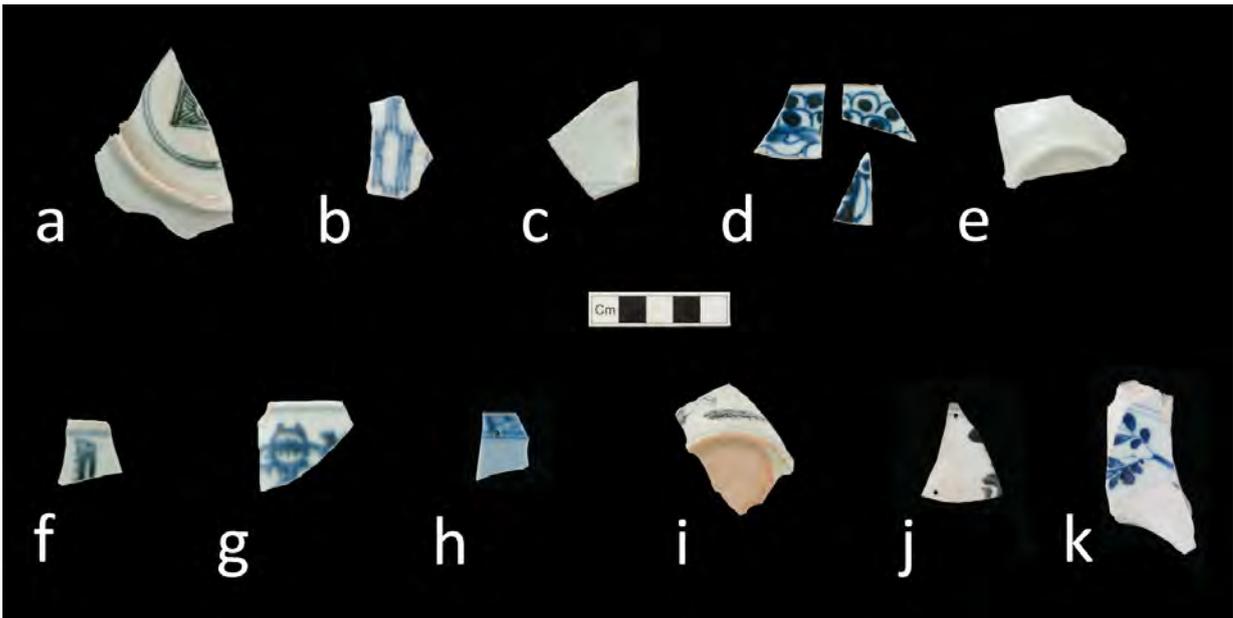


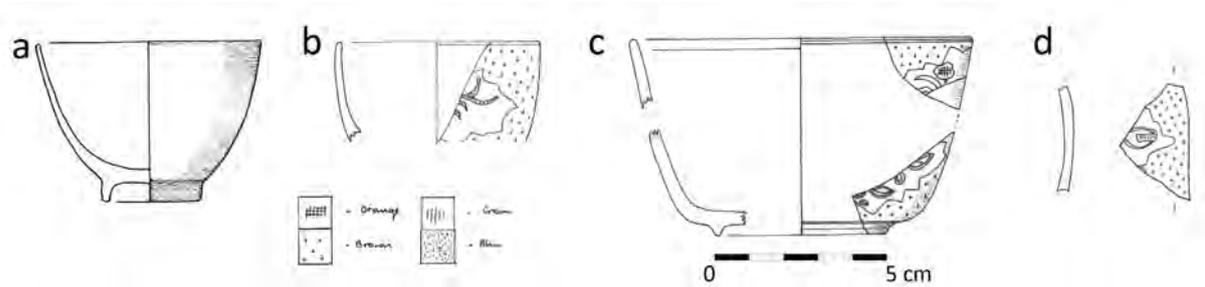
Figure 8.20: Chinese Blue and White Porcelain.

- a. Bowl (pot cat 198) b. Bowl (pot cat 455) c. Bowl (pot cat 466) d. Bowl/Plate (pot cat 458) e. Bowl (pot cat 463)
- f. Bowl (pot cat 465) g. Bowl (pot cat 459) h. Bowl (pot cat 130) i. Bowl (pot cat 128) j. Bowl (pot cat 341)
- k. Large Bowl (pot cat 349)



Figure 8.21: Chinese Batavian (also opposite).

- a. Cup (pot cat 443) b. Cup (pot cat 456) c. Cup (pot cat 464) d. Small Bowl (pot cat 467)



8.3.3 Chinese Porcelain Blue

This ware is a high quality Chinese porcelain with monochrome blue underglaze decoration with remnants of badly preserved over-painted golden motifs (Figure 8.22). The single recorded sherd from Freiha is part of a small bowl of 18th – 19th century date.

Provenance: China

Dating: 18th - 19th century

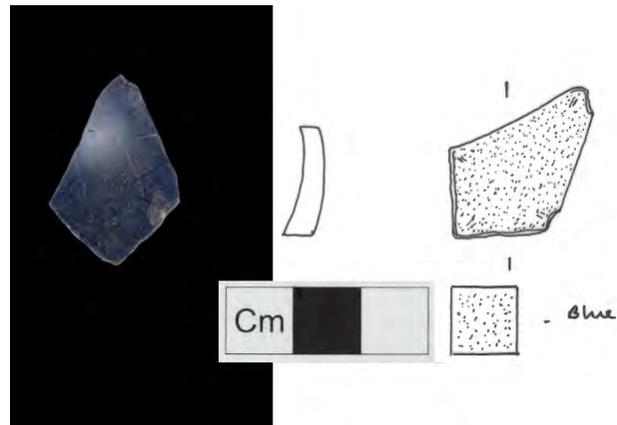


Figure 8.22: Chinese Porcelain Blue.
Small Bowl (pot cat 127)

8.3.4 Chinese Celadon

Only three fragments of this high quality Chinese Celadon porcelain were found and recorded at Freiha and probably come from the same vessel, most likely a charger (Figure 8.23). It is decorated with the classic underglaze decoration covered with a green celadon glaze. These vessels have a wide date range and could be as early as the 16th or as late as 18th century.

Provenance: China

Dating: 16th - 18th century

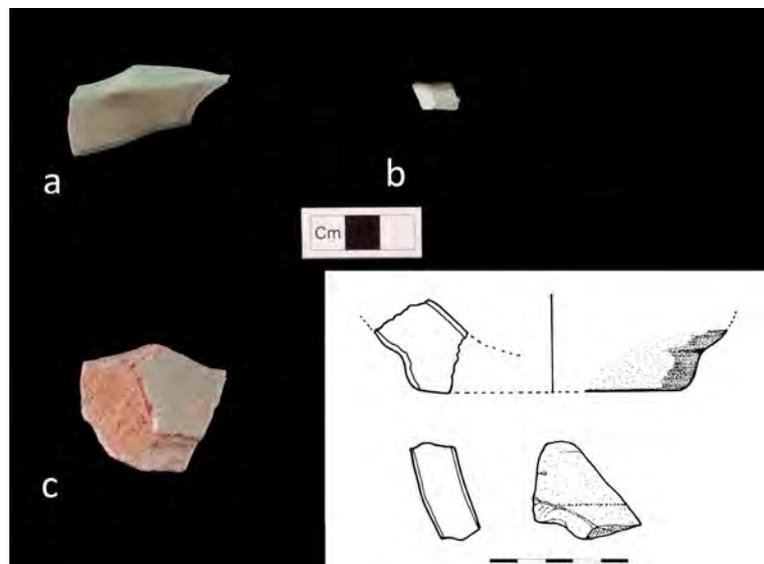


Figure 8.23: Chinese Celadon.
a. Charger (pot cat 180) b. Charger (pot cat 408) c. Charger (pot cat 179)

8.3.5 Chinese Imari

The first Chinese Imari was produced in the 17th century (Kangxi period 1662-1722). The type of porcelain found at Freiha dates to the 18th - 19th century, with only fourteen fragments recovered so far. Cups of various size are glazed, with an underglaze blue painted decoration and over glaze painted decoration in gold and dark orange (Figure 8.24).

Provenance: China

Dating: 18th - 19th century

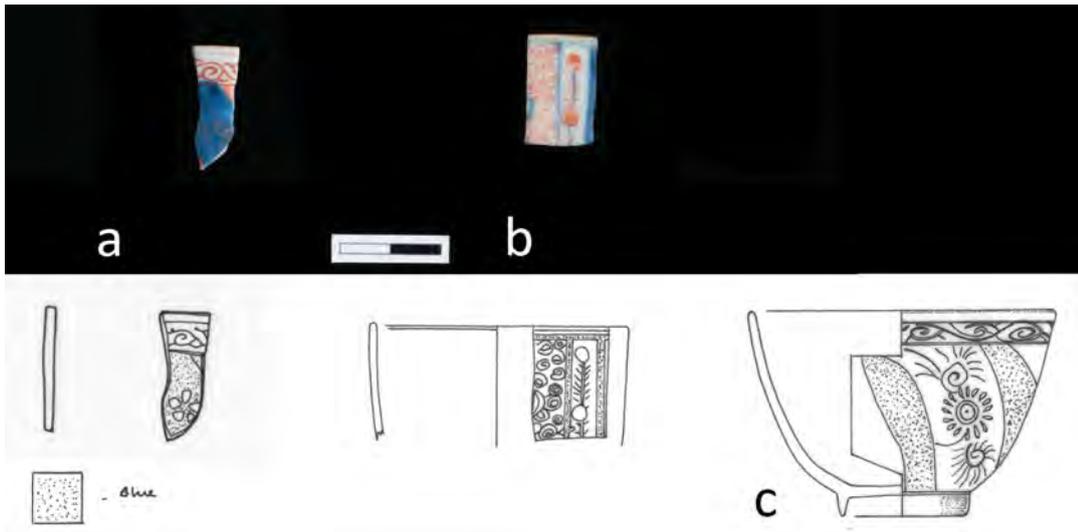


Figure 8.24: Chinese Imari.

a. Cup (pot cat 246) b. Cup (pot cat 378) c. Cup (pot cat 411)

8.3.6 Vietnamese Blue and White Stoneware

The fabric is grey in colour, hard and well-fired with glaze and underglaze-painted cobalt dark blue/brown decoration. The only recorded form is a bowl (Figure 8.25). The ware is much darker in colour than Chinese porcelain. Some examples of Vietnamese stoneware are dark grey with dark greenish shade (parallels: Kennet 2004: 68, Ware 65; Hansman 1985: Pl. V a,b,c).

Provenance: Vietnam

Dating: 18th century



Figure 8.25: Vietnamese Blue and White Stoneware.
Bowl (pot cat 395)

8.3.7 Stoneware

A Stoneware bowl rim fragment is the only example of this type found in Freiha (Figures 8.26 and 8.27). The fabric is grey and well-fired. The internal surface is overglaze painted with large, dark orange leaves. Around the internal rim of the vessel are stylised Arabic black letters on a white background. Its origin is probably the Far East. There are no known parallels.

Provenance: unknown

Dating: unknown

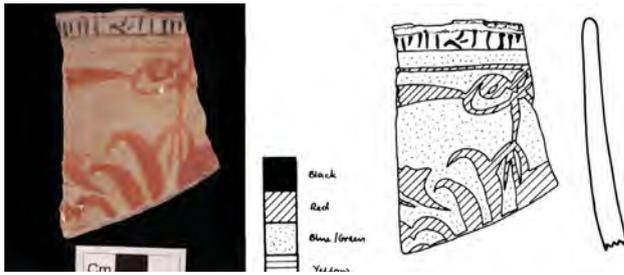


Figure 8.26: Stoneware.
Bowl (pot cat 113)

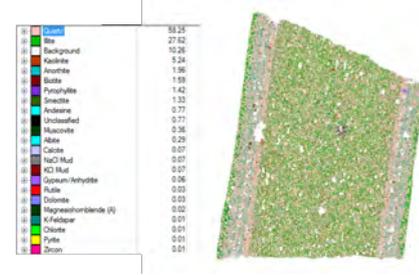


Figure 8.27: Thin section sample of Stoneware bowl (pot cat 113).

8.3.8 Dark Brown Glazed Stoneware

Only eight sherds of this thick, hard, dark pink stoneware were found and recorded, which might be of Chinese provenance. Most likely a small storage jar, decorated with unevenly spread thick, dark brown glaze. One sherd shows a ridge (Figure 8.28).

Provenance: China

Dating: 18th - 19th century

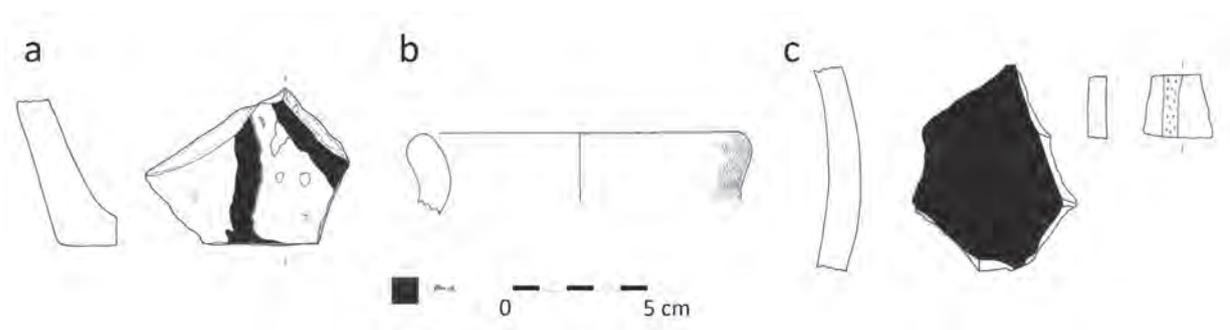
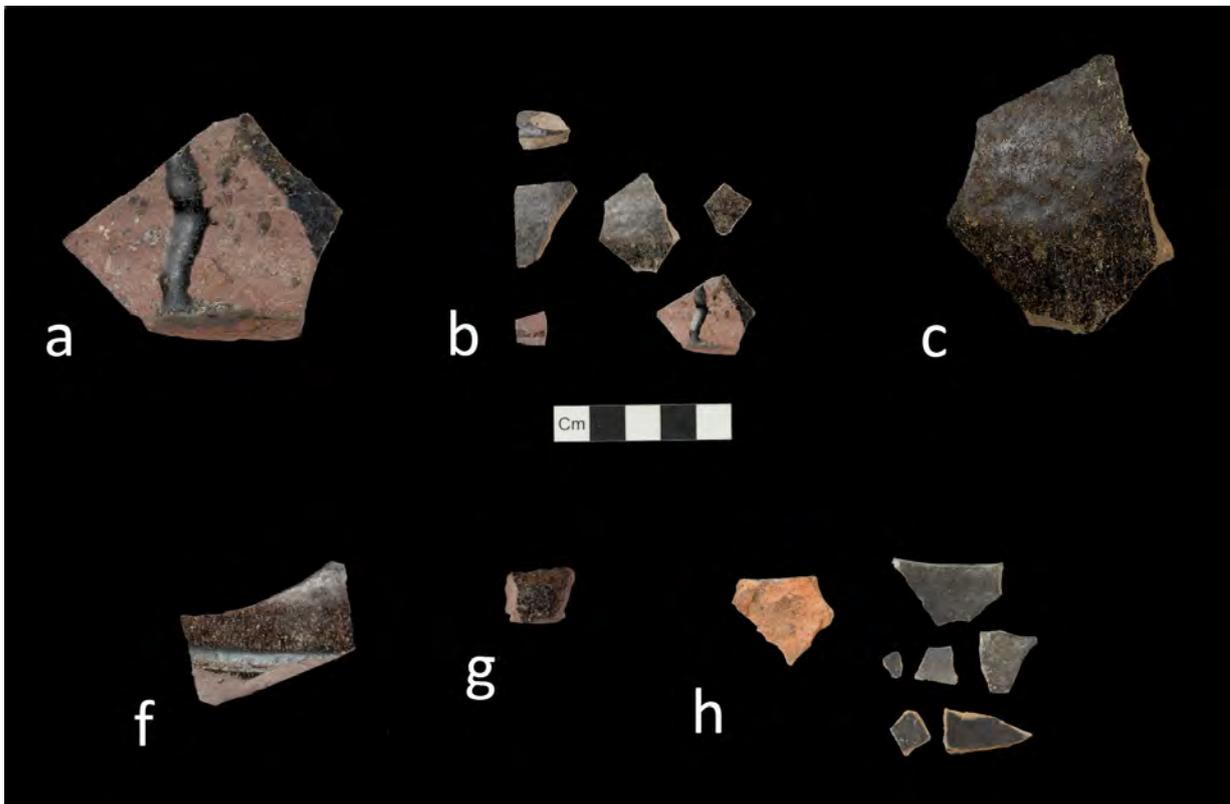


Figure 8.28: Dark Brown Glazed Stoneware.
a. Jar (pot cat 161) b. Jar (pot cat 31) c. Jar (pot cat 34)
d. Jar (pot cat 331) e. Jar (pot cat 384) f. Jar (pot cat 30)

8.4 EUROPEAN GLAZED WARES

8.4.1 Refined White Earthenware

Only 28 examples of modern Refined White Earthenware (semi-porcelain) were found in Freiha.

The sherds are painted by brush-and-sponge decoration over the glaze with polychrome colours. The Refined White Earthenware is an import from either the Dutch companies of Petrus Regout and Co. of Maastricht or Société Céramique (Maastricht).

The main forms are bowls of various sizes, plates and saucers (Figure 8.29).

Provenance: Netherlands

Dating: 20th century



Figure 8.29: Refined White Earthenware.
a. Bowl b. Bowl

8.5 MODERN PORCELAIN FROM EUROPE AND THE FAR EAST

This group includes porcelain sherds of various qualities of material probably from Europe or, in many cases, China or Japan. The sherds are glazed and many are decorated with overglazed painted decoration in a variety of forms: plate, saucer, bowl, and cup (Figure 8.30).

Provenance: Europe, China, Japan

Dating: 19th - 20th century

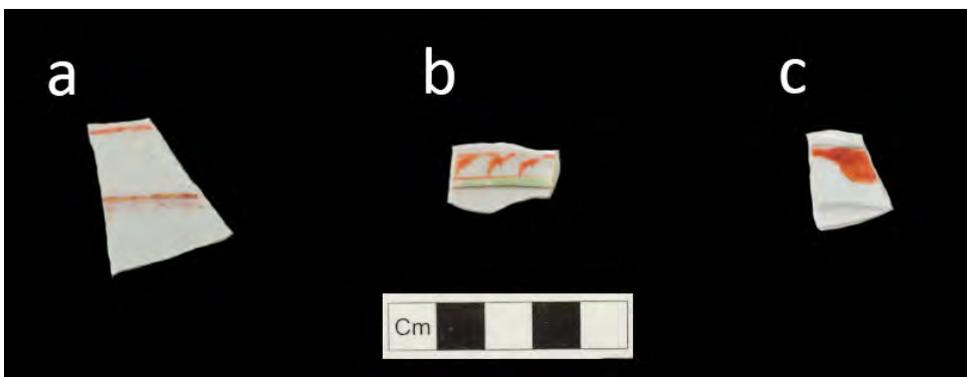


Figure 8.30: Modern Porcelain.
a. Bowl b. Small Bowl c. Bowl

8.6 UNGLAZED GULF WARES

8.6.1 Creamy Sandy Ware (Aali)

Creamy Sandy Ware is cream/orange in colour and made of sandy clay, is well levigated and hard fired. The decoration could be combed and/or incised, but the majority of the vessels are not decorated.

Forms:

- Bowl (rounded or carinated) with everted rim (Figure 8.31)
- Water jug (Figure 8.32)
- Jar (small and medium in size) with rounded to carinated body with loop handles (one to

three handles), rounded or collared rim, and with a ring base (Figures 8.32, 8.35 and 8.36)

- Jar with three heavy and upwardly arched handles extending above a narrow neck (three-handled jar) (Figures 8.33 and 8.34)
- Torpedo jar (Figure 8.37)
- Lids with flange, plain or flat rim, and with squared or round knob (often with steam holes) (Figures 8.38, 8.39 and 8.40)

The ware may be cream in colour (Creamy Sandy Ware) or slightly buff (Coarse Creamy Sandy Ware) or with an orange body, and orange in section (Orange Sandy Ware). The buff version of Orange Sandy Ware is named Coarse Orange Sandy Ware.

Aali Wares (Creamy Sandy Ware and Orange Sandy Ware) are the most common wares at Freiha.

Provenance: Aali village, Bahrain

Dating: 18th - 20th century

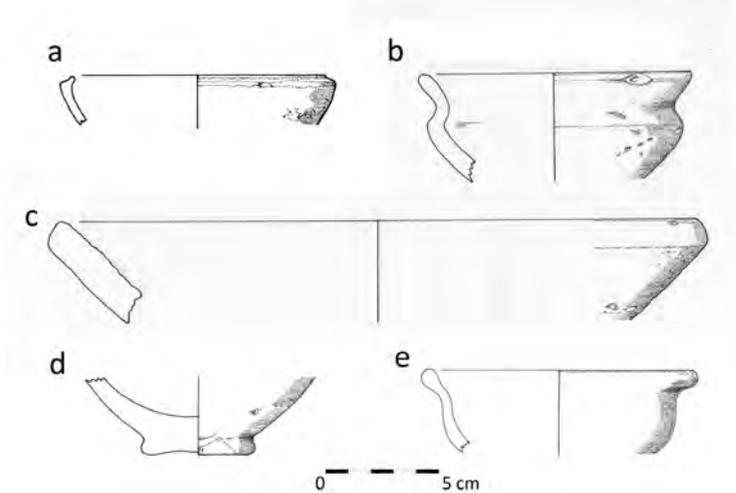
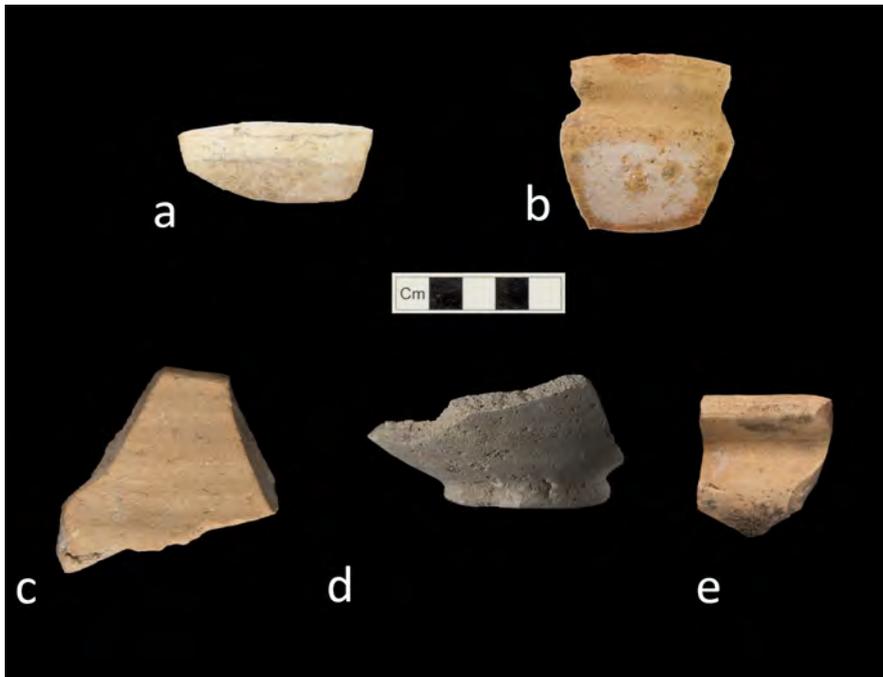


Figure 8.31: Creamy and Orange Sandy Ware Bowls.
 a. Bowl (pot cat 413) b. Carinated Bowl (pot cat 44)
 c. Large Bowl (pot cat 169) d. Bowl (pot cat 250) e. Carinated Bowl (pot cat 357)

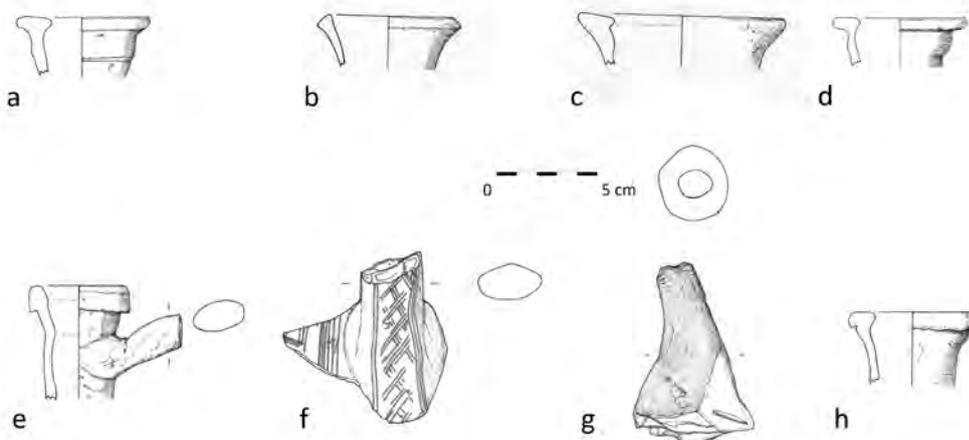


Figure 8.32: Creamy and Orange Sandy Ware Jugs.

- a. Jug (pot cat 412) b. Jug (pot cat 175) c. Jug (pot cat 176) d. Jug (pot cat 312)
 e. Jug (pot cat 379) f. Jug Handle (pot cat 356) g. Jug Spout (pot cat 322) h. Jug/Bottle (pot cat 279)

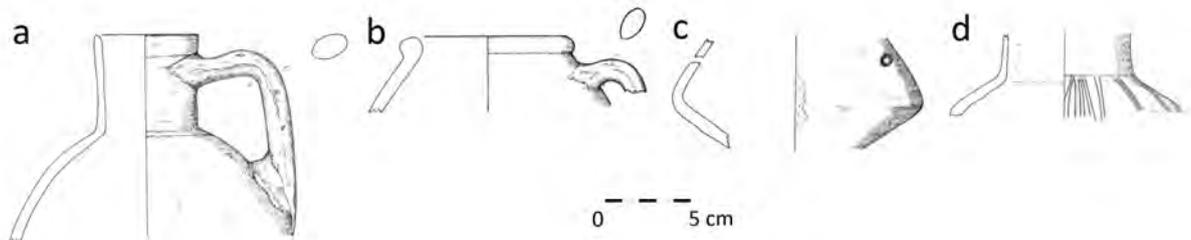


Figure 8.33: Creamy Sandy Ware Jars.

- a. Jar (pot cat 445) b. Jar (pot cat 436) c. Carinated Jar (pot cat 43) d. Jar/Jug (pot cat 6)

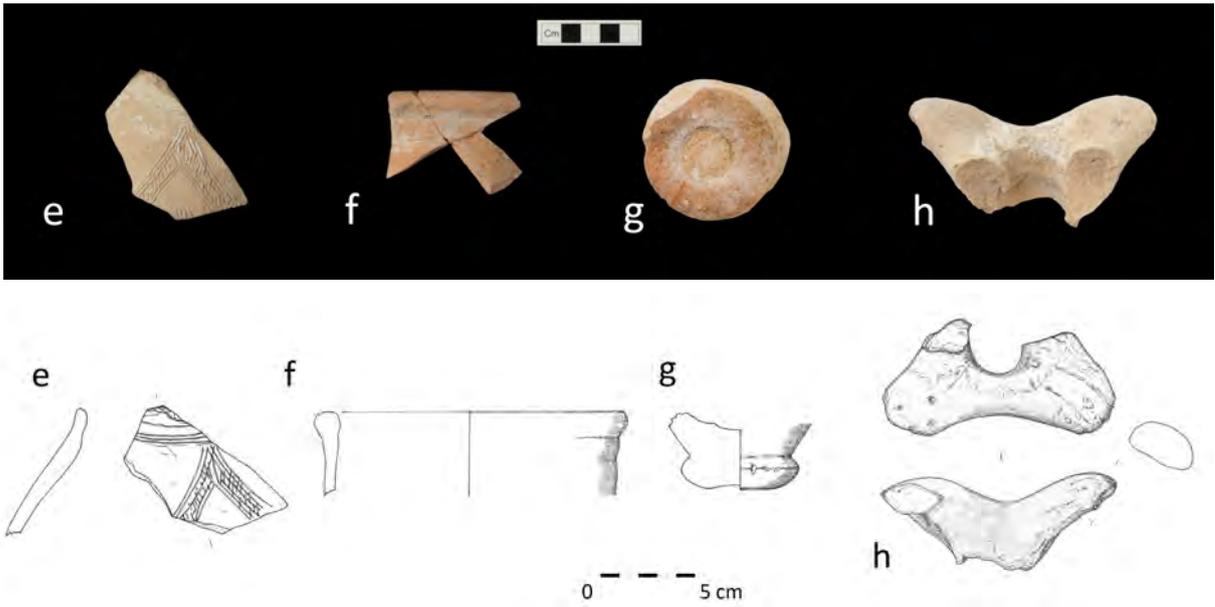


Figure 8.34: Creamy and Orange Sandy Ware Jars.
 e. Jar (pot cat 240) f. Jar (pot cat 263) g. Three-handled Jar or Torpedo Jar Base (pot cat 47) h. Three-handled Jar



Figure 8.35: Creamy Sandy Ware Jar fragments and reconstructed (pot cat 82).



Figure 8.36: Orange Sandy Ware Jar fragments and reconstructed (pot cat 81).



Figure 8.37: Coarse Orange Sandy Ware Torpedo Jar (pot cat 233).

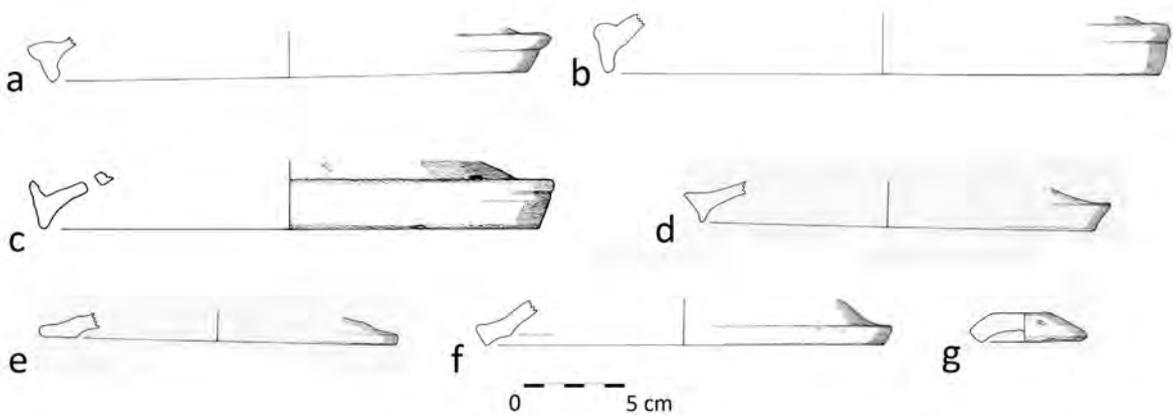


Figure 8.38: Creamy, Orange and Coarse Orange Sandy Ware Lids.
a. OSW Lid (pot cat 2) b. COSW Lid (pot cat 297) c. COSW Lid (pot cat 159) d. CSW Lid (pot cat 174)
e. CSW Lid (pot cat 171) f. CSW Lid (pot cat 305) g. CSW Small Lid (pot cat 3)



Figure 8.39: Creamy Sandy Ware Lids (Knob) (pot cat 422)



Figure 8.40: Creamy Sandy Ware Lid (pot cat 435)

8.6.2 Creamy Sandy Ware Red-Painted

Only two rim sherds were recorded. The ware resembles Creamy Sandy Ware, but the internal surface of the bowl sherds are decorated with simple red paint (Figure 8.41).

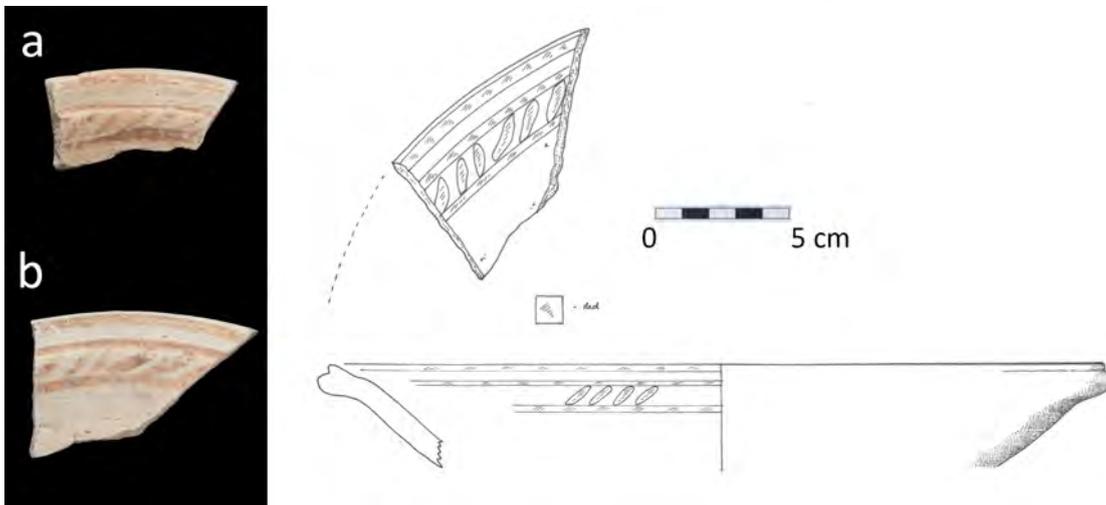


Figure 8.41: Creamy Sandy Ware Red-Painted Bowl.
a. Bowl (pot cat 339) b. Bowl (pot cat 347)

8.6.3 Julfar Ware

Julfar ware is a hand-made earthenware, hard-fired, coarse red or red-brown with frequent angular quartz and lime inclusions. It has five sub-classes (see Kennet 2004: 53), which are present at Freiha:

- Julfar 1: Orange ware with white wash and decoration painted in red. Forms found in this type are jugs and table jars (Figure 8.42).
- Julfar 2: Reduced black ware with painted dark red or purple decoration. Forms are mainly cooking pots with rounded body and externally bevelled rim (parallel to Kennet form CP 4.1, CP4.3, CP4.4, CP5.1) (Figure 8.43).

Examples of Julfar 2 lids are also present: a flat lid (parallel to Kennet 2004: 122, Fig.25) and a red painted arched lid (most likely a lid of an incense burner?). This has triangular steam holes and a flattened top of knob. The latest is similar in form to a Julfar 1 arched lid found at Al Zubarah (ZUEP01, Locus 1249, pot cat 129).

- Julfar 3: Red-painted decoration but no white wash (sometimes self-slip in pale orange colour) (Figures 8.44 and 8.45).

Forms present at Freiha are jars and bowls with ledge rim and closed form cooking pots with ledge rim grooved for lid seating (parallel to Kennet CP4.1), often with grey/creamy colour slip.

Cooking pots with lugs are closed in form with an incurved thickened rim. The characteristic luting line can be seen where the rim is joined to the body of the vessel. The number, shape and size of lugs change through time, and can be used for more precise dating. (Kennet 2004: Table 23).

- Julfar 4: Black body, no paint and no self-slip (Figure 8.46).

The ware is thin-walled. Its forms are cooking vessels with plain rim and side lugs. A cooking pot form with a continuous horizontal ridge has also been found. Kennet suggests a date between 12th-15th/16th century (Kennet 2004: Table 23, CP1.2). Examples of this type at Freiha are of 17th - 18th century date.

- Julfar 5: The ware is not decorated and has no self-slip (Figures 8.47 and 8.48). Vessels with side lugs, closed form and 'S' shape profile of the neck could be compared with Kennet's CP5.1.

Decoration: White wash (Julfar 1) painted in red or purple colour (Julfar 1, Julfar 2)

Forms: bowl, jar, cooking pot, flat lid

Provenance: Julfar, Ras al-Khaimeh (UAE)

Dating: from medieval period until 1969 (Hansman 1985: 64)

8.6.4 Grey Red-Painted Ware

Only one sherd of this ware was recorded, and this is most likely a body sherd of a bowl. The ware is hand-made, grey in colour and hard in texture. The internal surface is decorated with grey slip and-red painted with a thin chevron motif (Figure 8.49).

Dating: 18th century possibly

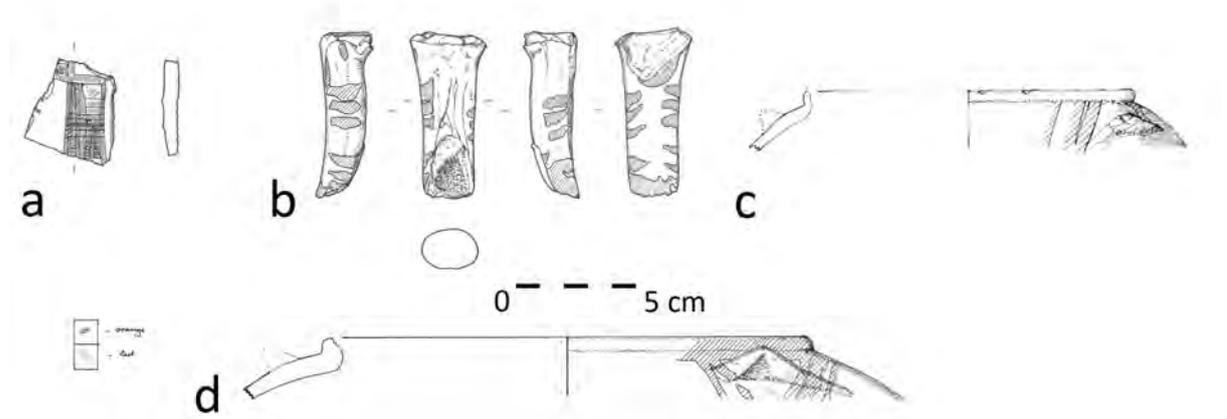


Figure 8.42: Julfar 1 Ware.
 a. Jug (pot cat 461) b. Jug Handle (pot cat 329) c. Bowl/Jar (pot cat 421) d. Bowl Jar (pot cat 437)

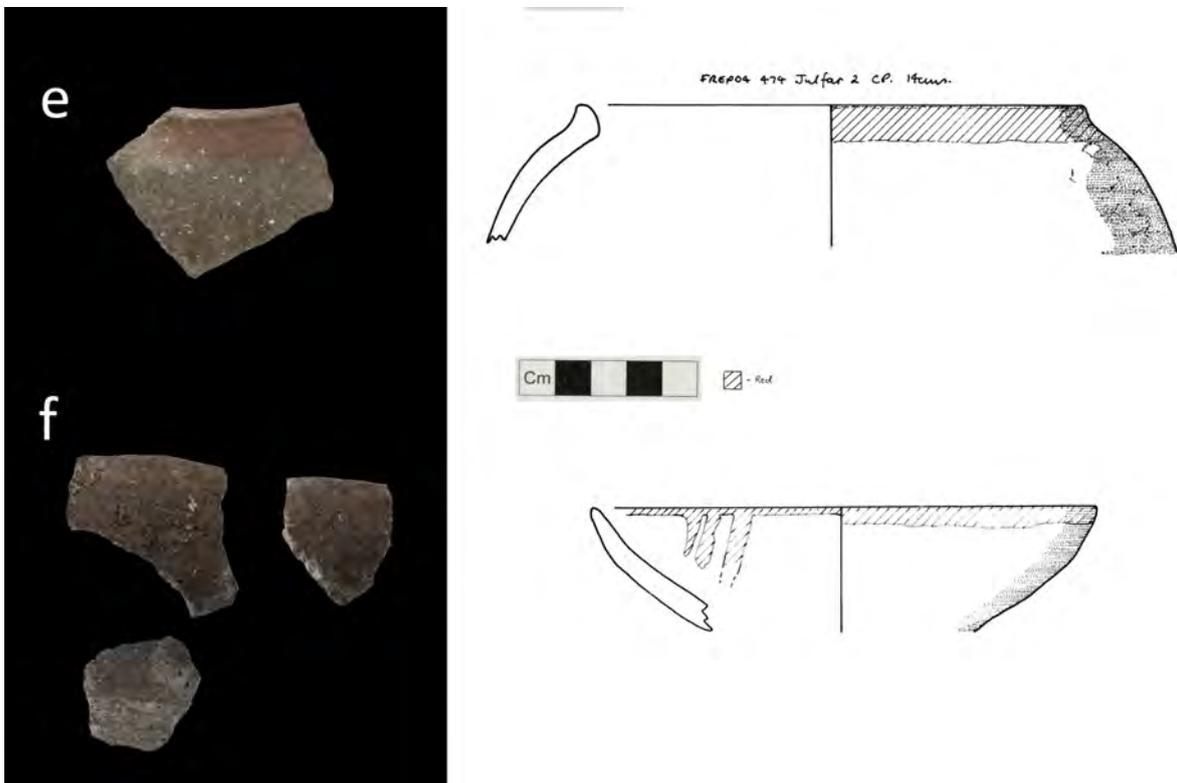


Figure 8.43: Julfar 2 Ware.
 e. Cooking Pot (pot cat 432) f. Bowl (pot cat 430)

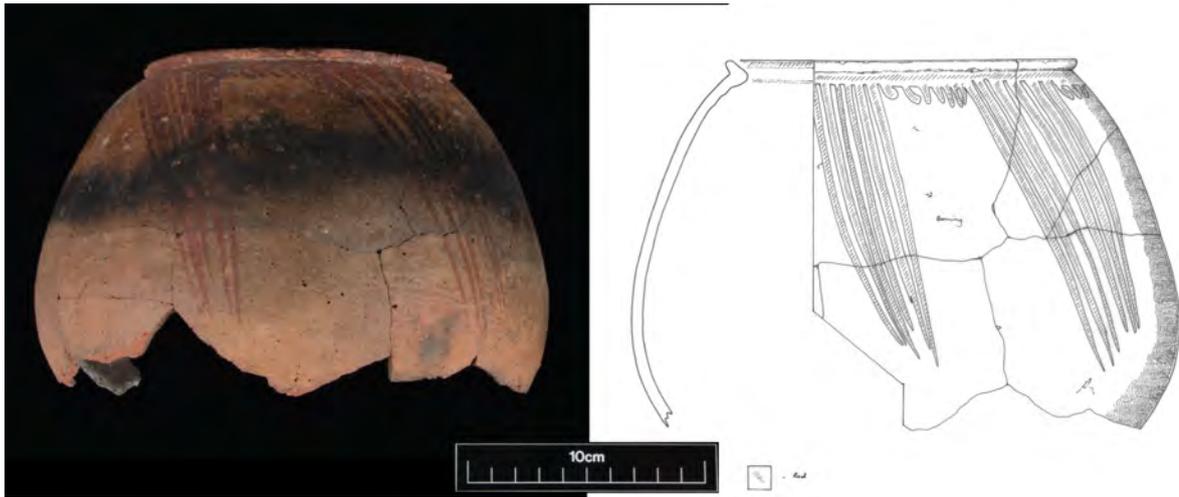


Figure 8.44: Julfar 3 Ware. Cooking Pot (pot cat 214).

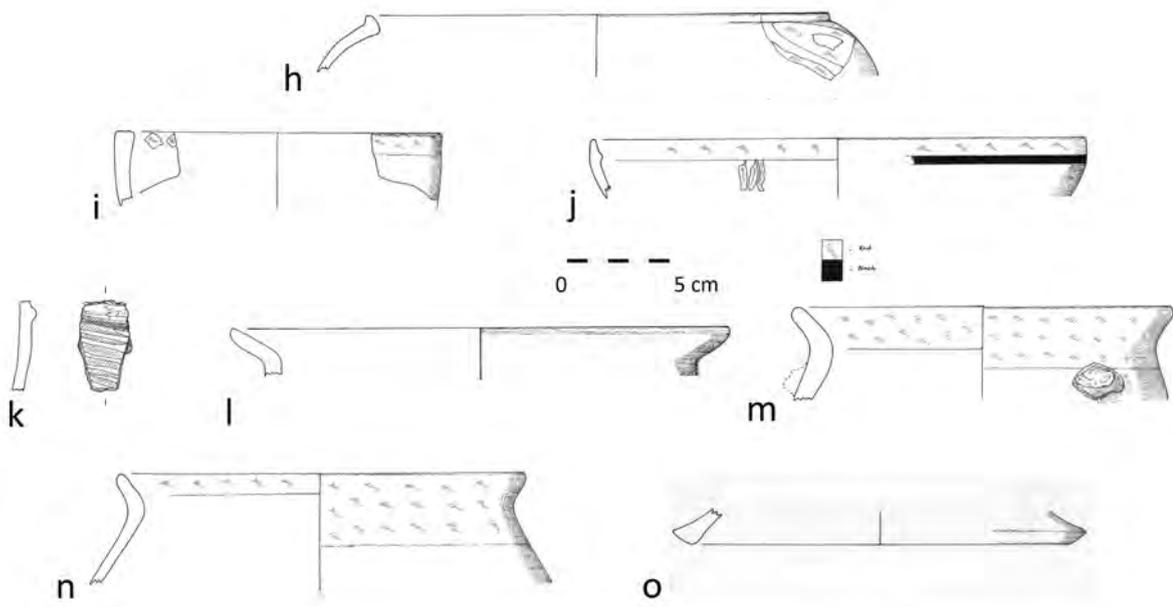


Figure 8.45: Julfar 3 Ware.

- h. Cooking Pot (pot cat 271) i. Jar (pot cat 328) j. Bowl (pot cat 372) k. Lid (incense burner) (pot cat 425)
- l. Jar (pot cat 433) m. Jar (pot cat 390) n. Jar (pot cat 352) o. Jar (pot cat 157)

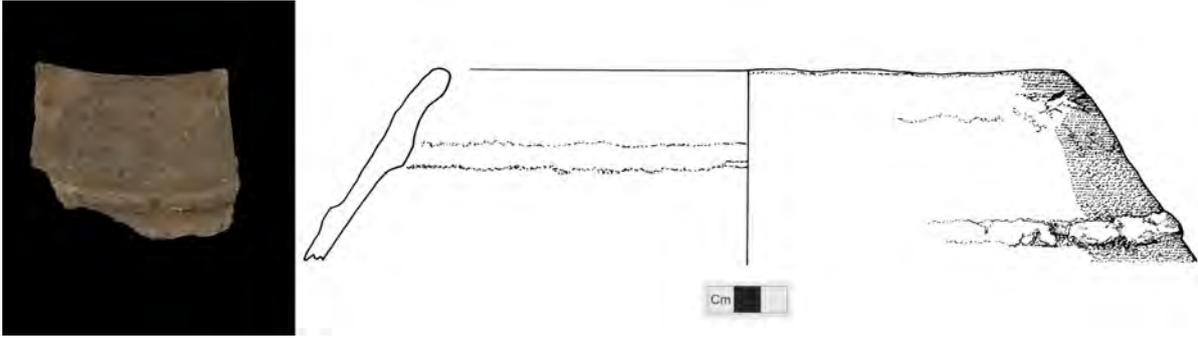


Figure 8.46: Julfar 4 Ware. p. Cooking Pot (pot cat 423).



Figure 8.47: Julfar 5 Ware. r. Cooking Pot (pot cat 428).

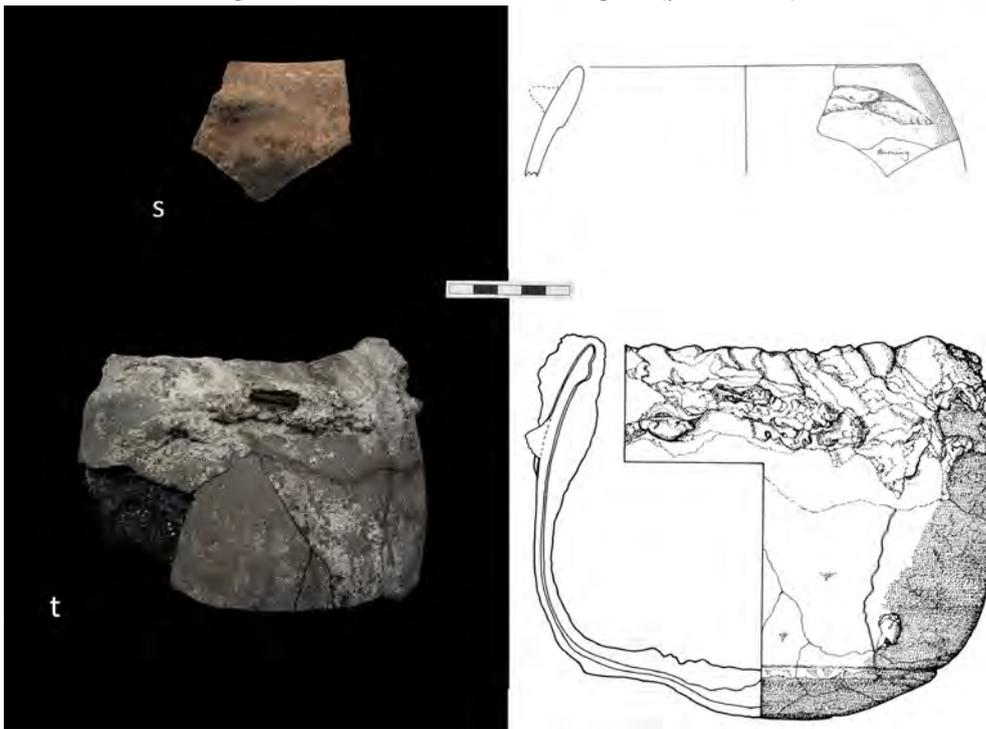


Figure 8.48: Julfar 5 Ware.
s. Cooking Pot (pot cat 368) t. Cooking Pot (pot cat 48)

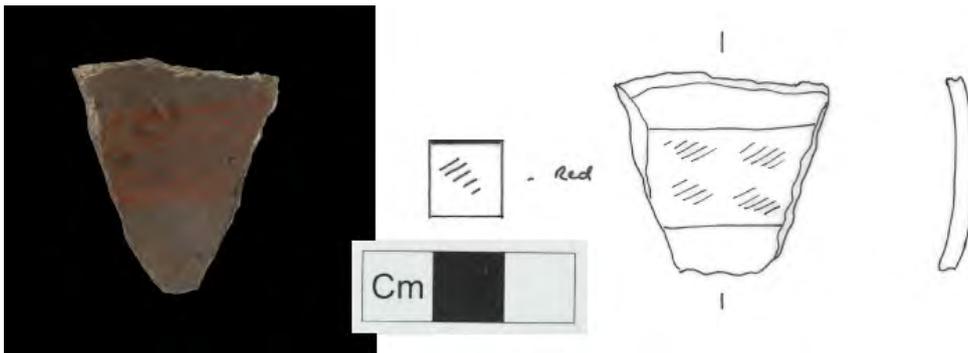


Figure 8.49: Grey Red-Painted Ware. Bowl (pot cat 27)

8.6.5 Coarse Cooking Pot Ware

The ware fabric is hard-fired, coarse red-brown with frequent angular quartz inclusions. It is covered internally and externally by a dark pink slip (Figure 8.50). It was noted that the form of the rims of these hand-made cooking pots changed over time. The earlier forms have a flared neck with a notched rim for the lid; on later vessels the lid sits on a flat ledged rim, sometimes grooved, and the lid form matches the vessel. The only lids which can correspond by the diameter and shape with these cooking pots are made from Cream Sandy Ware. No lids made from Coarse Cooking Pot Ware fabric have been recorded to date.

This ware is similar to Julfar ware, but further study needs to be undertaken to confirm this.

Provenance: unknown

Dating: unknown (parallels from Al Zubarah suggest up to 19th century)

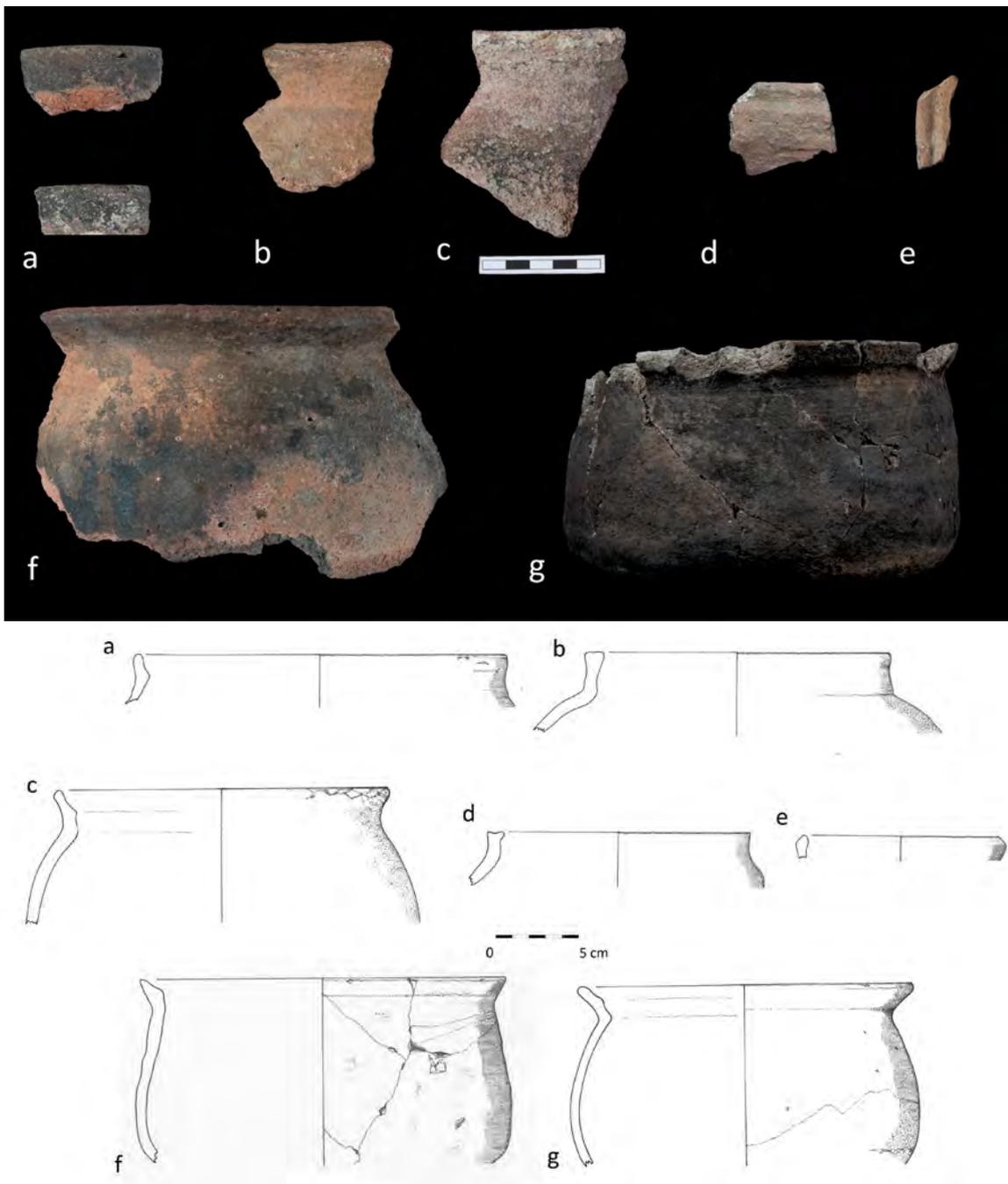


Figure 8.50: Coarse Cooking Pot Ware.

- a. Cooking Pot (pot cat 106) b. Cooking Pot (pot cat 267) c. Cooking Pot (pot cat 371) d. Cooking Pot (pot cat 389)
- e. Cooking Pot (pot cat 388) f. Cooking Pot (pot cat 333) g. Cooking Pot (pot cat 123)

8.6.6 Buff Coarse Ware

The ware is coarse and gritty, hard and dark grey in colour (Figures 8.51 and 8.52).

Jars of this ware are heavy duty vessels with incurved, collared rim (sometimes with groove on the top of the rim) and external black slip, often with cordon and/or wavy cordon decoration. The complex rim forms vary from collared rims to incurved with single or double grooving lid-seat on the top of the rim.

Jugs are necked with flat base, strap handle and side spout. The external surface is often covered with grey, black or red-brown slip. These water jugs may be associated with ablution purposes.

Provenance: Bahrain or Iran

Dating: 18th century

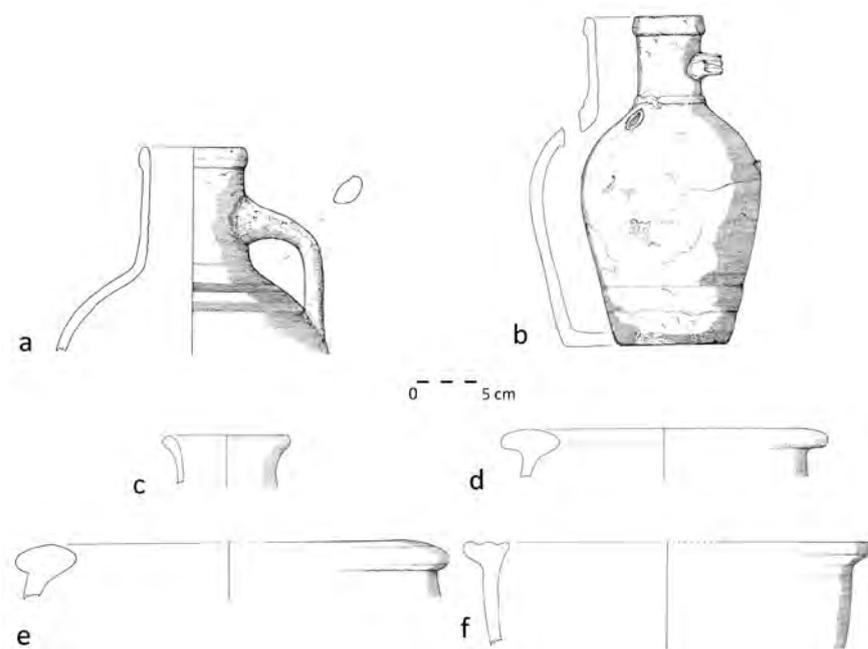


Figure 8.51: Buff Coarse Ware.

a. Jug (pot cat 440) b. Jug (pot cat 155) c. Jug (pot cat 255)
d. Jar (pot cat 268) e. Jar (pot cat 317) f. Jar (pot cat 451)



Figure 8.52: Buff Coarse Ware. Jar (pot cat 83)

8.6.7 Buff Sandy Ware

Ware with dark yellow sandy fabric. Recorded forms are cooking pot, carinated bowl and bowl. They are hand-made and undecorated (Figure 8.53).

Provenance: unknown

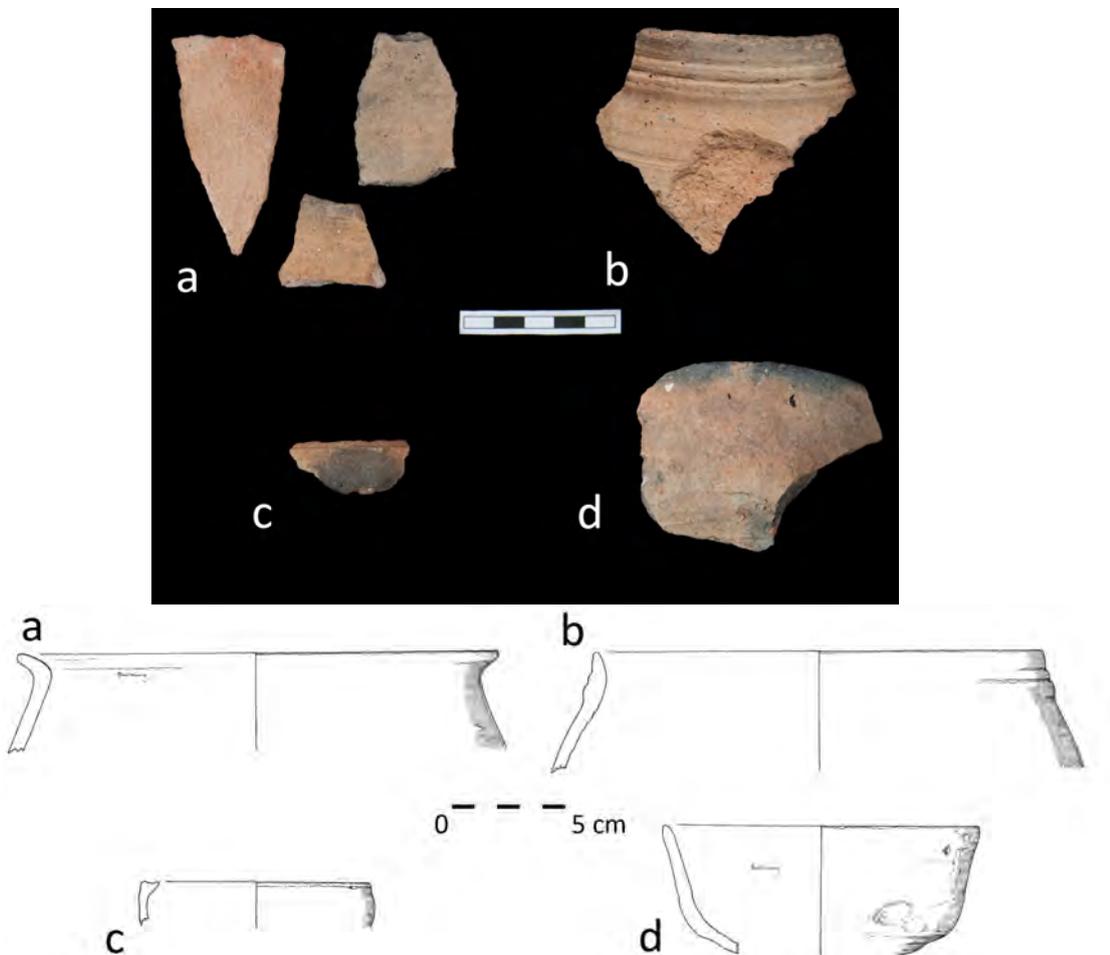


Figure 8.53: Buff Sandy Ware

a. Cooking Pot (pot cat 370) b. Cooking Pot (pot cat 369) c. Bowl (pot cat 385) d. Carinated Bowl (pot cat 391)

8.6.8 Coarse Brown Sandy Ware

The body type of this ware is coarse brown to orange, hard and sandy. Decoration consists of incised lines and marks with brown-grey external slip with metallic hue. Only three sherds were recorded under this category (Figure 8.54).

Provenance: unknown

Dating: likely 18th - 19th century



Figure 8.54: Coarse Brown Sandy Ware. Jar (pot cat 40)

8.6.9 Orange Hard Ware

The ware is dark orange, well-fired and hard (Figure 8.55). The sherds are most likely a part of a wheel-thrown jar and they are only residual. No parallels are known.

Provenance: unknown

Dating: likely 18th - 19th century

8.6.10 Oxidised Coarse Ware

The ware is very hard, very coarse, red-brown, and often the external surface has a creamy hue. The forms recorded at Freiha are jug and jar with flared neck and plain rim (Figure 8.56).

Provenance: unknown

Dating: 18th - 19th century



Figure 8.55: Orange Hard Ware. Jar (pot cat 16)



Figure 8.56: Oxidised Coarse Ware. Jug.

8.6.11 Oxidised Coarse Sandy Ware

This ware describes large storage jars with in-turned rim, small loop handles, basins and large bowls with thickened externally or in-turned rims; and flat lids (note that example p and r show a wavy impressed-line decoration) (Figures 8.57 to 8.60).

The ware is reddish or dark pink in colour, with a sand fabric with lime inclusions. Its appearance is very similar to the description of Lime (Lime-Tempered) Ware from the al-Mataf excavations (Kennet 2004: ware 79).

The Oxidised Coarse Sandy Ware has also been recorded in Bahrain and dated as a late Islamic period group. The ware is well-represented in the Freiha assemblage (2702 sherds recorded), with only 37 sherds found and recorded at Al Zubarah. Petrographic analysis of the material would be able to clarify the origin, which is most likely Bahrain.

A very similar lid was found in Qala'at Bahrain outside the Northern Semicircular Tower of the Islamic fortress in the upper layers of the excavation. It is described as red-brown gritty ware, and the lid is described as 'disc-shaped (...) with a center handle' (Frifelt 2001: 99). The lid from Freiha has two perforations and is decorated with incised/impressed wavy lines. Frifelt states that these lids 'fit the larger container with broad flat rim', possibly like these from Freiha (see Figure 8.58 e,f,g).

Frifelt suggests that this type of jar was used for supplies that needed airing (therefore the lids will have a number of perforations).

Provenance: likely Bahrain

Dating: early 18th century (latest date)

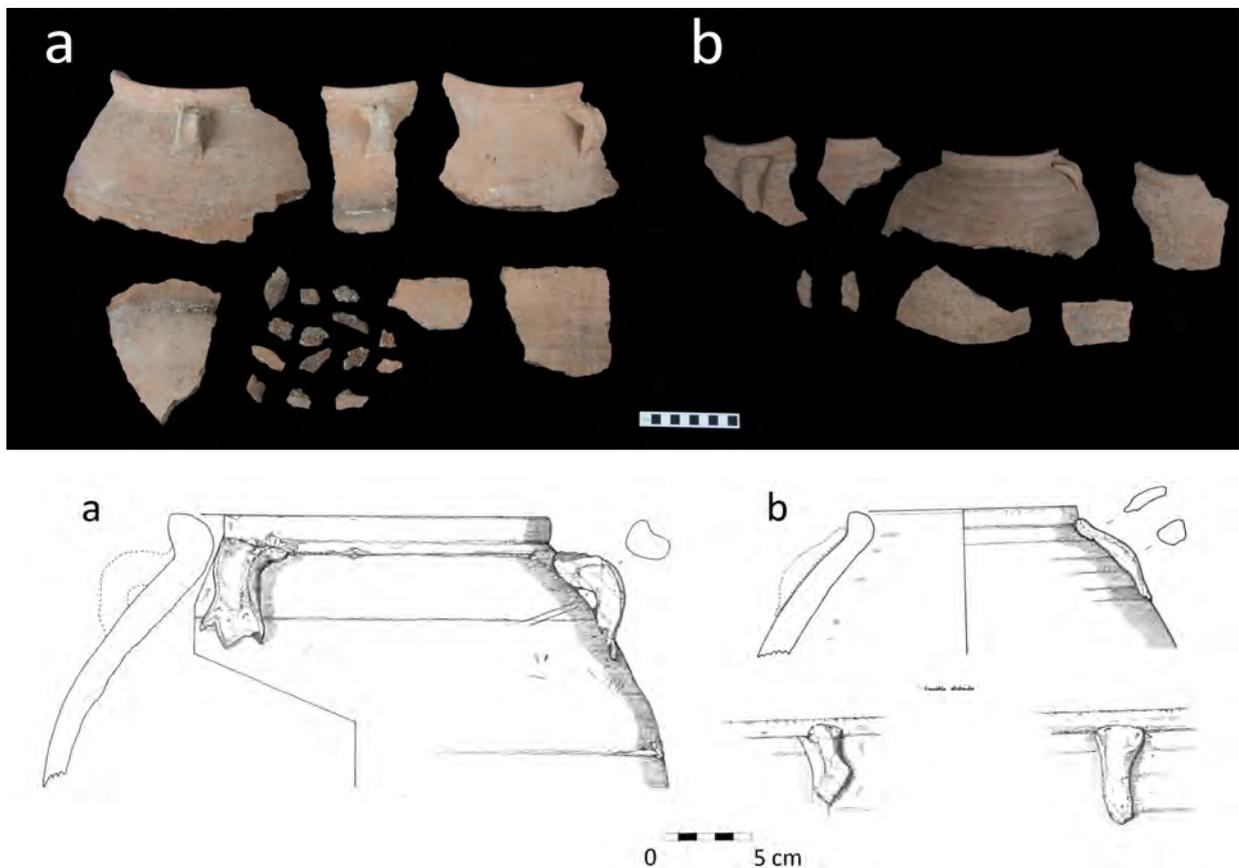


Figure 8.57: Oxidised Coarse Sandy Ware.
a. Jar (pot cat 152) b. Jar (pot cat 98)

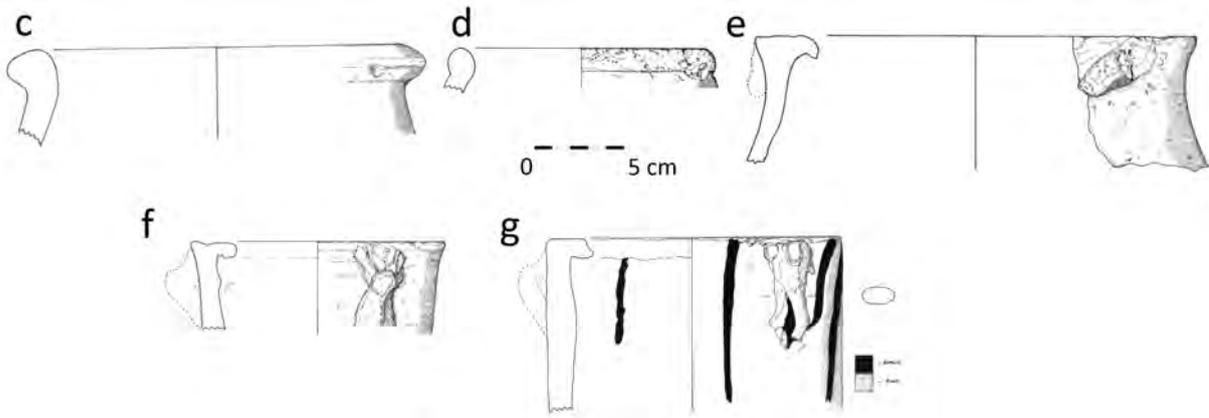


Figure 8.58: Oxidised Coarse Sandy Ware Jars.
 c. Jar (pot cat 19) d. Jar (pot cat 438) e. Jar (pot cat 439)
 f. Jar (pot cat 79) g. Jar (pot cat 289)

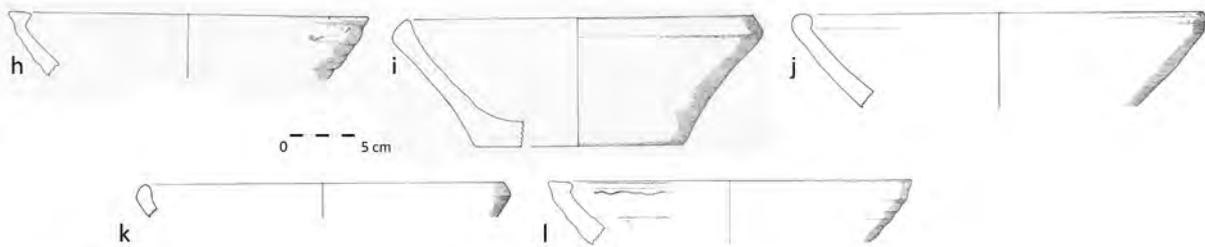
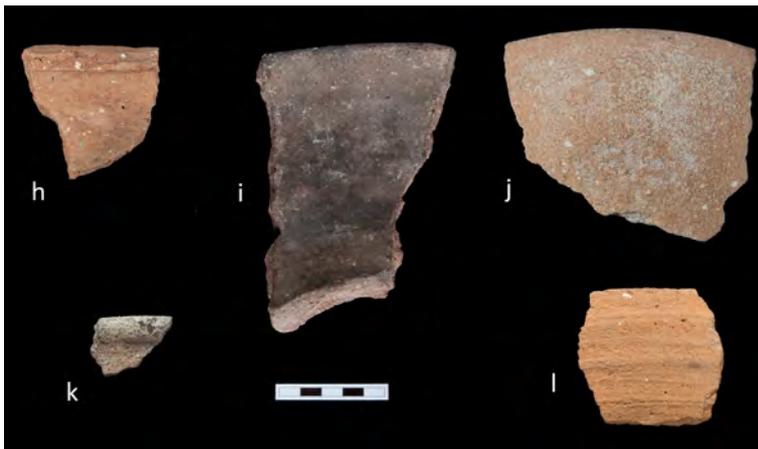


Figure 8.59: Oxidised Coarse Sandy Ware Bowls.
 h. Bowl (pot cat 33) i. Bowl (pot cat 56) j. Bowl (pot cat 232) k. Bowl (pot cat 262) l. Basin/Large Bowl

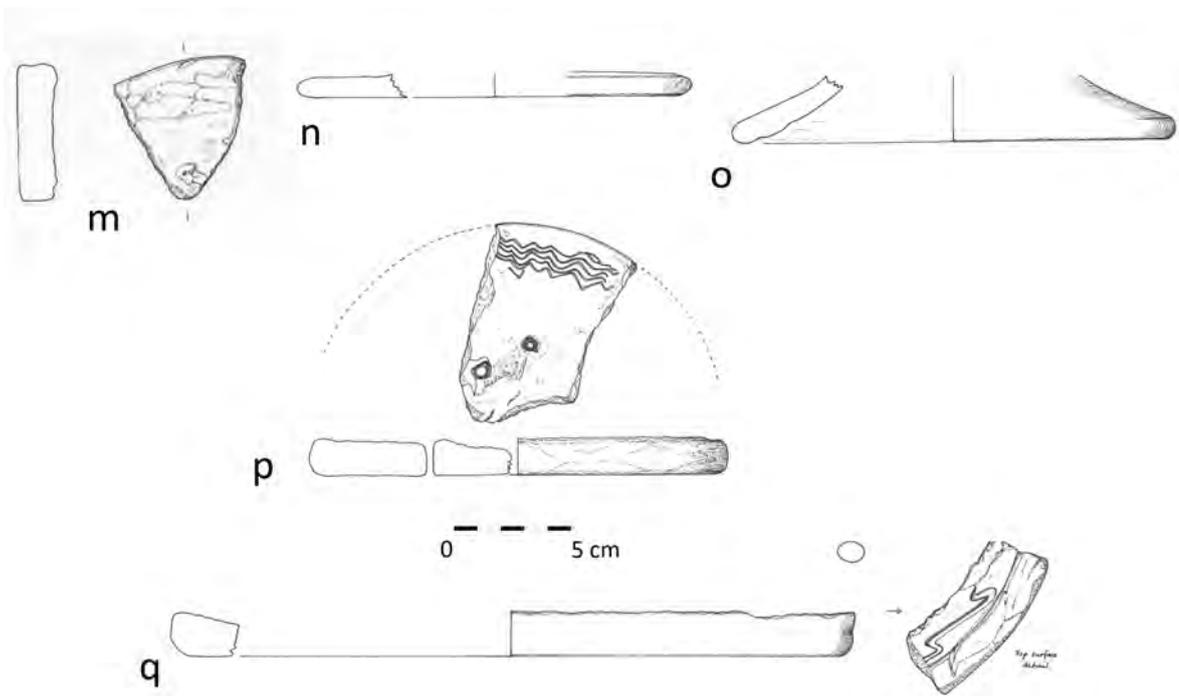


Figure 8.60: Oxidised Coarse Sandy Ware Lids.
 m. Lid (pot cat 96) n. Lid (pot cat 444) o. Lid (pot cat 376) p. Lid (pot cat 374) q. Lid (pot cat 66)

8.6.12 Coarse Orange Sandy Ware Speckled

The ware is coarse, orange and light creamy with speckles of round, light cream-coloured inclusions (Figure 8.61). The external surface is often covered with a creamy orange or slightly pink wash. The best examples of the sherds of this ware were found in a midden, and they are parts of cooking pots with a ledge rim. These vessels are wheel-thrown and often with horizontal incised lines on the external surface. Many of the sherds are sooted.

One sherd of a lid was found and recorded.

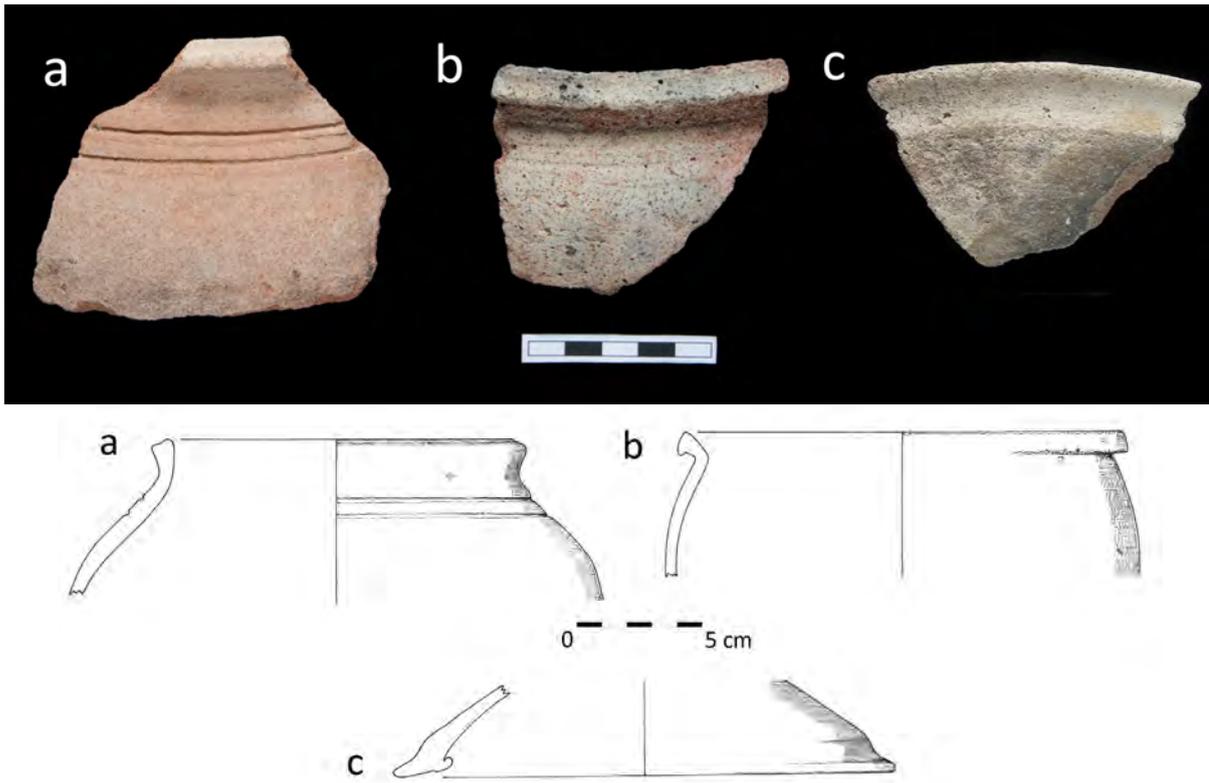


Figure 8.61: Coarse Orange Sandy Ware Speckled
 a. Cooking Pot (pot cat 73) b. Cooking Pot (pot cat 294) c. Lid (pot cat 280)

8.6.13 Reduced Coarse Ware

The origin of this ware could be Iran or Bahrain. The body is very coarse, very hard with large, ill-sorted black quartz inclusions, and a grey or dark grey fabric. The decoration is a black or dark grey slip (on the exterior surface of a vessel); combing and cordon decoration is also often present. Reduced Coarse Ware heavy duty jars are well represented in the Freiha assemblage. These wheel-made vessels could be compared with Reduced Coarse Ware found in Al Zubarah.

Forms recorded at Freiha are jar, heavy duty jar and basin (Figure 8.62).

Provenance: Iran or Bahrain

Dating: 18th century



Figure 8.62: Reduced Coarse Ware.
 a. Jar (pot cat 476). b. Basin (pot cat 301)

8.6.14 Tabun Ware

This is most likely a local ware, which is friable and light yellow in colour (Figure 8.63).

Tabun Ware vessels are very rare; their appearance is crude and they are hand-made. Normally this fabric is used in the construction of tabuns. Some of the rim sherds are decorated with impressed dots.

The form could be an incense burner or a bowl to store a charcoal for water pipes.

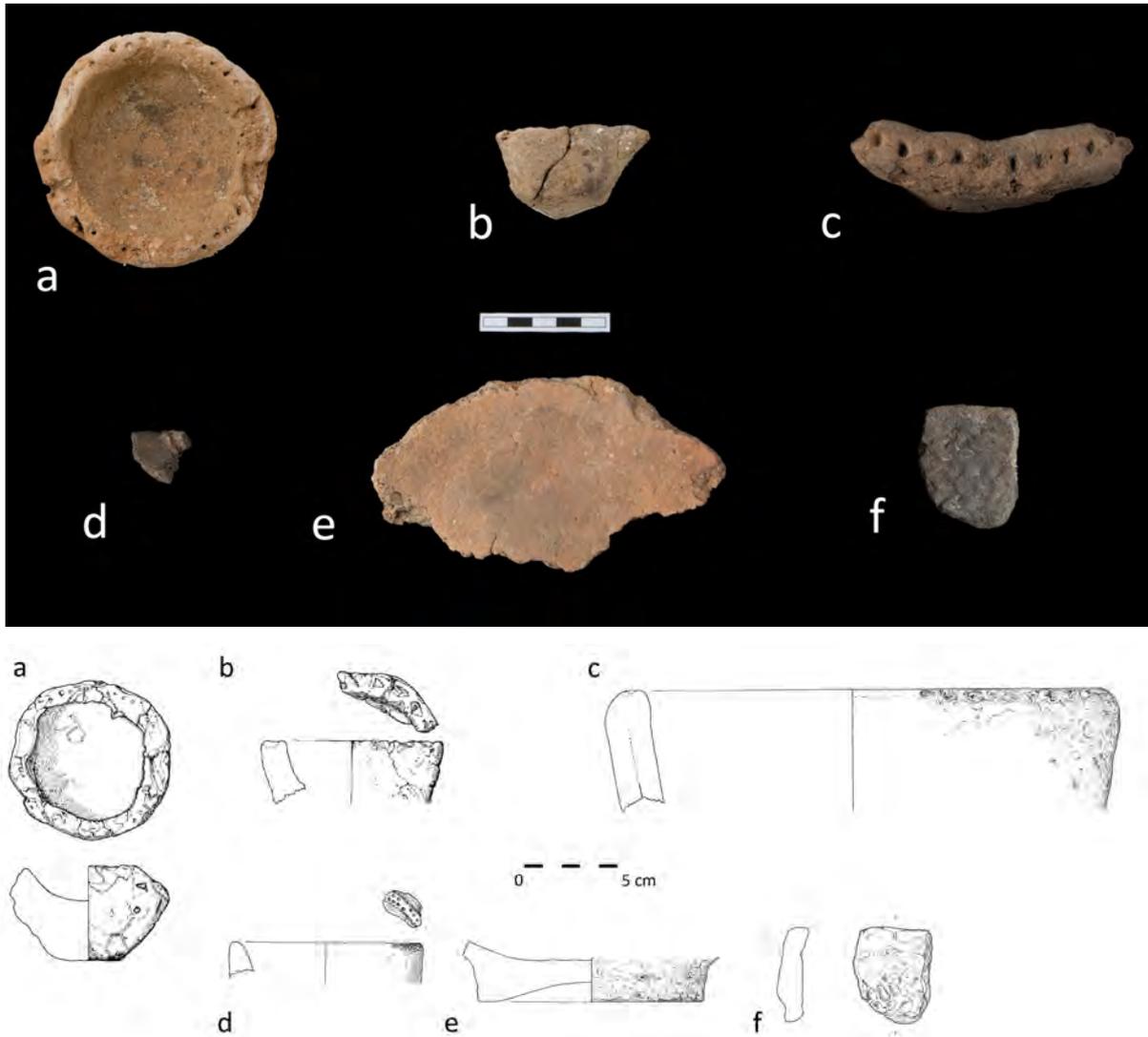


Figure 8.63: Tabun Ware.

a. Bowl (pot cat 153) b. Bowl (pot cat 441) c. Rim of unknown form (pot cat 228)
d. Rim of unknown form (pot cat 338) e. Flat Base Bowl (pot cat 293) f. Large Bowl (pot cat 348)

8.6.15 Brown Sandy Ware

The ware is sandy, dark orange/brown and very hard-fired. The main form produced from this ware is a water pipe burner of a flared shape and with incised zigzag-and-lines decoration. The internal surface is sooted. All found water pipe fragments (body sherds of jars, burner's bowls and necks) from Freiha are recorded in the Pottery Reference Collection (Figure 8.64).

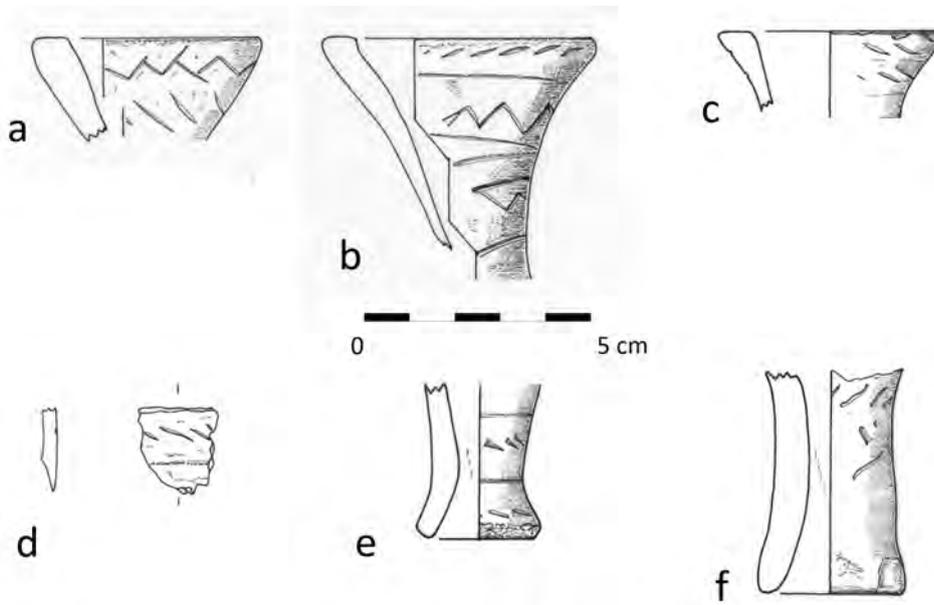
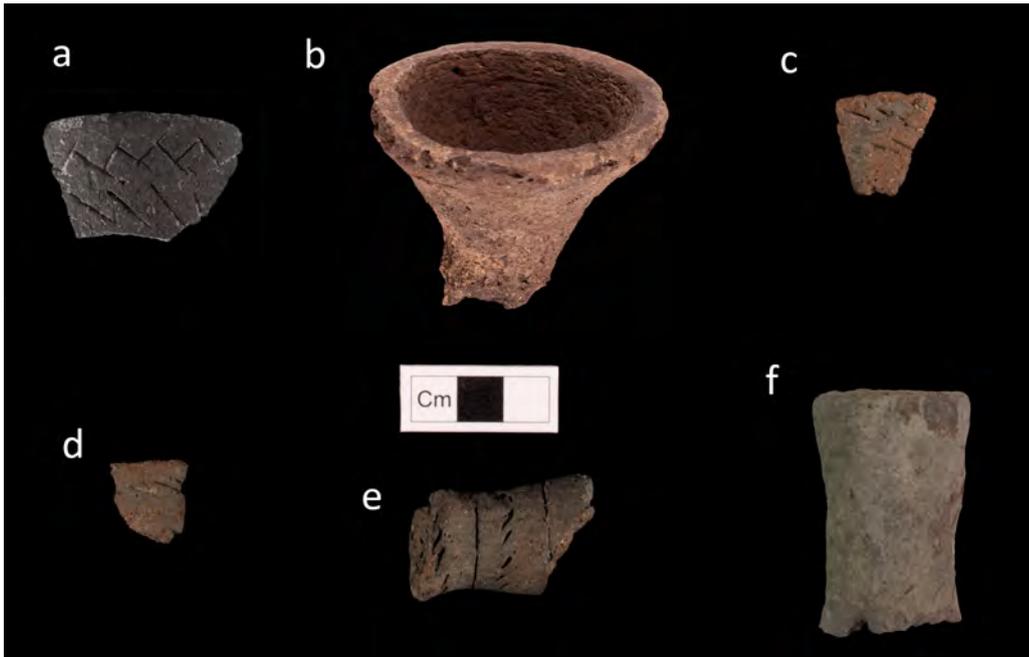


Figure 8.64: Brown Sandy Ware.

a. Burner's Bowl (pot cat 103) b. Burner's Bowl (pot cat 195) c. Burner's Bowl (pot cat 142)
d. Neck of Water Pipe (pot cat 313) e. Neck of Water Pipe (pot cat 277) f. Neck of Water Pipe (pot cat 248)

8.7 CONCLUSION

This report has concentrated on a ware type introduction, and consequently, a number of forms have not been included in the report. These are water pipes, tobacco pipes and gaming pieces, which are made from the main wares described above.

The next stage is to analyse the pottery stratigraphically.

9. FREIHA ARCHAEOICHTHYOLOGY

Lisa Yeomans

9.1 INTRODUCTION

During the autumn 2013 to spring 2014 season, archaeoichthyological research focused on the fish bone from Freiha. This report is a summary of the data by phase and space allowing integration of the evidence for fish utilisation with the results from other classes of material. Aside from the analysis of the fish bone from Freiha, work continued on the compilation of the fish reference collection and photographing the modern specimens for a forthcoming book on the identification of fish bones from the Arabian Gulf.

9.2 ANALYSIS OF FISH BONE FROM FREIHA

Research Questions, Data and Methodology

The analysed assemblage of fish bone was based on a list of priority loci provided by primary excavator Gareth Rees. For the most part these were occupation debris, midden deposits, pit fills, tannurs and fire pit fills as well as surfaces. The fish bone from 322 loci were recorded and, in total, this resulted in an assemblage size of 17,394 fish bones identified to species, genus, family or, on occasion, just class level. This provides a substantial dataset from which to address research questions; all phases of the occupation sequence are more than adequately covered by this material, although there is substantially more material from the latest phase of occupation.

The research questions that this data provides information to address include: Which fish were caught and how? How important were fish in the diet of the settlement's inhabitants? Where were people fishing? What processing methods were employed? What spatial and temporal differences exist in the utilisation of fish, and how do the fishing practices used at Freiha compare with Al Zubarah?

9.3 RELATIVE IMPORTANCE OF FISH THROUGHOUT THE STRATIGRAPHIC SEQUENCE

Fish was a major resource for Freiha, with the settlement located on the coast and surrounded by stone built intertidal fish traps. This is clearly demonstrated by a comparison of the total weight of fish to non-fish. Flotation samples are less likely to be biased by poor recovery; even dry sieving with a 4mm mesh results in the loss of the bones of the smaller species of fish. Two-thirds (66.0%) of the weight of bone analysed from the heavy residue is fish bone, suggesting that fishing was by far the most common method for the inhabitants of Freiha to obtain animal protein. Herding and hunting supplemented the diet.

Nevertheless, there is still evidence that the level of fishing activity varied through time. Figure 9.1 shows the total weight of analysed fish bones compared to non-fish bones from Phase 6 through Phase 1 (see Rosendahl 2013: 5 for a list of phases) and recovered by dry sieving. Figure 9.2 shows the weights when the bone was recovered by sorting of the heavy residue from flotation. The pattern is probably somewhat exaggerated in Figure 9.1, as non-fish bone is more likely to be recovered on-site using a 4mm mesh, and the difference between the two graphs highlights the importance of flotation to gain a full insight into the patterns of fish utilisation. Overall, however, the evidence suggests that fishing increased in importance during the occupation sequence.

Species Representation and other Evidence for Fishing Techniques

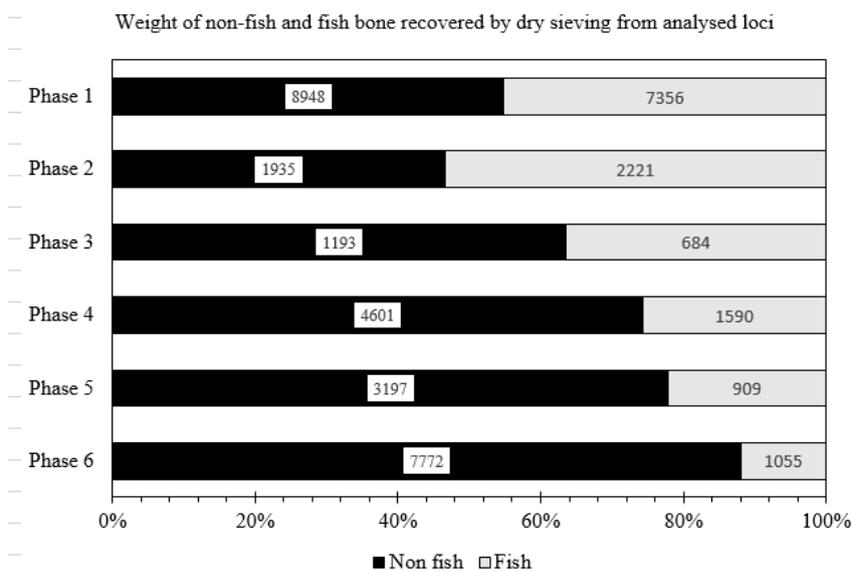


Figure 9.1: Total weight (grams) of non-fish and fish bone analysed by phase recovered by dry sieving using a 4mm mesh.

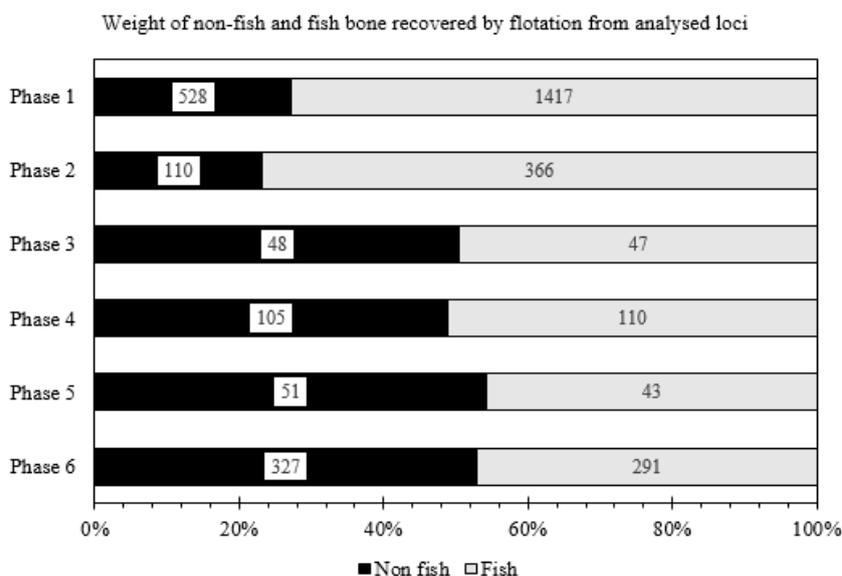


Figure 9.2: Total weight (grams) of non-fish and fish bone analysed by phase recovered from the heavy residue of flotation and sieved using a 1mm mesh.

Table 9.1 provides data on the number of identified specimens (NISP) for each phase of occupation at Freiha. Summarising this data by grouping the different species or genera within families and calculating the proportional representation of fish bones from each family makes it easier to see significant changes in the representation of fish. This data is shown in Table 9.2 and it is clear that, while overall the range of fish species caught did not alter substantially, there are certain phases when the targeted fish differ. The main difference is the high frequency of Scrombridae in Phase 6, which decrease substantially by Phase 5 and 4 and eventually become of minimal importance by the latest phase of occupation. Most of the Scrombridae identified are from the tuna tribe or kingfish (*Scomberomorus* spp.). Typically, these fish are caught in deeper waters, probably northeast of Qatar, suggesting that hook-and-line fishing in these areas was a common practice during the initial occupation of Freiha. Of particular interest is that the

analysis of the mammal bone (Bangsgaard this volume) has shown a high representation of sea mammals, including dolphin, during the earlier phases. It seems that fishermen venturing into the deeper waters off Qatar were hunting sea mammals as well as fishing for the large, seasonally available pelagic fish.

Throughout the occupation sequence, there is evidence that basket traps were a common fishing method. Species such as Lethrinidae, Scaridae and Serranidae are typically caught this way. While the Lethrinidae and Serranidae may also have been caught using hook and line, ethnographic evidence suggests that the use of basket traps was equally common (Bowen 1951). The basket traps would likely have captured other species as well, including Ariidae, Haemulidae and Pomacanthidae. Evidence from Al Zubarah (Yeomans forthcoming) and the evidence presented here suggest that at both sites fishing by basket traps was very common.

Freiha is surrounded by numerous stone-built intertidal fish traps, known locally as *hadrah* (Figure 9.3). Stratigraphically, these structures cannot be tied into the occupation sequence at Freiha,



Figure 9.3: Stone built intertidal fish trap (*hadrah*) off the coast from the settlement of Freiha.

but it may be possible to identify the catches of these structures within the archaeoichthyological record. Several species of fish commonly taken in these structures include the Belonidae and Mugilidae families. There is an increase in both of these species from Phase 3, with the exception of a low representation in Phase 1 of Mugilidae - but this is a reflection of a very high number of bones recovered from one locus (see below) affecting the overall representation of species in this phase. Other species such as those in the Siganidae family can be caught in intertidal traps but more commonly in basket traps. The Sparidae family is diverse but includes a number of littoral-zone-dwelling fish that can be caught by fish traps, for example yellowfin

seabream (*Acanthopagrus latus*), which inhabits the shallow inshore waters. Similarly, the juvenile king soldierbream (*Argyrops spinifer*) can be found in the shallower intertidal zone whereas the adults inhabit deeper water. One of the most notable differences in the assemblage from Freiha compared to Al Zubarah is the greater frequency of *Acanthopagrus* spp. in the former, whereas *Argyrops spinifer* is more common in Al Zubarah (Figure 9.4). In many respects, the local environment of these geographically close sites is very similar, so it seems unlikely that environmental differences could explain such a significant difference in the representation of these species of Sparidae. Unfortunately, it is not possible to separate the different species of *Acanthopagrus* spp. based on their osteology. Undoubtedly, bones of *Acanthopagrus bifasciatus* are represented in the assemblage, with this species found in the rocky reef areas also exploited by the well-represented parrotfish (Scaridae). The other two species within this genus (*Acanthopagrus berda* and *Acanthopagrus latus*) dwell in shallow waters. To examine the differences between Freiha and Al Zubarah further, Figure 9.5 shows the size distribution of *Argyrops spinifer* at the two settlements to assess if different catches could be associated with different fishing methods. The assemblage from Freiha clearly includes more of the smaller, juvenile fish which can be found in the shallow intertidal waters. This, however, is not a clear

		Phase					
		6	5	4	3	2	1
Alopiidae	<i>Alopias</i> spp.				1		5
Carcharhinidae	<i>Carcharhinus</i> spp.	21	4	5	10	17	116
Myliobatidae		2	1	3		7	42
Pristidae		2		4	1	5	23
Rhinobatidae							2
Sphyrnidae	<i>Sphyrma</i> spp.						1
Dasyatidae					1		
Chondrichthyes		2	1	1	2	5	7
Belonidae		65	15	35	30	95	332
Hemiramphidae			2		2	6	20
Chirocentridae	<i>Chirocentrus</i> sp.	1		1	3		1
Clupeidae		6		2	1	5	49
Mugilidae		8	1	12	19	94	100
Carangidae	<i>Alectis</i> spp.		1	1			
Carangidae	<i>Alepes</i> spp.	1					
Carangidae	<i>Atule mate</i>					1	
Carangidae	<i>Carangoides fulvoguttatus</i>	11	2				
Carangidae	<i>Carangoides</i> spp.	11	1	11	2	3	21
Carangidae	<i>Caranx</i> spp.		1	7			6
Carangidae	<i>Decapterus</i> spp.						25
Carangidae	<i>Gnathanodon speciosus</i>	2	5	19	3	2	
Carangidae	<i>Megalaspis cordyla</i>	2		2		8	1
Carangidae	<i>Scomberoides</i> spp.	13		10		10	7
Carangidae	Scads			1	3	5	9
Carangidae	Jacks, trevally or threadfin	3		6		6	8
Carangidae		4	6	63	7	12	23
Echeneidae	<i>Echeneis naucrates</i>			2		3	9
Gerreidae	<i>Gerres</i> spp.	12	6	11	10	102	171
Haemulidae		20	12	10	2	27	68
Haemulidae	<i>Pomadasys</i> spp.			1			
Labridae		3	6	1	1	1	9
Lethrinidae	<i>Lethrinus</i> spp.	290	191	288	179	916	2297
Lutjanidae	<i>Lutjanus</i> spp.	18	3	1	3	25	18
Nemipteridae		39	4	29	3	52	92
Pomacanthidae	<i>Pomacanthus</i> spp.	12	1	3	1	22	51
Rachycentridae	<i>Rachycentron canadum</i>		2				1
Scaridae		55	38	79	35	215	536
Scombridae	<i>Euthynnus affinis</i>						9
Scombridae	<i>Rastrelliger kanagurta</i>	1				2	3
Scombridae	<i>Scomberomorus</i> spp.	40	1	4	1	1	7
Scombridae	<i>Thunnus</i> spp.	9	11				
Scombridae (Thunninae)		77	23	45	11	29	63
Serranidae		157	153	181	84	238	1253
Siganidae	<i>Siganus</i> spp.	124	48	179	23	470	3281
Sparidae	<i>Acanthopagrus</i> spp.	57	66	74	65	157	411
Sparidae	<i>Argyrops spinifer</i>	16	16	18	14	118	253
Sparidae	<i>Rhabdosargus</i> spp.	14	25	21	20	53	109

		Phase					
		6	5	4	3	2	1
Sparidae		73	47	90	48	295	629
Sphyraenidae	<i>Sphyraena</i> spp.					1	7
Teraponidae	<i>Terapon</i> spp.	1					
Trichiuridae	<i>Trichiurus</i> spp.			1			
Paralichthyidae	<i>Pseudorhombus</i> spp.				1	1	4
Platycephalidae	<i>Platycephalus</i> spp.			1		1	4
Ariidae	<i>Arius</i> spp.	16	17	15	24	216	325
Tetraodontidae							1
Triacanthidae						1	
Unidentified					1	2	10
	TOTAL	1167	706	1232	600	3212	10298

Table 6.1: Number of identified specimens (NISP) of fish bones subdivided by phase.

	Phase					
	6	5	4	3	2	1
Chondrichthyes	2.27	0.85	1.05	2.45	1.05	1.88
Belonidae	5.47	2.11	2.83	4.91	2.94	3.19
Hemiramphidae		0.28		0.33	0.19	0.19
Chirocentridae	0.08		0.08	0.49		0.01
Clupeidae	0.51		0.16	0.16	0.15	0.47
Mugilidae	0.67	0.14	0.97	3.11	2.91	0.96
Carangidae	3.96	2.25	9.70	2.45	1.46	0.96
Echeneidae			0.16		0.09	0.09
Gerreidae	1.01	0.85	0.89	1.64	3.16	1.64
Haemulidae	1.68	1.69	0.89	0.33	0.84	0.65
Labridae	0.25	0.85	0.08	0.16	0.03	0.09
Lethrinidae	24.41	26.90	23.28	29.30	28.37	22.05
Lutjanidae	1.52	0.42	0.08	0.49	0.77	0.17
Nemipteridae	3.28	0.56	2.34	0.49	1.61	0.88
Pomacanthidae	1.01	0.14	0.24	0.16	0.68	0.49
Rachycentridae		0.28				0.01
Scaridae	4.63	5.35	6.39	5.73	6.66	5.14
Scombridae	10.69	4.93	3.96	1.96	0.99	0.79
Serranidae	13.22	21.55	14.63	13.75	7.37	12.03
Siganidae	10.44	6.76	14.47	3.76	14.56	31.49
Sparidae	13.47	21.69	16.41	24.06	19.29	13.46
Sphyraenidae					0.03	0.07
Teraponidae	0.08					
Trichiuridae			0.08			
Paralichthyidae				0.16	0.03	0.04
Platycephalidae			0.08		0.03	0.04
Ariidae	1.35	2.39	1.21	3.93	6.69	3.12
Tetraodontidae						0.01
Triacanthidae					0.03	
Unidentified				0.16	0.06	0.10

Table 9.2: Proportional representation of fish of different families by phase.

division because the larger adult fish of this species would have been taken in the basket traps or by hand and line and still be represented in the overall assemblage. It is suggested that the smaller *Argyrops spinifer* in Freiha may have been caught in the intertidal fish traps along with the other inshore dwelling species of Sparidae. This would also explain the difference in frequency of these two groups of Sparidae to the numerous shallow water dwelling fish caught at Freiha in the intertidal traps.

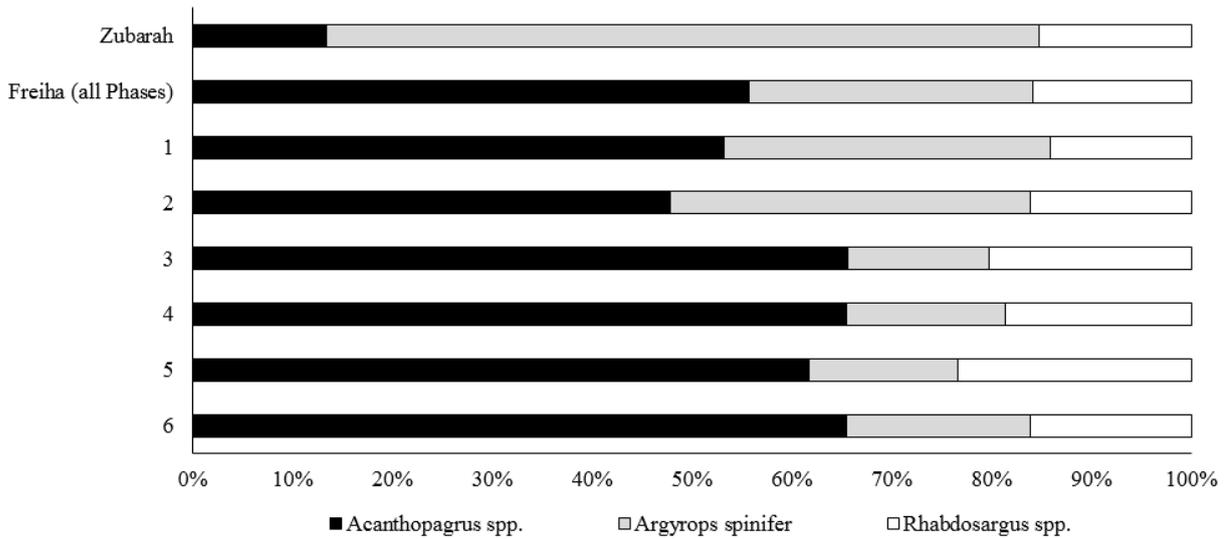


Figure 9.4: Percentage representation of the different species of Sparidae throughout the stratigraphic sequence at Freiha and compared to Al Zubarah.

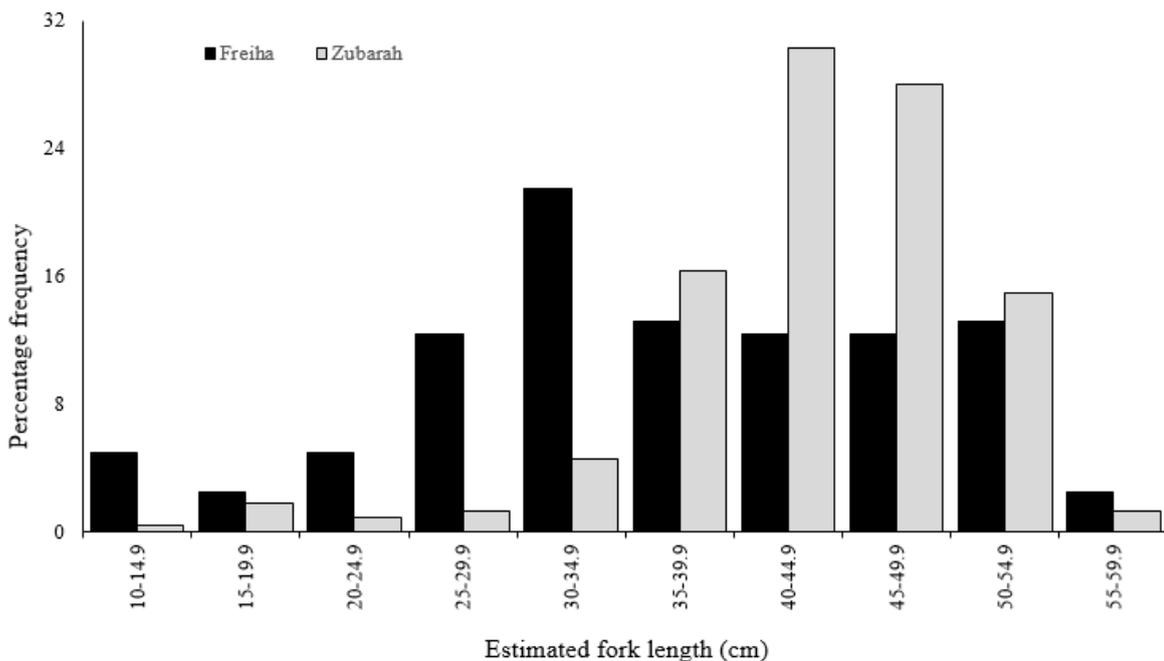


Figure 9.5: Estimated size distribution of kingsoldier bream *Argyrops spinifer* represented in the assemblage from Al Zubarah and Freiha calculated using the regression formulae.

Overall, it is difficult to tease apart the evidence for the different fishing methods; many fish can be caught in a number of ways, and there is the difficulty of being able to separate the osteology of fish to individual species. Fish, even within the same genus, can have significantly different habitat requirements. However, there is a very clear sign of decline in the hook-and-line method for pelagic fishing in the later phases of occupation at Freiha, and this change matches the decrease in sea mammal exploitation. The use of basket traps seems to have been the most common fishing practice, and intertidal fish traps also seem to have been used throughout the sequence. The intertidal traps may have replaced the use of beach seines over time, as both methods provide access to inshore fish.

Environments Exploited

The marine environments exploited by the fishermen of Freiha varied substantially. As already mentioned, there is evidence for the fishing in the deeper waters probably to the northeast of Qatar for pelagic fish especially in the early phases of occupation. The coral reef habitats were frequently fished with basket traps and probably also hand lines, with numerous reefs within the vicinity of the site located just offshore as well as further afield (Figure 9.6). Inshore waters would have been exploited by the intertidal fish traps, and beach seines and casting nets would also have been used in this zone. Previously it had been suggested that the areas of the seafloor covered with muds (Figure 9.7) were not extensively exploited during the occupation of Al Zubarah, as only a few bones of fish (such as the *Platycephalidae* (flathead)) inhabiting these areas were found in the assemblage. It seemed that the *Ariidae* (sea catfish) species were more likely to be those found close to reefs (*Arius thalassinus*), despite this species being less common in the Arabian Gulf. In the faunal assemblage analysed so far from Al Zubarah, no cranial bones were complete enough to allow identification to species level. Several complete or almost complete crania from Freiha can, however, be identified as *Arius bilineatus* (Figure 9.8). These indicate that either the fishermen were setting basket traps on the muddy sea floor areas or that this species of catfish was not confined to those areas of the seabed and had a wider ecological habitat than suggested. The second of these suggestions seems more probable, as a lack of *Platycephalidae* bones in the Freiha assemblage still suggests minimal exploitation of muddy sea floor areas, and the distribution of the various species of catfish suggested by Hassan et al (1988) was based on a study of catfish in Kuwaiti waters. The marine environments exploited by the fishermen of Freiha and Al Zubarah using basket traps would have preferentially been the coral reef areas as they support a greater density of fish. Catfish (*Arius bilineatus*) were frequently caught, suggesting that they were common in the favoured fishing grounds.

Analysis of the Fish Bones by Phase and Space

Six phases of occupation were identified from the stratigraphic sequence, and a full discussion of the archaeoichthyological remains by Phase and Space is summarised here. It is worth mentioning here that Space 60 is the earliest stratigraphically and associated with the construction of the large courtyard building in Phase 6. Most of the faunal remains derive from the various fills of two large pits containing faunal material, which are very different to the rest of the material from the site in general. Several kingfish and tuna (Figure 9.9) are represented as well as sea mammals, and it is the faunal remains from this Space that provides the high representation of deep-water pelagic fish discussed above. It seems that there was a very different subsistence strategy employed at the very earliest phase of occupation. Does this reflect the resources brought to the settlement upon the initial occupation, or do these features actually represent an earlier phase of settlement before the relatively consistent subsistence patterns were established? This is an area that needs clarification through further analysis of the stratigraphy and any material evidence that can be dated.

Many of the archaeoichthyological remains recovered from Freiha are from loci containing mixed faunal remains and are, as such, not indicative of specific activities. The material appears to

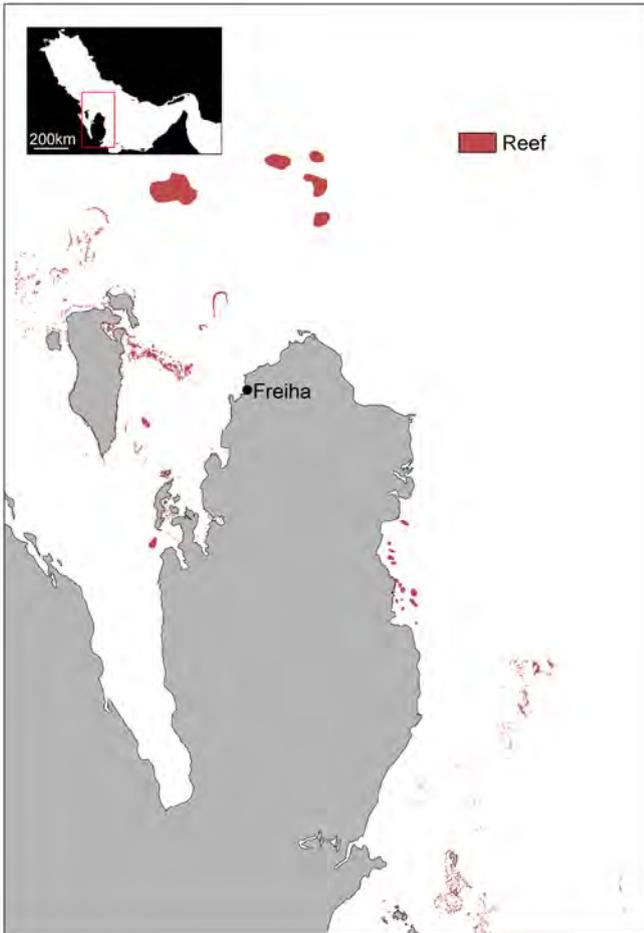


Figure 9.6: Map showing the location of Freiha and the distribution of coral reefs around Qatar.

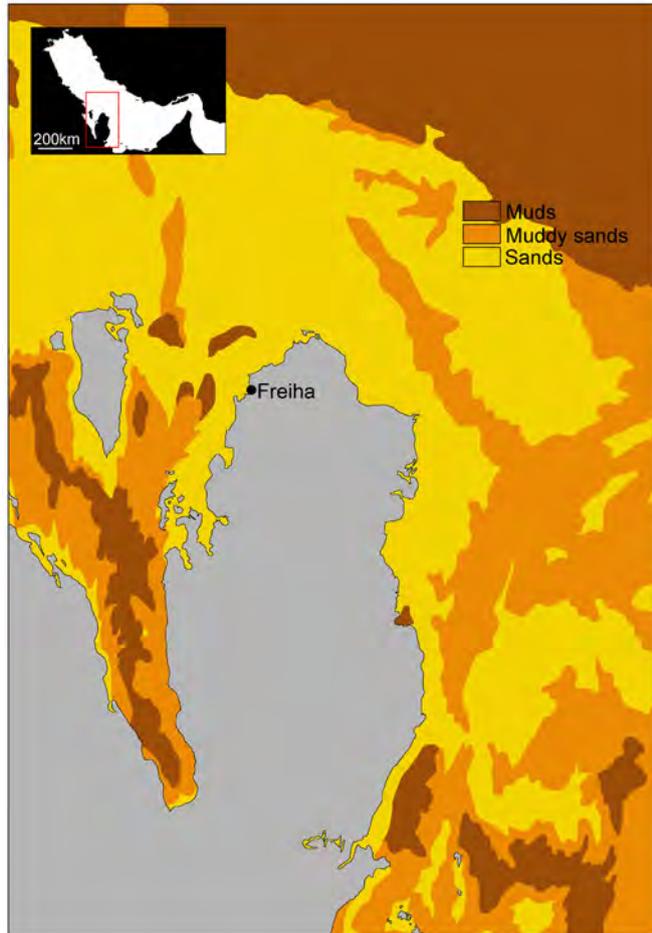


Figure 9.7: Map showing the location of Freiha and the sea floor types around Qatar.



Figure 9.8: Crania of catfish that can be identified to species level and indicate the presence of *Arius bilineatus*.

have been redeposited to a certain extent and has been trampled around during the occupation of the settlement and redeposited onto the midden areas. Overall, the general pattern of fishing can be reconstructed, with basket traps seemingly the most commonly used fishing method and further catches produced in the intertidal fish traps. However, it has not often been possible to clearly identify spatial patterns to the distribution of fish remains by method, with the exception of Spaces 12 and 14, the occupation of which in Phase 2.2 seems to have been dominated by fish caught in the fish traps. The remains from Space 60 in Phase 6 were also very different, with frequent pelagic fish in the same contexts as numerous sea mammals; this is an area that needs further investigation. In Phase 1, Space 13 and the adjacent area of the courtyard (Space 84) probably functioned as an area where fish were prepared. The presence of pits used for storage of fish is of particular interest, but there is no pattern evident to the spatial distribution of these features.

Fish Preparation and Cooking

Very few of the fish bones display any evidence of butchery, as cut marks are very rare. Cutting into the bone when using a knife will damage the blade, so a careful fishmonger will avoid the bones. This differs from the evidence from the mammal bone, which displays a large number of cut marks (Bangsgaard this volume), and the difference between the two patterns needs further consideration. Figure 9.10, showing the dentary of a large golden trevally (*Gnathodon speciosus*)



Figure 9.9: Tuna and kingfish dentary bones from pit fill in Space 60.

with deep cut marks on the ventral margin, is one of the few examples of visible butchery marks. These were probably caused when the knife strokes used to slit open the underside of the fish for gutting continued through the head, catching the dentary bones.

The fills of tannurs and fire pits contain a mixture of bone that accidentally fell into these installations whilst the fish were being cooked, and ended up burnt due to their proximity to hot embers. Bones displaying burning (Figures 9.11 and 9.12) are clearly from the use phase of the tannurs and fire pits, with unburnt bones present as secondary material. Overall, there is not much burnt bone in such features as they only occur when parts of the cooking fish were accidentally dropped into the embers. Combining the occurrence of burnt bones from all phases and spaces can provide the range of species cooked in the tannurs and fire pits (Table

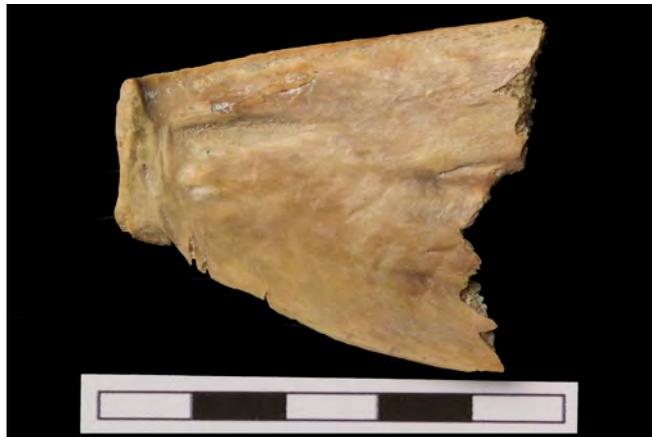


Figure 9.10: Dentary of a golden trevally (*Gnathodon speciosus*) displaying cut marks.



Figure 9.11: Burnt catfish (*Arius* spp.) from the fill of a tannur in Phase 4.3.



Figure 9.12: Emperor fish, threadfin bream and needlefish bones at different burning stages recovered from the fill of a tannur from Phase 6.

9.3), but not much information on the frequency of species can be extracted due to the limited presence. The best evidence for this is from the occupational debris that accumulated in and on the surfaces within the different spaces of use. It is clear from the lack of burnt bone recovered from occupation debris and middens that, as at Al Zubarah, the cooking installations were not, as a rule, cleaned out and reused. Once a tannur or fire pit had become too full of ash for use, the upper part was infilled and a new installation constructed.

Family	Species	Number of Burnt Bones from tannur and fire pit fills
Carcharhinidae	Carcharhinus spp.	2
Chondrichthyes		1
Belonidae		9
Hemiramphidae		2
Chirocentridae	Chirocentrus spp.	3
Clupeidae		5
Haemulidae		2
Lethrinidae	Lethrinus spp.	46
Mugilidae		2
Myliobatidae		1
Nemipteridae		10
Pomacanthidae	Pomacanthus sp.	1
Scaridae		34
Serranidae		8
Siganidae	Siganus spp.	68
Sparidae	Acanthopagrus spp.	3
Sparidae	Argyrops spinifer	1
Sparidae	Rhabdosargus sp.	1
Sparidae		11
Ariidae	Arius spp.	10
Platycephalidae	Platycephalus sp.	1

Table 9.3: Number of bones at various stages of burning from the fills of firepits and tannurs.

Summary of the Evidence for Fish Storage

Throughout the stratigraphic sequence of Freiha, numerous pits were excavated. In Space 28 during Phase 1.4, a pit [1123] measuring 0.55m in diameter with a depth of 0.50m contained thousands of bones of small fish. The most likely explanation for the large numbers of small fish is they were stored in a salted and dried state to be consumed at a later date but never returned to. In Oman, filleted whole fish are salted and dried in the sun before being stored in palm leaves and/or sacks buried in pits for consumption in future months (EIMahi 2000). The upper fill of [1123] was comprised of 25% mortar and seems to have been used to cap the buried fish stored in the lower portion of the pit. The pit would have been sufficient to store hundreds of preserved fish and the large stones present in the lower fill would probably have been to fill in the voids between batches of dried fish. In total this feature contained 2918 identified fish bones, with rabbitfish (*Siganus* spp.) the most dominant species represented by far with a minimum of 133 individuals based on the representation of skeletal elements. Given that only a portion of the pit was sampled for flotation and the size of rabbitfish bones biases against their recovery when dry sieving with a 4mm mesh, it seems likely that originally this feature contained substantially more fish, perhaps several hundred. Other small species are present, but rabbitfish form over 78% of the NISP and 83% of the MNI (minimum number of individuals). All of the fish are small in size and easy to dry. It is also interesting that the fish are those often caught in the intertidal traps and the drying and storing of fish caught by this method may have been done when an exceptional yield had been obtained. This is just one of a number of

features used for the storage of dried, salted fish that have been excavated.

It had been previously suggested that some of these features at Al Zubarah may have been storage pits that were subsequently reused for rubbish disposal (Yeomans 2013: 53). Five pits at Freiha had remains of stored fish inside, demonstrating that this was the case. Table 6.4 provides summary information of these features. Aside from the composition of the archaeoichthyological remains deriving from a large number of fairly complete and well-preserved fish all of a similarly small size, the pits frequently contained numerous large rocks. The two exceptions are pit [2210] (Space 34, Phase 4.4), which appears to have been used mostly for the storage of rice with only a few fish alongside, and pit [612] (Space 14, Phase 2.2), which appears to have been largely emptied of its cache. The rocks may have been used to backfill the pits, allowing the level of

Phase	Cut	Filled by	Measurements	NISP
4.4	[2210]	Two fills (2211) and (2215) dominated by rice husks. Fish in the lower fill.	0.3 x 0.27m x 0.44m	116
4.3	[2196]	Fill (2195) contained frequent rocks.	0.25m x 0.25m x 0.3m	97
2.2	[612]	Course sand and shell fill (613).	0.4m x 0.4m x 0.2m	76
1.4	[1123]	Lower fill (1567) contained frequent rocks and fish bones and capped by (1119).	0.55m x 0.55m x 0.5m	2918
1.3	[1925]	Fill (1924) contained frequent rocks.	0.44m x 0.44m x 0.55m	203

Table 9.4: Summary information on five fish storage pits.

stored fish to be reached quickly each time the pit was reopened, and perhaps they also acted as a deterrent to burrowing rodents.

Table 9.5 provides the NISP from the fills of the fish storage pits; whilst some of the fish bones represented by only one or two specimens are probably intrusive, most of the remains derive from a few types of fish. Rabbitfish (Siganidae) were by far the most frequently stored species, but needlefish (Belonidae), Mojarra (Gerridae), small grunts (Haemulidae), small emperor fish (*Lethrinus* spp.), threadfin bream (Nemipteridae), parrotfish (Scaridae), small groupers (Serranidae), various species of seabream (Sparidae) and small specimens of catfish (*Arius* spp.) were dried and salted for storage too.

The fish represented in the fills of the storage pits are generally small: both small species and small specimens of generally larger species. This is demonstrated very clearly by comparison of the estimated fork length of *Lethrinus* (spp.) from the storage pits to the rest of the loci from Freiha regardless of phase or space (Figure 9.13). The method of size estimation of Lethrinidae was presented in last season's report (Yeomans 2013) but has been updated to use power regression curves. A couple of larger Lethinidae bones from the storage pits probably represent intrusive bones, with most of the fish between 8 and 22cm in size. There is evidently a deliberate selection of the smaller fish chosen for drying and storage; larger fish would take too long to become desiccated enough, with the flesh starting to rot before they were sufficiently dry to be kept. The selection of fish to be stored in the pits probably was not based species but on size, with rabbitfish (*Siganus* spp.) a particularly good size for storage. Examination of the skeletal element representation of the rabbitfish from pit [1123] shows that some of the more delicate bones of the skull are less common than would be expected if whole fish were present. It is suggested that the fish were whole when stored in the pits, having probably been split open, salted and sun-dried as in the method described by ElMahi (2000). The biased skeletal element representation is a factor of preservation, recovery and identification issues and there is no evidence to suggest that anything other than whole fish were stored.

9.4 CONCLUSIONS AND FURTHER RESEARCH

In summary, there is good evidence for the extensive use of the marine environment by the

Family	Species	Pit Fill				
		613	1567	1924	2195	2215
Carcharhinidae	Carcharhinus sp.			1		
Belonidae		3	87		2	
Clupeidae			2			1
Mugilidae			1			
Gerreidae	Gerres spp.	1	23	1		
Haemulidae			27			
Hemiramphidae				1		
Lethrinidae		8	230	42	15	8
Lutjanidae	Lutjanus sp.			1		
Nemipteridae			15	2		
Pomacanthidae	Pomacanthus sp.					1
Scaridae		2	5	15		
Scombridae (Thunninae)				1		
Serranidae		1	75	8	15	30
Siganidae	Siganus spp.	59	2288	116	55	73
Sparidae	Acanthopagrus spp.		6	5	1	1
Sparidae	Argyrops spinifer		24		1	
Sparidae		2	66	5	8	2
Sparidae	Rhabdosargus spp.		3			
Ariidae	Arius spp.		64	4		
Unidentified			2	1		
	TOTAL	76	2918	203	97	116

Table 9.5: NISP from fills of pits interpreted as fish storage pits.

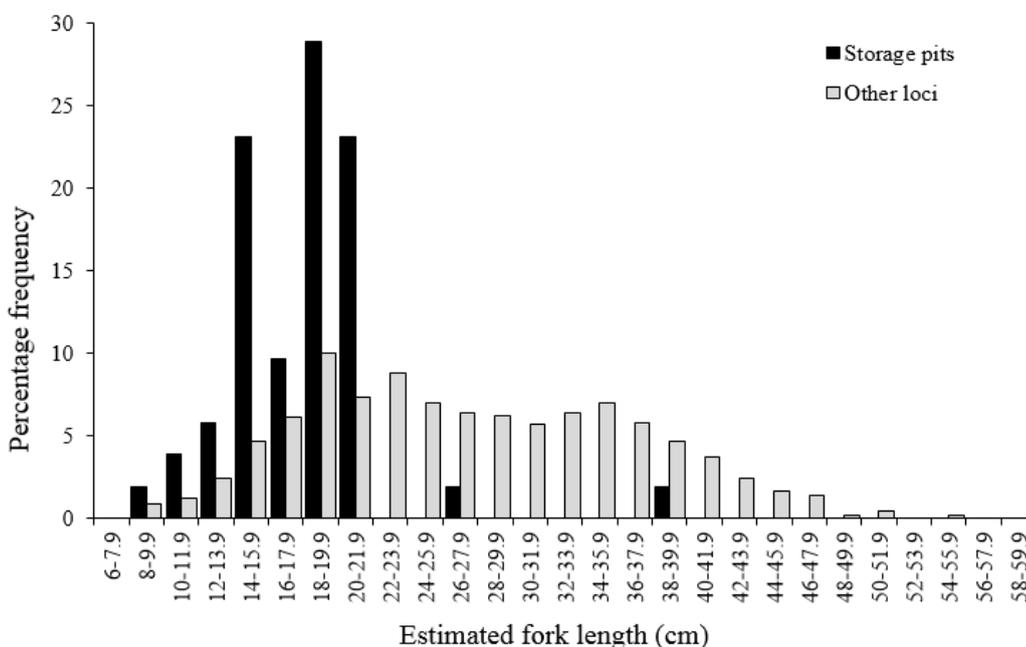


Figure 9.13: Proportion representation of estimated sizes of Lethrinus spp. from fills of storage pits compared to other loci.

inhabitants of Freiha, exploiting the local fish stocks with the use of basket and intertidal fish traps. This utilisation increased over time as additional intertidal traps were constructed, and the substantial yields of fish caught would have been partially salted and dried for medium-term consumption. Overall, a wide range of fish were caught and consumed through the variety of fishing methods employed. Further research is needed on the other evidence from Space 60



to better understand the nature of this early phase of occupation. The next stage should be the publication of the archaeoichthyological remains from Freiha, focusing on the archaeologically unique evidence for fish storage in pits. Osteometric analysis of the remains also provides clear evidence for the differential exploitation of intertidal and inshore fish at Al Zubarah and Freiha, providing further evidence of slightly differing fishing strategies at the two sites as a result of the immediate environmental characteristics. In the future, extending the range of species for which it is possible to provide such osteometric analysis will further aid in the interpretation of the archaeoichthyological remains. The detailed analysis of space and phase distribution, at this stage, is less informative regarding differences in consumption practices, but this avenue of research may become more fruitful with integration of the other archaeological evidence.



10. ARCHAEOZOOLOGY - FREIHA

Pernille Bangsgaard

10.1 INTRODUCTION

Zooarchaeological analysis of all (non-fish) faunal remains was begun in spring 2014 with three weeks of identification work focused on the assemblage from Freiha. The data summarised here are preliminary results, with approximately one third of the priority loci having currently undergone analysis. A full analysis of the assemblage will be completed by spring 2015.

The analysis has revealed a high number of domesticates, mainly sheep and goat, along with dromedary, cattle and equids. The assemblage also includes a long list of wild species, illustrating diverse usage of the surrounding hinterlands - marine, coastal and desert alike. A first attempt at a chronological analysis has revealed some interesting trends, including a dominating presence of marine species in the earlier phases of occupation.

10.2 RESEARCH QUESTIONS AND METHODOLOGY

This initial work had two primary goals: the setting up of a database with appropriate information for further analysis, and an expansion of the comparative collection of modern skeletons, which currently includes some 50 skeletons of terrestrial and marine mammals, birds and reptiles.

In time, it is envisioned that the non-fish assemblage from Freiha will be able to answer a number of research questions, naturally in cooperation with any results of the archaeoichthyological analysis (Yeomans this volume). These research questions include the following: what species were bred, hunted and fished at the site? What does this distribution tell us about the daily lives of the inhabitants of Freiha? The zoological evidence will also address the use-pattern of the surrounding coastal, marine and desert hinterland. The basis for these and other research questions is a full and exhaustive registration of all the non-fish species from the priority locus list.

10.3 SPECIES DISTRIBUTION AT FREP04

Currently 3,382 fragments (approximately 10.5 kilograms) have been analysed from the Freiha priority loci. The current faunal assemblage represents less than half of the Freiha collection; the remaining material is a diverse assemblage of fish remains. Both in number of identified fragments (NISP), in volume and weight of bones, the fish remains dominate the total Freiha collection. It is therefore clear that fishing was of paramount importance to the inhabitants of Freiha, and fish likely represent the main source of protein (Yeomans this volume). It is within this framework that the analysis of the non-fish assemblage has to be understood.

During the initial analysis, seven domesticates and 17 wild species, genera or families have been identified (Table 10.1). In the following sections each of these species will be briefly described.

10.3.1 Domesticates

The group of domesticates account for most of the fragments. The group includes seven species, which supplied the inhabitants with meat and possibly secondary products such as milk and hides, or served a less tangible purpose, such as transportation or pest control. Among the unspecified fragments is a large group of ungulate bones of medium and large size. This group

	NISP	Weight of Fragments (in g)
Domesticates		
Cattle, <i>Bos taurus</i>	31	354
Horse/donkey, <i>Equus</i> sp.	16	165
Sheep, <i>Ovis aries</i>	107	850
Goat, <i>Capra hircus</i>	64	426
Goat/sheep, <i>Capra hircus/Ovis aries</i>	631	2352
Dromedary, <i>Camelus dromedarus</i>	49	1781
Dog, <i>Canis familiaris</i>	12	41
Cat, <i>Felis domesticus</i>	6	12
Wild Mammalian Species		
Gazelle, <i>Gazella</i> sp.	14	49
Arabian oryx, <i>Oryx leucoryx</i>	2	6
Hedgehog, <i>Erinaceidae</i> sp.	1	0
Sand hare, <i>Lepus capensis</i>	3	1
Fox, <i>Vulpes</i> sp.	2	1
Carnivore, <i>Carnivora</i> sp.	6	11
Avian Species		
Cormorants, <i>Phalacrocorax</i> sp.	38	59
Hérons, <i>Ardeidae</i> sp.	4	8
Gulls, <i>Laridae</i> sp.	6	5
Doves & pigeons, <i>Columbidae</i> sp.	4	0
Pheasants & Partridges, <i>Phasianidae</i> sp.	37	33
Birds, <i>Aves</i> sp.	85	46
Marine Species		
Dugong, <i>Dugong dugon</i>	1	41
Ocean dolphins, <i>Delphinidae</i> sp.	8	146
Sea mammals	12	428
Sea turtles, <i>Cheloniidae</i> sp.	11	40
Rodent Species		
Rat, <i>Rattus</i> sp.	9	1
Mice & rats, <i>Muridae</i> sp.	14	0
Unspecified		
Large ungulate sp.	30	369
Medium ungulate sp.	249	341
Ungulate sp.	53	93
Unidentified	1877	2884

Table 10.1: Number of identified specimens (NISP) and weight of fragments for all faunal species at Freiha identified during the 2014 study

of bones is probably to be assigned to sheep/goat, cattle, equid and dromedary. But as the group may also contain other ungulates such as gazelle, it is currently considered unspecified.

The overwhelming majority of bones in the domesticate category and approximately 70% of total number of identified specimens (NISP) were identified as sheep and/or goat (*Ovis aries* and *Capra hircus*), With sheep twice as frequent as goat. Both species are well equipped for the harsh conditions of the desert area. Although periods of plenty exist during winter with sufficient grasses and scrubs, other periods have very limited vegetation, and thus husbandry in the area requires semi-nomadic movement through the landscape and hardy animals adapted

to such conditions (Ferdinand 1993).

Cattle represent a marginal species at Freiha with only 31 identified fragments, and as such the keeping of cattle may relate more to the supply of cow's milk or as a beast of burden rather than meat procurement. It is also interesting to note that the size of the cattle bones at Freiha is particularly small compared to other archaeological specimens from the Middle East (Figure 10.1). The domesticates include 16 fragments from species of equids. The dental evidence suggests that it was likely donkeys (*Equus asinus*) of a small stature (Johnstone, 2004). The largest ungulate species identified at Freiha is likely the dromedary or Arabian camel (*Camelus dromedarus*), which is present with 49 fragments, but the Bactrian camel (*Camelus bactrianus*) cannot be completely ruled out. But due to the general slenderness of the remains and a marked difference in heat tolerance between the two species, an identification of dromedary is likely (Potts, 2004). Additionally, two domesticated carnivores are also present in the assemblage: 12 fragments stem from dog (*Canis familiaris*) and 6 fragments from domesticated cat (*Felis domesticus*).

23 bones from various mice and rats (*Muridae* sp.) were found at Freiha. The size and morphology suggest multiple species, but currently only the house rat or black rat (*Rattus rattus*) has been securely identified. Although these animals do not belong to the domesticates, most of them can comfortably be described as commensal species and as such they would have found a habitat within the human occupation.

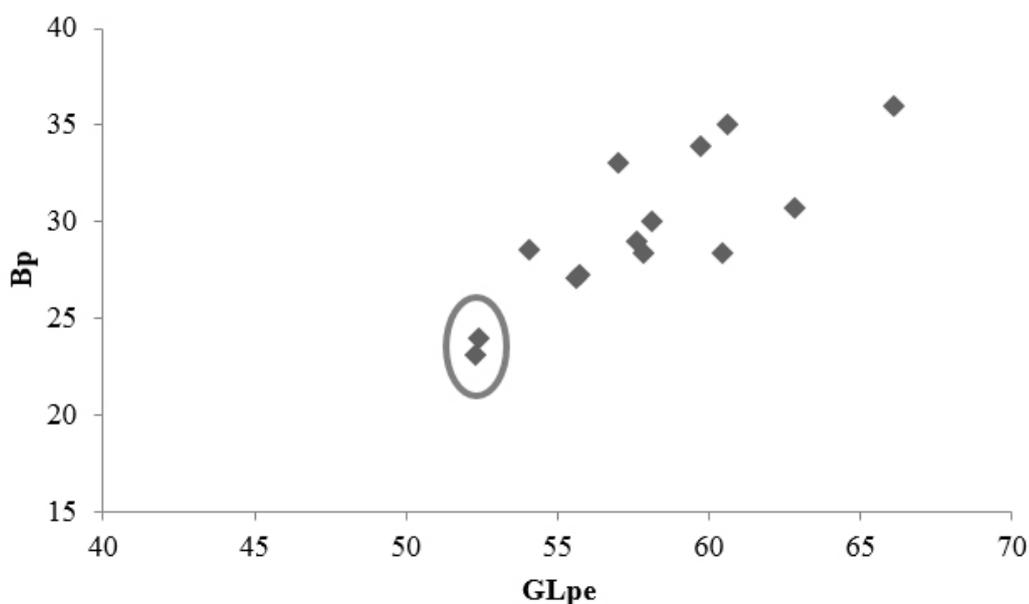


Figure 10.1: Size variation of 1st phalanges from cattle – circled are the two Freiha specimens, the remainder are from Jarash (Early Islamic) and Tell-el-Fukhar (multiple periods) in Jordan as well as the Barbar temples (Dilmun), Bahrain. (Driesch, 1979)

10.3.2 Wild Fauna

The wild fauna identified in the Freiha assemblage include a number of different families, genus and species. Generally speaking these can be subdivided into two none-taxonomic grouping suitable for the current purpose, as it readily informs about human utilisation of the surrounding landscapes.

Desert Habitats

At least six species of mammals and birds indicate that the desert was occasionally utilised to supply the inhabitants with proteins and other products such as skin and fur. The mammals include primarily gazelle (*Gazella* sp.) as well as Arabian oryx (*Oryx leucoryx*), sand hare (*Lepus*

capensis), hedgehog (*Erinaceidae* sp.) and fox (*Vulpes* sp.). Most numerous among the wild animals are pheasants and partridges (*Phasianidae* sp.), while another group of desert birds, namely the dove and pigeons (*Columbidae* sp.) are less frequent. Both these latter families may include domesticates, but both, along with the foxes and the group identified simply as mammalian carnivores, are likely to include multiple species.

Marine and Beach Habitats

The second group of wild animals include a minimum of six species of mammals, birds and reptiles. These animals are characterised by marine and/or coastal habitats. Several vertebrates stem from ocean dolphin (*Delphinidae* sp.), of which there are currently eight species in the Arabian Gulf (Carpenter et al, 1997). Additionally, various fragments from sea turtles (*Cheloniidae* sp.) and one from a dugong (*Dugong dugon*) were also present, along with various rib fragments attested simply to sea mammal. The avian fauna include 38 fragments belonging to cormorants (*Phalacrocorax* sp.), while a few fragments have been identified to herons (*Ardeidae* sp.) and gulls (*Laridae* sp.). The group of cormorant bones display a wide variation in general size and morphology, suggesting that at least two species were presents at the site. The larger species is probably the great cormorant (*Phalacrocorax carbo*) and the smaller the Socotra cormorant (*Phalacrocorax nigrogularis*). Among the cormorant remains are three long-bones with clear cut marks. The location and nature of these marks suggest that the birds were skinned and dismembered.

10.3.3 Cut marks and other induced bone changes

A number of other cut marks were identified in the Freiha assemblage: two on long-bones from pheasants and/or partridges and two on sea mammal ribs. The latter are most likely dugong, and thus testify to the consumption of this animal. The remaining cut marks were found on sheep, goat and dromedary bones. When more of the Freiha assemblage has been registered, this group of data promises to become the basis for a full analysis of butchering and carcass handling, and as such may give insight into cooking techniques and eating habits at the site. For the moment it is worth noting that the majority of cut marks on the sheep and goat remains can be attributed to the dismembering process and the division of the carcass into more manageable pieces of meat. One such mark is Cv1, which consist of transverse cuts across the ventral and cranial surface of atlas, the first of the cervical vertebrates (Figure 10.2).



Figure 10.2: Atlas from a sheep or goat (*Capra/Ovis* sp.) with clear cut-marks, associated with the separation of the head and the neck.

10.4 SPECIES BY PHASE

It is envisioned that the zooarchaeological assemblage from Freiha can be utilised for a full spatial and temporal analysis. At this preliminary stage, a first division of the species distribution into the six main phases of occupation is feasible and should give an impression of any significant variation in species occurrence (Table 10.2).

	6	5	4	3	2	1
Domesticates						
Cattle, <i>Bos taurus</i>	12	1	-	2	4	12
Horse/donkey, <i>Equus</i> sp.	1	2	1	-	1	11
Sheep, <i>Ovis aries</i>	60	6	-	6	10	25
Goat, <i>Capra hircus</i>	38	2	-	3	7	14
Goat/sheep, <i>Capra hircus/ Ovis aries</i>	245	26	4	48	115	193
Dromedary, <i>Camelus dromedarus</i>	41	5	1	-	1	1
Dog, <i>Canis familiaris</i>	4	1	-	1	4	3
Cat, <i>Felis domesticus</i>	-	-	2	1	2	1
Wild Mammalian Species						
Gazelle, <i>Gazella</i> sp.	5	-	1	4	1	3
Arabian oryx, <i>Oryx leucoryx</i>	-	-	-	-	1	1
Hedgehog, <i>Erinaceidae</i> sp.	-	-	-	-	1	-
Sand hare, <i>Lepus capensis</i>	-	-	-	-	1	2
Fox, <i>Vulpes</i> sp.	-	-	-	1	-	1
Carnivore, <i>Carnivora</i> sp.	2	-	-	2	-	1
Avian Species						
Cormorants, <i>Phalacrocorax</i> sp.	12	-	1	6	5	14
Herons, <i>Ardeidae</i> sp.	4	-	-	-	-	2
Gulls, <i>Laridae</i> sp.	2	-	-	2	-	-
Doves & pigeons, <i>Columbidae</i> sp.	1	1	-	-	1	1
Pheasants & Partridges, <i>Phasianidae</i> sp.	6	-	1	4	5	21
Birds, <i>Aves</i> sp.	26	7	1	10	9	32
Marine Species						
Dugong, <i>Dugong dugon</i>	1	2	-	-	-	2
Ocean dolphins, <i>Delphinidae</i> sp.	8	-	-	-	-	-
Sea mammals	6	-	-	1	-	1
Sea turtles, <i>Cheloniidae</i> sp.	7	1	-	1	-	2
Rodent Species						
Rat, <i>Rattus</i> sp.	2	-	-	-	2	5
Mice & rats, <i>Muridae</i> sp.	-	-	-	1	7	6
Unspecified						
Ungulate sp.	69	26	14	35	39	149
Unidentified	490	96	34	173	309	775
TOTAL	1042	176	60	301	525	1315

Table 10.2: Number of identified specimens (NISP) for all fauna by phase

Phases 4 and 5 and partly Phase 3 is represented by a very limited amount of fragments (< 500 fragments). This means that the current result should be seen as only indicative, as the results are not well founded on secure statistical evidence. Phase 2 consist of just over 500 fragments, whereas both Phases 1 and 6 are on more solid statistical ground with over 1,000 fragments each.

The distribution of all wild species, attributed to either desert or marine habitats is presented in Figure 10.3. It is symptomatic for the general low number of fragments that the full range of animals is only found in Phases 1 and 6, where the largest datasets are available. Additionally, a shift appears to happen, currently visible between Phases 5 and 4. Species related to marine or beach habitats dominate in the two early Phases 5 and 6, whereas in the later Phases 1 to 4, the most numerous group of species are those belonging to desert habitats. Another shift is observable among the domesticates: although sheep and goat dominate across all phases, the dromedary is significantly more numerous in the earlier Phases 6 to 4 than during the later phases (Figure 10.4).

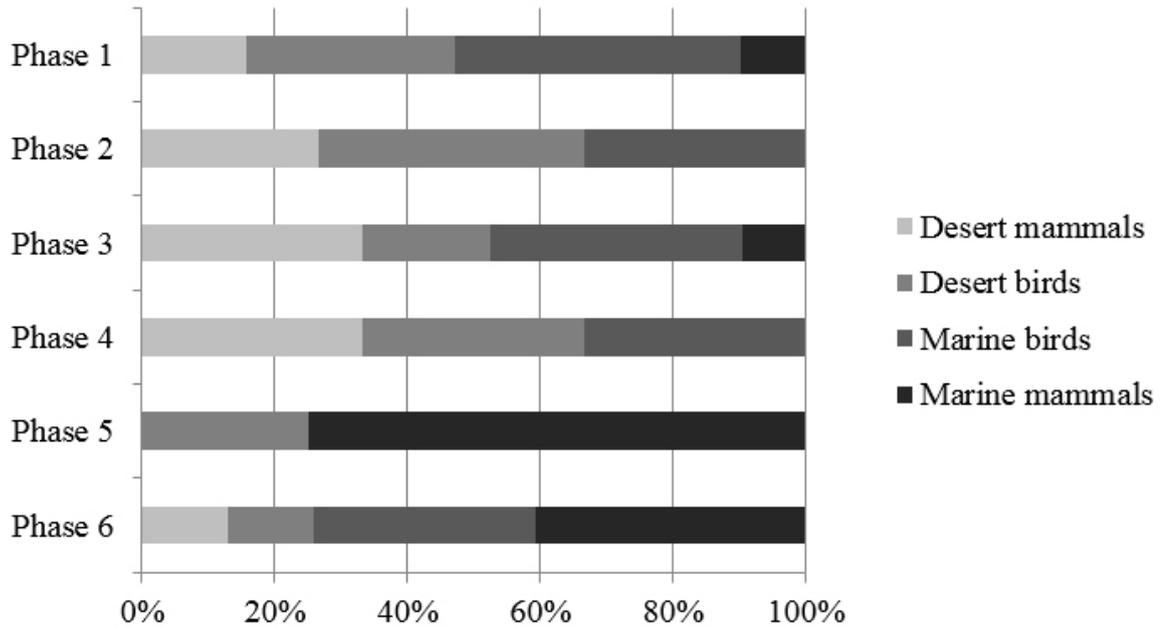


Figure 10.3: Distribution of various wild fauna at Freiha subdivided into phases.

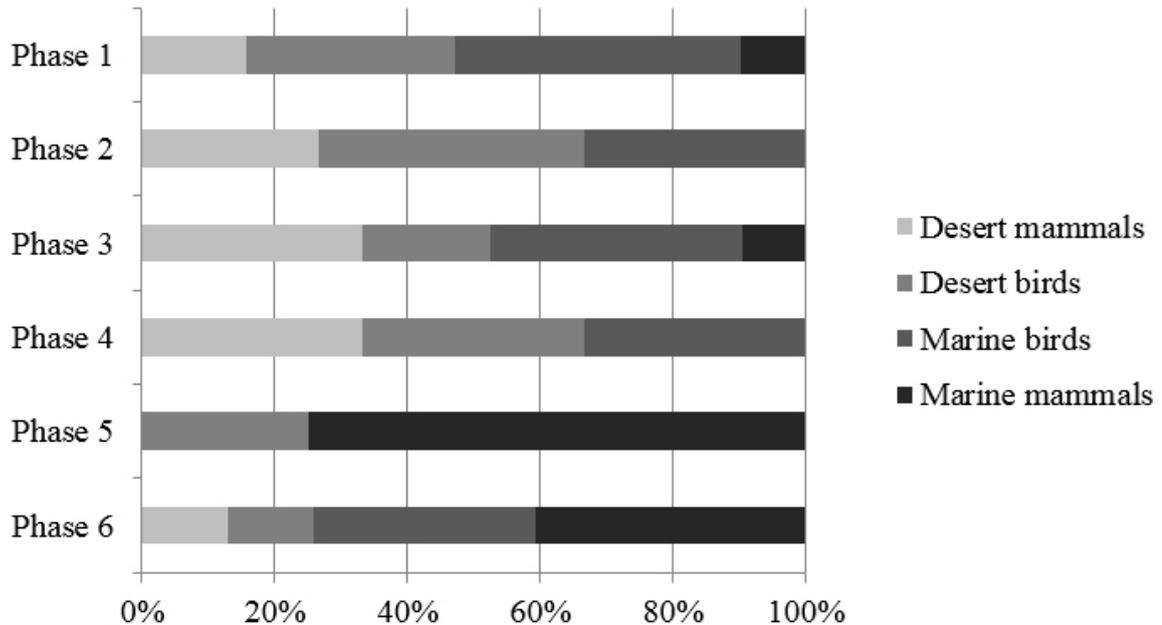


Figure 10.4: Distribution of domesticates subdivided into phases.

10.5 CONCLUSIONS AND RECOMMENDATIONS

The current preliminary analysis of the zooarchaeological assemblage illustrates that the marine and coastal areas played a primary role in supplying products for daily consumption at Freiha. This not surprising due to the site’s coastal location, but the marine resources clearly

dominated the overall assemblage, particularly when the archaeoichthyological analysis is considered (Yeomans this volume). But the inhabitants clearly also used the desert hinterland extensively. A substantial amount of this use was probably connected to the herding and husbandry activities of sheep and goat and the other domesticated ungulates. The desert was also used for hunting activities, as the substantial list of both wild mammals and birds illustrates. The combined evidence from domesticates and wild desert species suggests that the usage of the desert hinterland likely included a nomadic element, with movement through the landscape according to the seasons. Because of seasonally sparse vegetation, the breeding and keeping of such livestock would have required an active search for fodder and water.

Due to the limited size and scope of the material analysed so far, the results presented in the previous sections can only be described as preliminary. Therefore it is essential in the coming seasons to finish the analysis of all priority loci from Freiha so a full and statistical reliable analysis can be carried out. Of particular interest is a comprehensive spatial and temporal analysis of the species distribution, as the current analysis has shown promising results.

11. ARCHAEOBOTANY - FREIHA

Mary Anne Murray

11.1 INTRODUCTION

The archaeobotany department is concerned with the recovery of botanical remains from archaeological contexts via the process of flotation and the sorting and identification of the resulting material.

In flotation, the term “light fraction” refers to the organic material that floats, for example fruits and seeds, while “heavy fraction” describes material that does not float, for example gravel and large grained sand, but also fragments of pottery, bone, shell and other artefacts. The heavy fraction is sorted to 100% to recover these items and provide them to specialists for further analysis.

Focus this season has been on material from Freiha, with some additional samples processed from Al Zubarah.

11.2 FLOTATION

The goal for the 2014 season was to complete the flotation of the remaining Freiha samples as well as those for the domestic compound ZUEP01 and midden sondage ZUEP05 from Al Zubarah. The number of samples for each area is shown in table 11.1.

Area	Number of Samples	Percentage Floated
Freiha (all areas)	673	100%
Al Zubarah (ZUEP01)	253	100%
Al Zubarah (ZUEP05)	26	100%

Table 11.1: Summary of samples floated for each area.

11.3 HEAVY FRACTION

The heavy fraction process consists of

- the sorting and extraction of items,
- the double-checking for missed items, and
- the logging of the items into the database prior to distribution to specialists.

The goal for the 2014 season was to complete the process for all Freiha samples, both priority and non-priority, as well as for those from ZUEP01 and ZUEP05. A summary of the quantities processed is shown in table 11.2.

	Sorted	Double-Checked	Logged
Freiha (all areas)	x (164)	x (593)	x (878)
Al Zubarah (ZUEP01)	x (253)	-	x (253)
Al Zubarah (ZUEP05)	x (26)	x (26)	x (26)

Table 11.2: Summary of heavy fraction processes completed.

11.4 BOTANICAL ANALYSIS

The goals for the 2014 season were to analyse all Freiha priority samples based on stratigraphic context, including any extracted from heavy fraction, to complete the Freiha botanical database, and to identify and extract any suitable samples for C14 dating from Freiha (FREPO4) and Al Zubarah (ZUEP01).

The majority of plant remains are primarily preserved by charring (burning), but a wide range of material could be identified as having desiccated (dried), which resulted in different plants and plant parts surviving in the archaeological record (e.g. seeds, fruits, stems, leaves etc.). Some waterlogged rope has also been found in a well in the Freiha mosque (FREPO1).

While many of the samples contain primarily wood charcoal, they have proven to be more diverse than was initially expected based on other archaeobotanical data from the Gulf. In addition to a simple diet of dates, rice and fish, there are a variety of other cereals, fruits and legumes present.

With some analysis of material still ongoing, Table 11.3 below presents a preliminary species list of plants present in the Freiha assemblage.

11.5 QUANTIFICATION INDICES

Several methods of quantification have been used here to assess the presence (or ubiquity), relative density of items, abundance, diversity and preservation of the Freiha plant assemblage. For the purpose of this summary, these are:

- Presence (or ubiquity) percentages
- Density of plant items per litre
- Wood charcoal densities

Each of these indices is then calculated for stratigraphic variables such as locus, locus type, space or phase. These indices, particularly when used as a group, help to quantify the influence of the many factors affecting charred plant assemblages as well as to identify (and minimise) potential biases of depositional history, sample size etc.

11.5.1 Presence Percentages

Presence (or ubiquity) analysis is used to show the relative abundance of taxa within the assemblage, rather than within any particular sample, by quantifying the number of samples in which it occurs. For instance, if rice is found in 8 out of 10 samples, then it has a presence of 80% within that sample group. This is a more reliable measure of the relative proportions of taxa within the assemblage than a simple count of items. It has been used here to provide a measure of sample composition and can demonstrate, for example, that a space or phase may contain a very high proportion of a certain taxa, yet it may only be present in a very few samples.

Fruit is present in the highest percentage of all samples (77%), with charred date stones being the dominant single item in the entire assemblage (in 72% of samples). Other fruits in the assemblage include grape (*Vitis vinifera*) (Figure 11.1) in 3.5% of samples, melon in 2.4% (Figure 11.2) and fig in 1.2%.

Cereal grain is found in 66% of samples, and of this rice (*Oryza sativa*) predominates – with rice grain present in 42.4% of samples and rice husks found in 26% (Figure 11.3). Free-threshing wheat (*Triticum aestivum/durum*) is the next most commonly found cereal with the grain present

in 34.1% of samples. Two types of free threshing grain appear to be present - the 'compactum' type grain in 26% of samples (Figure 11.4), and the larger type of free-threshing grain in 8.2%. Free threshing chaff is present in 3.5% of samples. Barley (*Hordeum vulgare*) is not far behind, with barley grain (Figure 11.5) found in 27.1% of samples (and two specimens of barley chaff). A type (or types) of millet grain is also present in 15.3% of samples (Figure 11.6). Cereal chaff is present in 28.2% of samples, and these are primarily charred and uncharred rice husks. A single specimen of what might be a cereal culm node is the only indication thus far for the presence of cereal straw, presumably either because straw was not used as a fuel (unlikely if it was available)



Figure 11.1: Grape (*Vitis vinifera*) (OF-8805)



Figure 11.2: Melon (*Cucumis* sp.) (OF-8551)



Figure 11.3: Rice husks (*Oryza sativa*) (OF-8633)



Figure 11.4: Bread wheat (*Triticum aestivum* compactum type) (OF-8661)



Figure 11.5: Barley (*Hordeum vulgare*) (OF-8605)



Figure 11.6: Millet type (OF-8624)

or cereals were simply not locally grown. Figure 11.7 shows the relative presence of cereals found at Freiha. Legumes are found in 5% of samples, primarily small wild legumes but also several specimens which appear to be Fava bean (*Vicia faba*). Wild species are present in 82.4%, and while wild grasses are found in 46% of samples (Figure 11.8), the primary wild item present are the leaves of a succulent plant (in 68.2% of samples) (Figure 11.9), perhaps a member of the salt tolerant Chenopodiaceae family common to Qatar. More investigation is required to determine the uses of this plant so frequent in the Freiha samples - food, fuel, medicine, dye?

The popular medicinal plant *Terminalia* (Figure 11.10) could also be identified in the samples. Wet-loving plants are found in 7.1% of samples. Of interest, animal dung is present in 33% of samples (Figure 11.11) and in 67% of all tannur fills as an obvious source of fuel. Date stones are found in 83.3% of tannur fills, suggesting the possible use of dates and/or date pressings (from the *madbasat*) as fuel.

Presence of Cereal Grain at Freiha

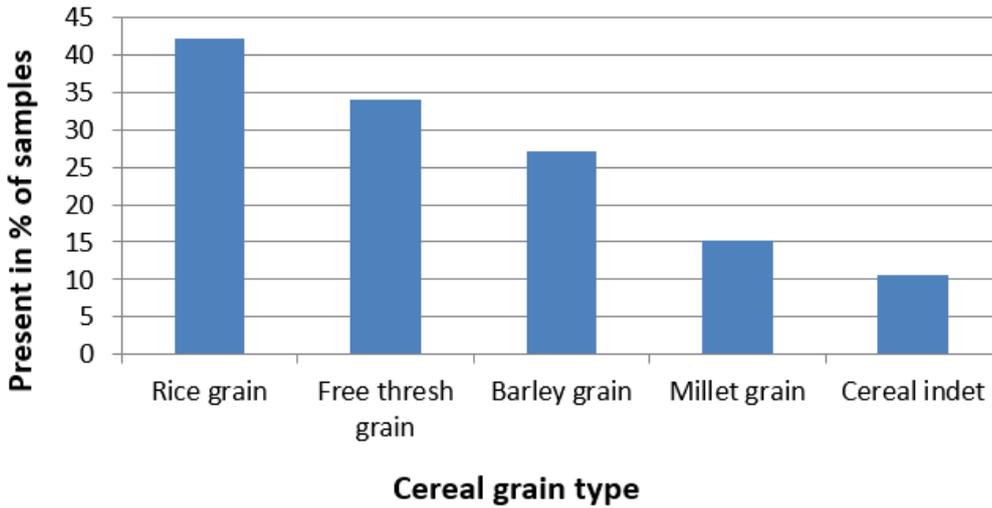


Figure 11.7: Presence of cereal grains in the Freiha assemblage



Figure 11.8: Wild grasses (Graminae family) (OF-8573)



Figure 11.9: cf. Chenopodiaceae leaves (OF-8591)



Figure 11.10: Wild grasses (Graminae family) (OF-8573)



Figure 11.11: Terminalia sp.

11.5.2 Density of Items per Litre

The relative density of plant items in each sample was measured by the average (mean) items per liter of deposit (IPL). This figure is a useful indicator of the relative ‘richness’ of plants when comparing stratigraphic units.

For the domestic compound FREP04 as a whole, the density of plant items per litre is 10.17 IPL.

Of the 14 different deposit types represented here, *tannur* fills had the highest items per litre (29.71 IPL), no doubt to their repeated use through time. The fill of a mortar-lined pit was also high (25.43 IPL). Occupation deposits had relatively high rates (23.87 IPL), as did fire pit fills (22.03 IPL). In contrast, foundation trench fills had the lowest density (0.07 IPL), as did general fills (0.92 IPL), demonstrating the lack of activity in these features post-deposition. Figure 11.12 shows the relative density of plants for all of represented locus types.

IPL of Deposit by Locus Type

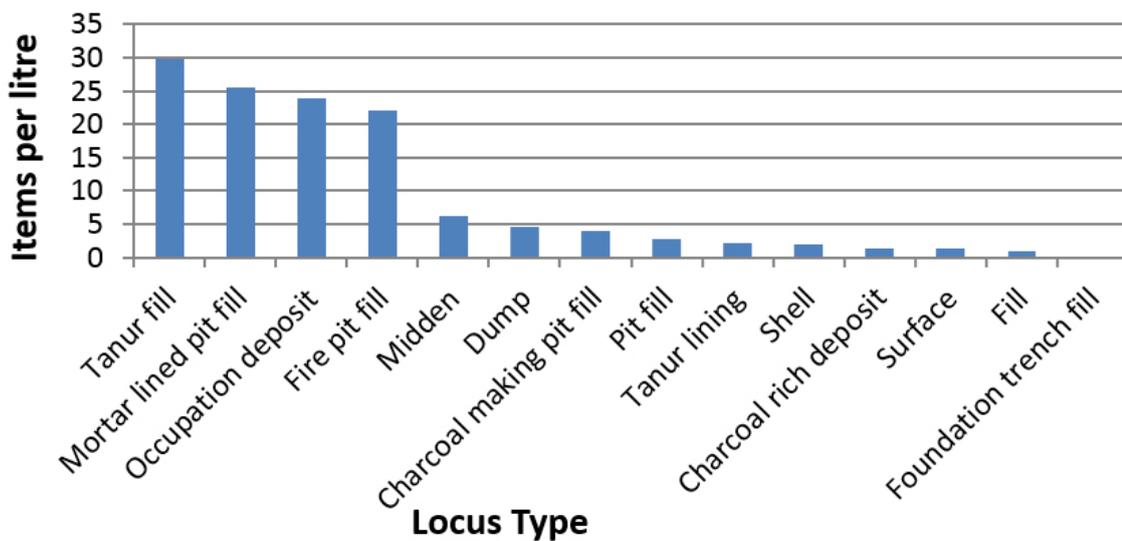


Figure 11.12: Items per litre of deposit by locus type.

The spaces with the highest densities of plants are Space 84 (a barasti structure inside a Phase 1 courtyard) with 728 IPL, Space 35 (an internal cooking space in Phase 1) with 105 IPL, and Space 81 (another Phase 1 cooking space, maybe partially open) with 71.58 IPL. The spaces with the lowest densities of plants are Space 32 (a possible cooking space inside a Phase 6 cellular room) with 0.28 IPL, Space 73 (an external shell surface from Phase 2) with 0.32 IPL and Space 22 (a storage or occupation room in Phase 1) with 0.44 IPL.

Phase 1.3 had the highest density of plants (59.12 IPL), followed by Phase 2.1 (35.11 IPL). The phase with the lowest IPL was Phase 1.2 (1.13 IPL). Phase 6, the earliest phase at FREP04, had the third lowest density of plants (4.28 IPL), which made it difficult to find enough plant material for C14 dating.

When looking at the phases within spaces, Phase 1.1 in Space 84 had the highest density (728 IPL) as did Phase 1.4 in Space 35 (105 IPL); however each of these are represented by a single sample. The next highest density with several samples is from Phase 1.3 in Space 81 with 71.58 IPL.

The density of plant items per litre for samples from interior spaces is higher (19.9 IPL) than those from exterior spaces (11.45 IPL), possibly due to the greater frequency of activities taking place there or to the more protective environment inside structures.

11.5.3 Wood Charcoal Densities

The volume of wood charcoal from all Freiha samples was measured in millilitres (ml), thereby providing a comparison of the mean wood charcoal density (ml per liter) between stratigraphic units. Wood charcoal densities may reflect a wide range of variables, such as the relative use

of fire, the consistency of burning activity, the use of wood as fuel and the degree of mixing of deposits.

The wood charcoal density for FREP04 as a whole is 6.61 ml/L, ranging from as low as 0.01 ml/L to 178 ml/L. Unsurprisingly, fire pit fills had the highest wood charcoal densities (28.3 ml/L), followed by dumps (18.5 ml/L) and *tannur* fills (16.75 ml/L). Shell deposits had the lowest (0.48 ml/L), followed by surfaces (0.55 ml/L).

Spaces 80 and 79 (Phase 1 external occupation spaces) had the highest wood charcoal density – Space 80 (178 ml/L) and Space 79 (109.5 ml/L). The lowest charcoal densities were found in Space 11 (a late Phase 1 courtyard) (0.05 ml/L), Space 82 (a Phase 1 courtyard) (0.22 ml/L) and 32 (0.23 ml/L).

Phase 2.1 had the highest wood charcoal density (53.33 ml/L) and Phase 1.2 had the lowest (0.29 ml/L). The earliest phase, Phase 6, had a wood charcoal density of 7.71 ml/L.

By phase in space, Phase 1.4 in Space 80 had the highest density (178 ml/L), as did Phase 1.4 in Space 79 (109.5 ml/L). The lowest charcoal densities were found in Phase 1.1 in Space 11 (0.05 ml/L).

The wood charcoal densities between interior and exterior spaces is nearly the same – interior spaces (8.92 ml/L) and exterior spaces (8.62 ml/L).

11.6 CONCLUSIONS AND RECOMMENDATIONS

The list of cereals, legumes, fruits etc. from Freiha is a varied and interesting one. The surprising diversity of taxa also adds to the question of the origin of these plants. Further studies into trade routes pertaining to the Arabian Gulf between the 17th and 19th centuries might shed more light on the story of food, medicine and fuel coming to the northwestern coast of Qatar. A microscopic study of the animal dung is also underway to determine what fodder or browse the animals may have been eating.

The analysis of the plants continues, and the figures presented here are likely to change with the addition of new samples, species, and interpretations.

Cereals	Types	Charred (c) / Uncharred (uc)
Rice (<i>Oryza sativa</i>)	grain, grain with husk, husk	c and uc
Bread wheat (<i>Triticum cf durum/aestivum</i>)	grain	c
Free threshing wheat (<i>Triticum sp.</i>)	chaff	c
Wheat indet (cf. <i>Triticum sp.</i>)	grain	c
Barley (<i>Hordeum sativum</i>)	grain, rachis internode	c
Millet type (<i>Panicadae</i> tribe)	grain, grain in matrix	c
Echinolchloa sp	grain, grain with chaff	
Panicoid	grain	
Cereal indeterminate	grain, chaff, culm nodes	c
Legumes	Types	Charred (c) / Uncharred (uc)
Vicia cf. faba	seed, seed coat	
cf. Leguminosae	large seeded cotyledon	
Fruit/Nuts		
Date (<i>Phoenix dactilifera</i>)	stone, skin, flesh, perianth	c and uc
Grape (<i>Vitis vinifera</i>)	seed	c
Fig (<i>Ficus carica</i>)	seed	
Melon family (<i>Curcubitaceae</i>)	seed	c
Fruit indeterminate	stone, flesh	
Nut indeterminate	shell	
Other tree fruits		
Terminalia sp.		
cf. Acacia / Prosopis	stem	
Wild plants		
Polygonaceae		
cf. Chenopodiaceae	seed, leaf	
Trigonella sp		
Leguminosae	seed	
Malva sp.		
Boraginaceae	seed	
Wild grasses		
Phalaris sp		
Wild grass	seed, rachis internode, rachis base, awn, culm node	
Wet-loving species		
cf. Cyperaceae	seed	c
cf. Cyperaceae/Polygonaceae	seed	
cf. Knotted leaf(s)/Cyperaceae		c
Indeterminate seeds		
Seed indeterminate	seed, bracts, seed head, seed pod	c and uc
Other/Indeterminates		
Indeterminates	leaf, buds, thorns, seed husks, root/tuber fragments	c
Dung		
Sheep/Goat dung		
cf. Rodent dung		

Table 11.3: Preliminary Freiha species list, summarised.

12. ARCHAEOMALACOLOGY - FREIHA AND AL ZUBARAH

Victoria Morgan

12.1 INTRODUCTION

Invertebrate zooarchaeological analysis during the 2013-2014 season focused on expanding the comparative collection, exploring past use of invertebrates within the region, continuing analysis of ZUEP01 priority spaces defined in the previous season, and beginning analysis of Freiha material. This report provides a summary of the invertebrate zooarchaeological work conducted during this season, the results of analysis, and recommendations for future work.

The overall aim of the invertebrate zooarchaeological studies is to understand the role these animals played in the lives of inhabitants of northwest Qatar during the Late Islamic period and possibly earlier. This information would support data gathered by other specialists, particularly vertebrate zooarchaeological and archaeobotanical analyses, in understanding the lifeways of the inhabitants and their interaction with the environment. Invertebrates provided more than just a food source, but also a source of raw material. They served as the basis of the pearling economy which sustained the region during this time. Determining which invertebrate species were preferred and their various uses helps build an understanding of the dietary, economic, and social significance of these animals.

The 2013-2014 season focused on studying invertebrate assemblages recovered from ZUEP01 and Freiha. Additional analysis of selected ZUEP01 cooking areas, begun in spring 2013, was completed, allowing interpretation of these spaces. Due to the large volume of recovery from Freiha, analysis of the material began with the early phases of FREP04. Particular attention was paid to functional areas of interest such as permanent structures, external occupational areas (temporary tent and barasti structures), and associated middens.

To support the invertebrate analysis, continued collection and identification of specimen for a comparative collection was required. Additional goals presented during the season included the testing of murex purple dye manufacturing processes.

12.2 SUMMARY OF WORK

12.2.1 Reference Collection

91 specimens were added to the invertebrate comparative collection during the 2013-2014 season. Although many modern specimens were added, some relevant species could not be found. Variations have also been observed. It was necessary to set aside archaeological examples of several species until physical examples for comparison are available. In addition, the increased recovery of crustacean remains required that the modern comparative collection also include reference samples.

12.2.2 ZUEP01

All analysis of ZUEP01 bulk finds from priority loci was completed. However, much of the invertebrate material collected from heavy fraction has yet to be studied. Total materials examined from 167 loci so far include 3549 complete and fragmented invertebrate remains weighing about 10.63 kg. Analysis of the material thus far has allowed interpretation of three enclosed areas associated with cooking activities at ZUEP01: Spaces 110, 166, and 191.

12.2.3 FREP04

Analysis of FREP04 material consisted mainly of priority loci from earlier phases, particularly Phase 4 occupation. Finds examined from 68 loci so far include 7936 complete and fragmented invertebrate remains weighing about 13.61 kg. This consisted mainly of invertebrate bulk finds, though some of the heavy fraction material was also examined. Phase 4 material provided the opportunity to address the relationship between permanent structures and temporary tents or barasti, and their association with extensive midden material. Areas completed from Phase 4 include Spaces 31, 34, 63, 64, 67, and the large midden locus 1168.

12.2.4 Additional Work

During the season, the opportunity arose to investigate the process of murex purple dye production seen within the region during the Late Bronze Age. Faisal Al-Naimi expressed an interest in testing potential methods since extensive knowledge of these procedures no longer exists. Archaeological evidence of purple dye processing using the marine snail *Thais savignyi* (Muricidae family) was found at Al Khor Island (Jazirat bin Ghannam) (Carter and Killick 2010; Edens 1999). Although modern examples of this species inhabit rocks along the pier at Al Zubarah, no significant archaeological evidence of its presence has yet been found at either Al Zubarah or Freiha. However, this has served as an opportunity to explore the importance that molluscs and other marine resources have played to the inhabitants of the Qatari peninsula in addition to the pearling industry.

12.3 CONCLUSIONS AND RECOMMENDATIONS

12.3.1 ZUEP01

Comparison of Spaces 110, 166, and 191 found that a variety of marine molluscs were prepared as food within the compounds, while limited evidence was observed of mollusc use in less intensive cooking areas. Both Space 110 and Space 166 were cooking rooms containing several *tannurs* within two compound complexes (Humphrey 2011), while Space 191 consisted of a curvilinear structure northeast of Compound 2 with only one *tannur* and possible small sleeping arrangement (Yeomans 2012).

Space 110 in Compound 1 contained mostly pearl oyster (Pteriidae family) and clam (Veneridae family) remains recovered from floor surfaces, though some turban (*Lunella coronata*) and olive shells (*Ancilla castanea*) were found in a *tannur* fill. Worked pearl oyster shells, possibly modified for tool use, were also found in this area. Recovery from Space 166 in Compound 2 yielded a large amount of true oyster (*Ostrea* sp.), clam (Veneridae family), and other bivalve (*Diplodonta* sp.) shells from later occupational debris, though shell material was absent from earlier surfaces. Space 191 yielded only a small quantity of pearl oysters and cuttlebone.

The invertebrate recovery from these spaces reflects that although potentially larger, protein-yielding food sources were predominantly consumed, preferences for specific marine mollusc species could also be observed. Shell debris found on floor surfaces of Spaces 110 and 166 indicates that these species were processed as food within the compound area. The limited recovery of shell and other invertebrate remains in Space 191 indicates that little of this food source was prepared in this area, and possibly that much of this material would be disposed of elsewhere.

12.3.2 FREP04

Analysis of Phase 4 material from FREP04 focused on examining the mudbrick-footed structures in Spaces 31 and 34, the tent or barasti occupied areas Space 63 and 64 to the north of Space 34, and midden material from Space 67 and locus 1168 (Rees 2013).

The few marine invertebrate remains from Spaces 31 and 34 indicate that food preparation of shellfish was unlikely in these interior areas. However, Spaces 63 and 64 to the immediate north of Space 34 demonstrated that much of the preparation and consumption of shellfish occurred in these temporary structures. Large amounts of pearl oyster (Pteriidae family) and coronate moon turban shells (*Lunella coronata*), as well as some Muricid snails (*Hexaplex kuesterianus*), crab, and cuttlefish remains, were recovered from these areas. The middens of Space 67 and locus 1168 yielded a large amount of invertebrate recovery. Most available species were heavily represented: pearl oysters, winged oysters, *Lunella coronata*, *Hexaplex kuesterianus*, true oysters (Ostreidae family), cuttlefish, crabs, olive shells, clams and cockles. This indicated that shellfish served as a valuable dietary resource. Recovery from this area also included modified shell, indicating that marine shell was locally worked to produce tools and ornamentation.

Analysis of the Al Zubarah and Freiha assemblages thus far has indicated that marine invertebrates provided a valuable contribution to the diet of the inhabitants of these settlements. Although the majority of the diet consisted of vertebrate fauna, shellfish still provided a source of nutrients. Clearly, preferences existed for specific species as the most common examples were recovered from food preparation areas and middens among other food remains. Often, mollusc remains could have multiple potential uses. Evidence of worked shell found in the studied midden material demonstrates that people were utilizing locally available materials rather than relying solely on imported goods. This can be seen with pearl oysters, which served as a potential food source and a raw material, both for mother-of-pearl and the pearls themselves. They have been found in great frequency within both settlements. *Pinctada radiata*, the smaller and most common species of pearl oyster, has been found throughout, though *Pinctada margaritifera* and the wing oyster (*Pteria* sp.), which were both used as a source of mother-of-pearl (Carter 2012), are increasingly common. Hinges of these shells were especially durable and could be shaped into objects for various uses, such as pins (Figure 12.1). *Hexaplex kuesterianus* served as a versatile resource, as this large marine snail could be utilised for food, bait, and raw material. Shells, such as bivalves (Figure 12.2) and cowries (Figure 12.3), were often used as ornamentation and are sometimes found perforated. Cowries and olive shells could also be used as game pieces.



Figure 12.1: Pearl oyster hinge preform from FREP04 (top) and mother-of-pearl shaft pin from ZUEP04 (bottom). (OF-4599)



Figure 12.2: Detail of pierced shell (*Acrosterigma* sp.) found in midden (Space 49) in FREP04. (OF-6419)



Figure 12.3: Worked cowrie shell, *Cypraea turdus winckworthi* from FREP04. (OF-4603)

12.3.3 Future Research

Invertebrate analysis of ZUEP01 work is nearing completion, though more supportive work must be conducted before this can be accomplished. In order to continue analysis and interpretation of the invertebrate remains from this area, heavy fraction must be sorted for data recording to continue. Also, a full stratigraphic report and final selection of priority loci would be required. Examining other phases within ZUEP01 would aid in understanding changes in use of this largely occupational area of Al Zubarah and provide comparable examples to the findings at Freiha.

Freiha invertebrate material also requires continued analysis as much of the bulk finds and heavy fraction recovery remains to be studied. Due to the large volume of invertebrate recovery, further prioritizing of loci and a full stratigraphic report are needed for Freiha. Though much progress was made, the large volume of material allowed only a portion of the assemblage to be analysed this season. Further assessment of significant areas would allow research to target material that would yield the most valuable information.

Further analysis of ZUEP01 and FREP04 would allow the opportunity to compare both sites.

Though FREP04 appears to have been occupied for a longer duration of time, both sites contain significant insight into life and preferences during the Late Islamic period. Of particular interest is a comparison of activities and functions of both internal and external areas, both through time, and within and between both settlements. The potential of designating spaces demonstrating not only food preparation and consumption, but also social activities, fishing and marine invertebrate harvesting practices, or cottage industry using mollusc shells as a raw material, would be beneficial in interpreting how inhabitants exploited the environment around them and the function marine resources played in their daily lives.

In order to interpret invertebrate data, further ethnographic research would be highly valuable. Although some ethnographic research into fishing and animal husbandry within the region has been conducted, little has been done in terms of invertebrate inclusion into the diet of the region. The value of marine molluscs to society within the Arabian Gulf region has been seen primarily in terms of the pearling industry; however, they were also consumed in the diet of the local people and utilised as sources of raw materials in the not too distant past. Use for ornamentation, tool making, and as a material used in recreation and building are all seen in the archaeological record within the region. Understanding the various functions of these materials and the adaptability of the people who used them would be greatly beneficial to the interpretation of the invertebrate assemblages.

The understanding of murex purple dye production requires further study into methods of dye processing, particularly in comparison to the purple dye industry of the Mediterranean, and the development of a specific controlled strategy to re-enact such techniques. A detailed proposal addressing these issues is recommended.

13. GEOMATICS & REGIONAL SURVEY

David Mackie

13.1 INTRODUCTION

The mapping team supported the excavation, photography and conservation teams at Al Zubarah and Freiha throughout the season. The main tasks undertaken were the setting out of grid at excavation points, and maintaining and establishing control points and temporary bench marks.

A survey of Zubarah Research Station and the area south of Al Zubarah Fort was completed, and the team finalised surveys of four distinctive linear settlements concentrated on the western side of the present farm c. 3.5km north-east of Al Zubarah town.

In addition, the team has finished surveying all the existing QNHER sites and new sites recorded in the vicinity of these settlements.

13.2 AL ZUBARAH TOWN

The main task this season was the survey of Zubarah Research Station and the area to the south of the Fort. The remodelling of the parking area, the upgrading of the visitor amenities and the construction of the monument commemorating the UNESCO inauguration all have necessitated a survey to be undertaken. The resulting map will be updated each season as new changes occur (Figure 13.1).

The existing plan of Al Zubarah town undertaken by Hugh Barnes in 2009 still forms the backbone of the site survey, showing the lines of the buildings, defensive walls, screening walls and middens. Using the methodology developed for mapping sites in the regional survey, areas of Al Zubarah town not initially mapped have been added to the overall plan in previous seasons. This season the beach fort (labelled ZUB 113) to the north of ZUEP02 was surveyed along with the compounds to the north of excavation point QMA1 (Figure 13.2).

The intention for further seasons is to continue the topographic survey off Al Zubarah across the whole town. This would provide height information for the existing survey and provide an opportunity to check and re-evaluate areas that may have been obscured previously.

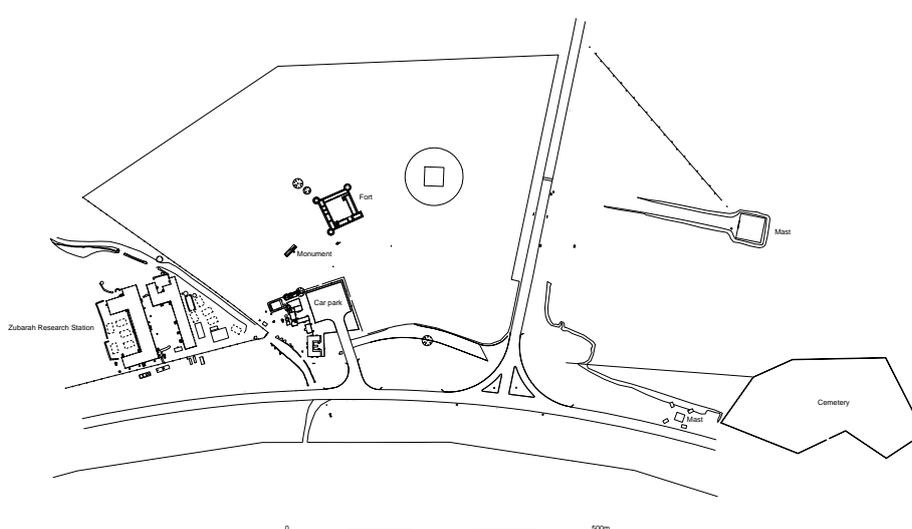


Figure 13.1: Map of Zubarah Research Station and Al Zubarah Fort with surroundings.



Figure 13.2: The Beach Fort (ZUB 113) showing top and bottom of slope and contours over previously surveyed wall lines.

13.3 SITES IN THE UNESCO BUFFER ZONE

The aim of this season was to continue to survey sites within the UNESCO Buffer Zone following on from previous work in 2011-2012, which concentrated on the key sites of Ain Mohammed, Musaikah, Helwan and Muhayriqat.

Work focussed on four linear settlement sites (QIAH40-0286, QIAH40-0277, QIAH40-0276 and QIAH40-0194) to the west of the present farm situated on an area of *rawdha*, 3.5km north-east of Al Zubarah (Figure 13.3). In addition to these, eleven QNHER sites in the vicinity were also surveyed together with five new sites, which together show the density and variety of sites from all periods in the area. Linear settlements are tentatively dated to the Early Islamic period based on surface finds of green-glazed pottery, and may be related to the large town of Murwab to the south.

The survey of each site provides a preliminary plan which defines the extent of the site and provides a basis for any future work. All the sites are characterised by linear clusters of small, square and rectangular structures aligned south-west to north-east. Some structures appear to be constructed on edged platforms while others are only visible as wall lines flush with the ground surface. The walls, when visible, are constructed from limestone and vary in thickness from site to site, with an average thickness of between 300mm up to 450mm.

It is possible to define discrete units made up of a main structure with their associated ancillary structures and walls; however, this is not always clearly discernable, and in places collapsed

natural feature.

- The third type consist of larger subdivided rectangular buildings with connected ancillary structures and walls which enclose a courtyard on the southern side, some of which contain small raised areas.

During the survey of these sites, quite large densities of material remains were noted on the ground, mainly comprised of small pottery and shell fragments with some clearly defined middens outside a number of the structures. Although much of the material has been weathered out, in some areas remnants of stratigraphy may survive. Within and outside some structures, larger fragments of pottery from the same vessel were noted together with quern fragments and fishing weights.

13.3.1 Linear Settlements

QNHHER 3228 (QIAH40-0286)

The northern-most site and the largest of the four settlements, QIAH40-0268 is comprised of a linear group of 40 or more small structures forming three distinct groups, with associated ancillary structures and walls. Its relationship to the small, heavily deflated settlement QIAH40-0571, located just north of its north-eastern end, is unclear. It is possible that it forms part of the same group of structures or represent another phase (Figure 13.4)



Figure 13.4: Southern extent of QNHHER 3228 on the ground. (JD-0111)

QNHHER 3227 (QIAH40-0277)

The site is situated c.116m south-east of QIAH40-0286 and consists of at least 20 structures that form three distinct groups predominantly made up of small single structures, some with additional walls and small platforms.

QNHHER 3226 (QIAH40-0276)

This is the southern-most site and the smallest of the four settlements. It is divided into two groups of structures with connected ancillary structures and walls with outlying structures (Figure 13.5).



Figure 13.5: Overview of QNHER 3226 showing remains of structures and walls. (JD-0078)

QNHER 10244 (QIAH40-0194)

The site is situated c. 79m to the north of QIAH40-0276 and c. 40m south of QIAH40-0277. It is made up at least 26, mainly single structures, some with additional walls and small platforms which can be divided into seven groups with single outlying structures. At the south-western and the north-eastern ends are larger structures with connected ancillary features and walls which form courtyards. A later Islamic cemetery (QIAH40-0569), containing 46 burial cairns, is situated to the south of a group of structures.

13.3.2 New Sites

Five new sites could be identified as separate from previously documented settlements. These have not yet been allocated separated QNHER numbers, and are therefore identified by their survey numbers (QIAH40).

QIAH40-0569

A later Islamic cemetery site situated within the earlier settlement QIAH40-0194. The cemetery is orientated south-west to north-east and contains 46 cairns of various size, some with visible head and foot markers.

QIAH40-0570

A heavily deflated site situated adjacent to an area of *rawdha* to the south of the wells and enclosures of site QIAH40-0280, this settlement is orientated east-west and consists of a least 9 structures with associated small platforms, cairns, wall lines. Some areas are heavily disturbed by later activity.

QIAH40-0571

This is another heavily deflated site situated on the north-east end of settlement QIAH40-0286 and north-west of the wells and enclosures of QIAH40-0280. The site is orientated south-west to north-east and is made up of eight structures with associated small platforms, cairns and other wall lines. Its relationship to QIAH40-0286 is unclear; it is possible that it forms part of the

same settlement or could be an earlier phase.

QIAH40-0572

The site is situated to the north-east of QIAH40-0571 and is comprised of three structures with three further indistinct features. The site is orientated north-south, and at the southern end has a clearly defined, slightly misaligned qiblah and a large sub-circular cut feature.

QIAH40-0573

Situated c.100m to the east of QIAH40-0572, the site is composed of three to possibly four structures with associated platforms and other wall lines. The site is orientated east-west and the area also has remnants of later tent positions and bottle dumps.

QIAH40-0574

This temporary camp is situated on the edge of an area of *rawdha* to the south-east of QIAH40-0286. It consists of five tent positions aligned south-west to north-east defined by loose lines of stones, a possible clearance cairn and a small cut feature.

13.3.3 QNHER Sites

Eleven QNHER sites that have been recorded in the immediate vicinity of the linear settlements were surveyed, including small settlements, well sites associated with temporary camps, wells with enclosures, a possible burial cairn and a cemetery.

13.4 CONCLUSIONS AND RECOMMENDATIONS

Al Zubarah town will continue to require survey support for both the archaeological and conservation teams. The existing plan of the town requires a topographic survey which will enhance the existing map and should ideally include all features within the Nominated Zone. The survey of the Research Station has been completed and is being updated as changes occur, and a start has been made on surveying public access routes, car park positions and walking routes to provide a plan which will help in the management of the site.

The survey of the linear settlements as well as other QNHER sites in the vicinity of the present farm show a continuity of use over time and a surprising density of sites likely linked to access to resources. The next concentration of sites lies to the north-east at Ain Mohammed concentrated around wells and *rawdha*.

All the objectives of this season were achieved, although there are still two linear settlement sites (QNHER 2074 and QNHER 2078) to the south that should be mapped; this would complete the full range of settlements within the Buffer Zone. In addition to these, there are small clusters of ruined structures and isolated structures not yet recorded on the QNHER database on the southern side of the present farm.

The mapping of these QNHER sites has shown the extent and complexity of the sites in the database, some of which might have an earlier date than previously thought. The planning of these sites is important in regard to sites within or close to present settlement and infrastructure. Plans showing the true extents of a site can be provided in the event of any development which can be used to mitigate any proposed development or infrastructure expansion, as well as serve as a foundation for future excavation projects.

14. SPECIAL FINDS

Ann Andersson

14.1 INTRODUCTION

The Finds Office has been handling and processing small and bulk finds from ongoing excavations since 2009. This includes the registration of all incoming finds, cleaning and appropriate storage, and distribution to specialists within the project (Figure 14.1). Some of the results of these studies on selected bulk material groups can be found within the specialist chapters in this report (Chapters 8 to 12); others are still awaiting analysis.

Of the many small finds that pass through the Finds Office, some have been selected as particularly special either due to their finds context, their uniqueness, or the story they tell in regards to an ongoing investigation in the field. In anticipation of more detailed object studies in the future, this chapter will illustrate three special finds and the stories behind them.



Figure 14.1: Look inside a storage container of bulk material. (KD-0043)

14.2 GLASS BOTTLE - ZUEP02

A small glass bottle with an octagonal body and a circular neck was found in ZUEP02 in spring 2014. The rim is flattened and out-turned with a rounded tip. The base of the small vessel is flat. The bottle is made from a clear glass and has a white mother-of-pearl-like coating on the interior, which may be a patina resulting from deterioration of the glass (Figure 14.2).

The bottle is interpreted as a decorative vessel for the storage of small quantities of medicine, ointments or perfume. It was found within the abandonment or collapse layers above the street through the date press area in ZUEP02, and may thus date from the intermediate occupation phase of the site.

A number of miniature bottles have been found in Al Zubarah, and particularly at ZUEP02, where



Figure 14.2: Top row: Glass bottle (catalogue # 2027) before and after conservation
Middle row: Two bottles from ZUEP02, catalogue # 1011 (left) and catalogue # 422 (right).
Bottom row: Black glass bottle from ZUEP04, catalogue # 351 (left), and a glass stopper, catalogue # 1231 (right)

they are all of a similar shape and design. At ZUEP04, a different type of miniature bottle made from a dark coloured glass and with an oval body was found on the floor of a room in Precinct Section 8. It has a rounded base and a long narrow neck with a flared rim. Its form indicates that it was especially suited as a liquid container, perhaps for holding perfume.

In addition to the bottles, three small glass stoppers were also discovered in ZUEP02, located across the excavation area and dating from various phases. Like the bottles, all the stoppers have approximately the same form with only minor variation. They all have a spherical top and are made from a clear glass.

Despite their different find contexts, the glass stoppers and bottles from ZUEP02 likely once went together.

14.3 BONE INLAY - ZUEP04

Within the backfill of Space 3040 in Precinct Section 7, a room with a *hammam* in the corner, eight fragments of a bone object with an incised dot-in-circle motif were recovered (Figure 14.3). They likely formed parts of a decorative inlay or other ornamental object.

The bone material has been cut into flat plates and shaped. The preserved fragments are cut into decorative patterns with small cut notches. These probably formed a larger, more complex pattern on the surface of the original object.

The incisions consist of a central dot surrounded by two concentric circles. This motif is produced by a specific carving tool called a *zahrāh* (Ziolkowski and Al-Sharqi 2006).

Bone inlays were used in the decoration of furniture such as chairs, tables, storage boxes, game boards etc. In the Gulf region, the dot-in-circle motif has been used as an element in decorative designs for millennia, for example in Bronze Age seals and soft stone vessels.



Figure 14.3: Six of the bone inlay fragments (catalogue # 2001) (OF-0547)

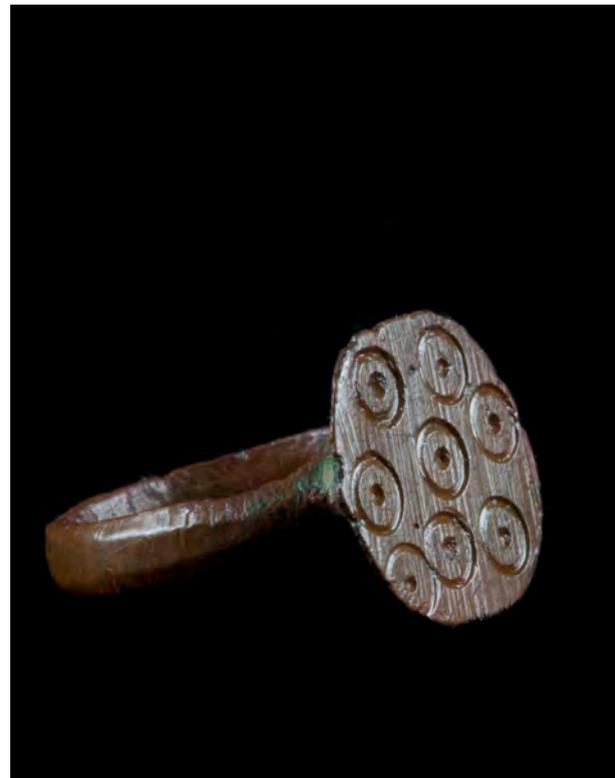


Figure 14.4: Finger ring from the earliest phase from FREP04 showing the dot-in-circle motif. (OE-8182)

The motif is sometimes interpreted as an “evil eye” talisman, but is also linked to sun symbolism. Examples of the motif have been found in northern Syria, Egypt and Oman.

In Freiha, a copper alloy finger ring with a similar motif has been found in the earliest phase of the domestic compound (Figure 14.4).

14.4 PEARLS - FREIHA

A complete natural pearl was found in a sondage in the Freiha excavations, where four pearls have been discovered altogether. These were all recovered in the process of heavy fraction and are thus an excellent example of the good work done by the archaeobotanists.

The other three pearls were recovered in the domestic compound FREP04. In comparison, Al Zubarah has yielded only a single pearl to date, coming from the early urban phase in ZUEP02. This number is likely to increase as flotation progresses into these areas.

The four pearls at Freiha illustrate different degrees of working. The pearl found in the sondage is a natural pearl without signs of working (Figure 14.5). Its surface is smooth, showing that it is well-formed, and nacreous and iridescent with a greyish and golden shine. It has a diameter of 5.1mm and weighs only 0.19 grams.

A second pearl, found in a midden in the vicinity of the domestic compound FREP04, has one possible perforation, perhaps indicating an attempt to manufacture a bead out of a natural pearl.

A third pearl has been perforated and worked into a bead. The pearl has been drilled from two points, at angles to each other but with no indication of the drill holes meeting. This pearl has a diameter of nearly 8mm, and appears somewhat irregular with banding and minor flaws resulting from natural discontinuous growth.

The last pearl recovered from the heavy fraction came from the backfill of a fire pit in an early-phase temporary shelter area. It has not only been perforated and worked into a bead, but additionally had a gold wire attached to it, demonstrating its likely use as a part of a jewellery item, perhaps an earring or other ornamentation. The length of the gold wire is 9.21mm, and the entire item weighs less than 1 gram.



Figure 14.5: Top row: Natural pearl (catalogue # 667), left, and perforated pearl (catalogue # 240), right. Bottom row: Pearl on a gold wire (catalogue # 467).

15. FIELD OBJECT CONSERVATION

Unn Gelting

15.1 INTRODUCTION

Several thousand field objects and special ceramic finds have been catalogued since 2009, when the Finds Office was first established for the excavations at Al Zubarah and sites in the region. Many of these objects required conservation to repair damage, prevent further deterioration, and prepare finds for exhibitions and long-term storage. During spring 2014, a variety of objects have been treated and preserved in the small established Conservation Lab at Al Zubarah Archaeological Site, adding to the corpus of conserved finds.

Most common materials excavated from the sites (Al Zubarah, Freiha, Murair, Fuwairit, Khasuma) as well as those picked up during Regional Survey are ceramics, metals and plaster; stone, glass, bone, amber, bitumen, shells and many more are also represented.

What all the materials have in common are degradation and damage to different degrees by soluble salts absorbed by the objects from the surrounding soil. After excavation, the objects remain in danger of further deterioration in storage due to extreme environmental conditions of heat, high and especially fluctuating humidity, and high salt content in the air.

The main task in the conservation of most of the objects, therefore, is to remove the soluble salts to stop further degradation. Various conservation methods, depending on the material and state of preservation, have been employed to that end: ceramics are treated by desalination, in some cases followed by consolidation; copper alloys are mechanically, chemically and physically treated by inhibition and consolidation; and iron is mechanically and physically treated by sandblasting and consolidation.

This report summarises the work undertaken in the Conservation Lab in spring 2014.

15.2 SUMMARY OF MATERIALS

Table 7.1 summarises the types of materials conserved from the various sites under investigation. Altogether, 248 objects have been worked on between January and March 2014.

Additionally, 9 objects have been re-conserved to prevent further degradation.

	Ceramic	Amber	Stone & Stone Ware	Glass	Shell & Pearls	Bone	Plaster & Gypsum	Copper Alloy	Iron	Lead	Bitumen	Other
Al Zubarah	38	35	16	14		9	13	6	3	3	3	5
Freiha	41		7	14	5	1		23	1		3	3
Murair	1											
Khasuma			1									
Survey	1							1				

Table 15.1: Summary of field objects conserved in 2014.

15.3 MAIN CONSERVATION ISSUES

The main problem for most objects is the deterioration of the materials caused by soluble salts. These can pose a huge problem, as the salts - dissolved within the material at high humidity - start to crystallise as soon as the environment gets drier. This process is reversed again when the humidity increases. If the object is kept in an unstable environment, the damage continues in a cycle as the salts keep dissolving and re-crystallising (Klopf 2013:1).

Archaeological ceramics frequently show various forms of deterioration such as flaking, powdering and visual efflorescence of salt on the exterior due to salt crystallisation inside the pore network (Figure 15.1). These are not the only form of damage that can take place due to soluble salt activity; a fluctuating environment may also result in salt growth deep within ceramics that show no efflorescence on the surface.

Salt crystals take up much more space than the dissolved salts, and the crystals exert pressure on a range of materials such as ceramics, plaster and stones, causing flaking of the surface and disintegration of the materials (Klopf 2001:2, Montana et al. 2013:1, Stephen et al. 2000:266).



Figure 15.1: An example of visual efflorescence of salt on the exterior of a ceramic bead and a low fired ceramic fragment. (OF-3731 & UG)

Soluble salts in metals, for example chlorides, are highly corrosive. Corrosion is defined as the destructive and unintentional attack on metal. The corrosion process is normally electrochemical: exposed to high humidity, soluble salts will be present as aqueous solutions and will thus be ideal electrolytes for a rapid corrosion process (Callister 2007: 623f, Hjelm-Hansen 1986:119f).

15.4 DESALINATION OF CERAMICS

Standard Desalination Treatment

The standard desalination method consists of placing the object in a static bath of tap water, usually in a plastic bucket (Figure 15.2). The water is changed daily except for weekends; a line is drawn on the bucket to obtain the same volume of water at each change. This is continued until the salinity of the solution has stabilised. The time taken to remove the soluble salts can vary from a few weeks to several months.

The extraction of salts in each bath is monitored by conductivity, microSiemens per cm ($\mu\text{S}/\text{cm}$) being the standard unit of measurement using a conductivity meter (Hanna Waterproof Tester EC/TDS). Studies on the desalination end-point suggest that a conductivity somewhere between 100-150 μS is a safe level to end the desalination (Montana et al. 2013:7, Stephen et al. 2000:271, Unruh 2001:81). Finally, the object is removed from the water and air-dried (Figure 15.3).



Figure 15.2: Desalination in progress. Ceramics are immersed in a static bath of tap water. (UG)



Figure 15.3: Ceramics drying after desalination. (OF-3373)

Treatment Before and After Desalination

The standard procedure at Al Zubarah before desalination is to first remove the remains of excavation soil from the surface by cleaning with a soft brush or carefully by sandblasting, using micro-crystalline glass beads.

If the ceramic is glazed and thus fragile, friable and exfoliating, the glaze is consolidated in a solution of 2-5 % PVB in ethanol, applied to the surface by dripping with a pipette. Thereby the

glaze is stabilised to the surface and the salts cannot migrate through consolidated areas.

After desalination, the glaze is again consolidated in the same solution of PVB. If the unglazed ceramic seems unstable, this will also be consolidated then.

If an object is low-fired or is degraded to a point where desalination will cause more damage than good, it is only mechanically cleaned followed by consolidation.

15.5 CONSERVATION OF METALS

15.5.1 Copper Alloys

The most common copper alloy objects excavated at Al Zubarah and nearby sites are coins. They are generally heavily corroded and, due to the salty burial and post-excavation environment, bronze disease is detected frequently.

Bronze disease is very easy to determine, indicated as a light green powdery corrosion product on the surface. The green powder is the Cu(I) chloride, the most common source of corrosion problems. When exposed to oxygen and atmospheric moisture with a relative humidity (RH) as low as 35%, bronze disease develops. This is a real problem in a country like Qatar due to its high and fluctuating RH.

Most copper alloy objects can be stabilised by treatment with an inhibitor, in this case benzotriazole (BTA). It is a simple and satisfactory method for stabilising bronze disease. The inhibitor forms an inert, stable, polymeric film on the surface of the copper and on the corrosion products, which isolates them from atmospheric moisture and oxygen (Hjelm-Hansen 1986:84, Pearson 1987:236f).

The standard treatment method used currently on the copper alloy objects in Al Zubarah is to remove the corrosion layer by mechanically cleaning with an ultrasonic scalpel, ultrasonic dental chisel and a hand scalpel. The cleaned coin is then chemically inhibited in a solution of 3% BTA in ethanol under vacuum for 24 hours and consolidated in a solution of 7% Paraloid B72 in ethanol/acetone 3:2 under vacuum for 8-12 hours (Figure 15.4).

After treatment, the objects are stored in an air-tight container together with silica gel, a desiccant, which absorbs moisture and thus controls the local humidity.



Figure 15.4: A collection of copper alloy coins, showing one untreated and seven treated by mechanical cleaning, chemical inhibition and consolidation. (OF-3311)

15.5.2 Iron

Like copper alloys, iron also undergoes corrosion after excavation through the action of chloride ions that have diffused into the object during burial (Figure 15.5). The chloride ions act as an accelerator after excavation when exposed to oxygen and relative humidity (RH).

The post-excavation corrosion product akaganeite is capable of promoting iron corrosion at only 15 % RH. The corrosion rate increases rapidly above 35 % RH, resulting in cracking, delamination and fragmentation of the object (Rimmer et al. 2013:326, Watkinson 2013:95).

An option to prevent corrosion is desiccation and keeping the iron in a dry environment below 15% RH, but this requires a strict maintenance programme. Any failure in the desiccation programme allows corrosion to resume, creating high risks of loss if the failure goes undetected for a long period of time (Rimmer et al. 2012:29).

In principle, the desiccation method is used in Al Zubarah before and after treatment. First, the corrosion layer is removed mechanically by light sandblasting using micro-crystalline glass beads and with a miniature drill, followed by consolidation in a solution of 7% Paraloid B72 in ethanol/acetone 3:2 under vacuum for 8-12 hours (Figure 15.6). This helps to stabilise the iron; at the same time, the consolidation acts as a coating on the surface that prevents incoming moisture to dissolve the chlorides.

After treatment, the objects are stored in an air-tight container together with silica gel, which absorbs moisture and thus controls the local humidity.



Figure 15.5: An untreated iron knife with a thick corrosion layer. Attached to the surface are residues of organic material. (UG & OF-3914)

Another well-known treatment method is the removal of the chlorides by desalination. Desalination enhances stability by reducing corrosion rates, rather than preventing corrosion and inducing stability (Rimmer et al. 2012:30).

The most common treatment is aqueous washing in an alkaline solution. Normally, sodium hydroxide (NaOH) solutions are used, while sodium sulphite (Na_2SO_3) has also been suggested. The method has proved to be efficient, but removal of all chloride ions has not yet been demonstrated.

Immersion into the solution causes the NaOH to flood the object with negative ions to replace adsorbed chloride ions; Na_2SO_3 , which deoxygenates the solution, stops the corrosion process and frees chloride ions from their attraction to positively charged anodes at the metal surface.

During the treatment, the chloride content in the solution is measured. The treatment is



Figure 15.6: Two iron knives consolidated in a solution of 7 % Paraloid B72 and ethanol/acetone 3.2 under vacuum. (UG)

normally continued until chloride concentration in the solution is low (<5 mg/l). This is a time-consuming treatment (Rimmer et al. 2013:335, Watkinson 2013:95), and therefore, desalination of iron is not performed in Al Zubarah at present.

15.6 DESALINATION EXPERIMENT AND RESULTS

During the season, it was discussed if an alkaline desalination in a short period of time would extract enough chlorides to slow down the corrosion process.

An experiment was set up to study whether the majority of chlorides would extract rapidly in the first few weeks, as is valid for ceramics, followed by more slow extraction, and to examine the degree of reduction of the chloride content after a relatively short desalination period. The experiment aimed to test if a short desalination treatment of 3 to 4 weeks could be a useful

treatment for future conservation of iron objects.

An iron nail was selected for the experiment and immersed in an alkaline solution of 0.1 M NaOH in distilled water. As the current equipment for measuring conductivity at Al Zubarah can only take measurements in pure water, the desalination process was carried out by leaving the nail in the solution for approximately one week, followed by 24 hours in tap water to wash out all NaOH, followed by another 24 hours in fresh tap water. It was then measured for its conductivity and its pH. This process was repeated throughout the two months the experiment lasted.

The experiment concluded without any clear results. However, the results indicate that the desalination process did wash out some chlorides, especially during the first couple of weeks. How much chloride was extracted was not possible to detect.

For more clarification, better equipment is needed, for example an ion analyzer with a chloride-



Figure 15.7: Iron nail after conservation by desalination experiment. (OF-4889)

specific electrode, which will be able to take measurements in the NaOH solution.

After desalination, the nail was chemically stabilised with 3% BTA for 24 hours under vacuum as an extra experiment to study if BTA can act as an inhibitor on archaeological iron. This was followed by consolidation in a solution of 7% Paraloid B72 in ethanol/acetone 3:2 for three hours under vacuum to physically stabilise the nail (Figure 15.7).

15.7 CONCLUSION

This spring's conservation focus was on ceramics, beads and various metal objects, with copper alloy coins being of particular interest to identify any that retained diagnostic features for dating and trading information. Heavy corrosion has, however, obscured much, and while conservation is usually able to stabilise these objects, lost information remains unretrievable.

Desalination efforts will continue to be the main focus of the Conservation Lab in the future. Special focus should be on iron objects, as the current conservation treatment is not optimal in relation to sustainable preservation in the long term without a strict maintenance schedule. A continuation in the study of desalination in an alkaline solution with the right equipment would be of great interest to establish a better and more efficient conservation method. The high humidity and salt content in the air on the north-west coast of Qatar, as in the rest of the country, present challenges for treatment and long-term storage, be it in on-site stores at Al Zubarah Archaeological Site or within museum exhibitions.

16. OUTREACH AND SITE PRESENTATION

Katie Campbell

16.1 INTRODUCTION

Presentation and outreach activities at Al Zubarah have grown considerably over the past year due to increased awareness and media coverage following the site's inscription on the UNESCO World Heritage list in June 2013. Thanks to Maersk Oil Qatar's funding, visitor facilities have been expanded and improved upon with the opening of a Visitor Centre (VC). The focus for this year's work was the grand opening of the site to the public on 12th December 2013. Throughout the second half of the season, the practicalities of maintaining, securing and running the VC were worked out (Figure 16.1). Education activities have also continued to expand, with more school visits than ever before and the opening of a new education centre at the Zubarah Research Station. The past year has been pivotal in terms of turning Al Zubarah into a fully functioning visitor attraction, and maintenance of this momentum is crucial in order to further develop the tourism opportunities available here.

16.2 SITE PRESENTATION

Alongside designing and installing a cutting-edge Visitor Centre, the ruins of the old town were presented so they could be opened to the public. The VC consists of static panels in six of the fort's rooms, as well as a video room and a shop run by QM Enterprise. In the town, 17 updated panels have been installed along a walking track through the southern part of the site. These are accompanied by two new leaflets focussing on the walking tour and VC.

The presentation strategy allows the visitors to focus on areas of particular interest to them. Interactive features in the VC, such as the touch screen display and the iPads, allow visitors to explore the site in as much or as little detail as they like, while specially tailored children's material and a dedicated kid's corner in the fort caters for younger visitors.



Figure 16.1: Visitors enjoying the Visitor Centre in the newly restored Al Zubarah Fort.

16.3 AUDIENCE DEVELOPMENT

In order to develop the most effective facilities for visitors, several audience surveys have been carried out at the site over the past five years, and these are continuing into this phase of the project. A detailed visitor survey carried out in January 2014, a few weeks after the opening of the VC, recorded a variety of relevant data including dwell time in each room, flow around the building as well as profiling the audience by group, age and access to technology such as smart phones or cameras.

The centre was designed to function in any order; however, this study showed a preference for starting in rooms G01 and G03 (Figure 16.2). This suggests that the layout is working successfully as these two rooms, with the video and timeline, are designed to provide an overview of the site before visitors explore further. The kid's area had the lowest number of visitors, although those who did enter tended to spend a significant amount of time there. The environment room (G07) also showed a very low dwell time, although far more people entered the room. This allowed us to focus on the areas which required more content in the second stage of installation in the VC (completed May 2014).

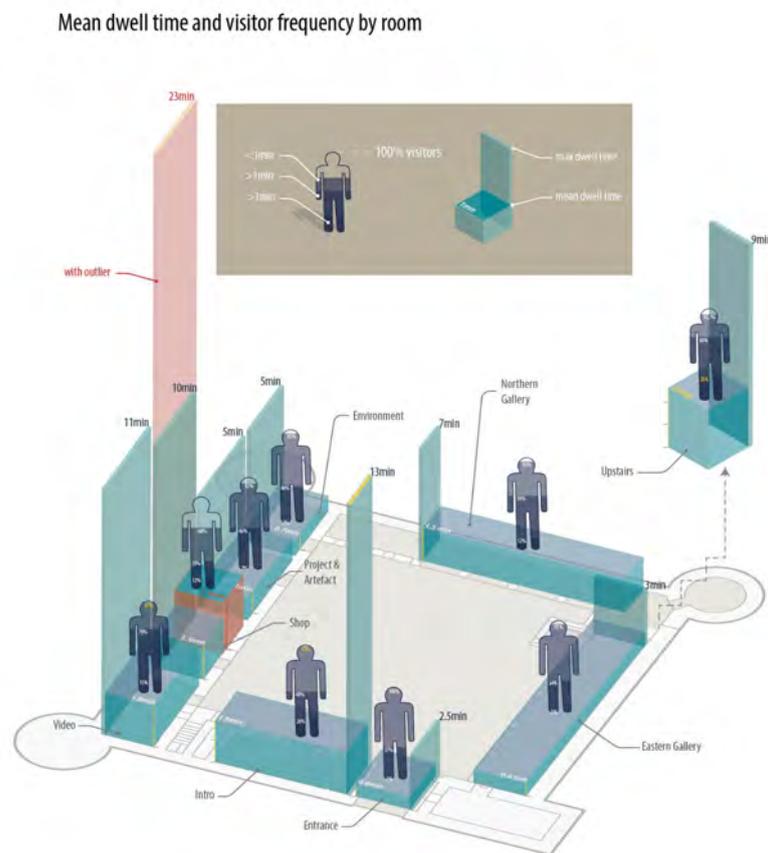


Figure 16.2: Mean dwell time and footfall within the Visitor Centre in January 2014.

Use of technology among visitors was also of great interest in order to further develop the interactive material for suitable platforms and devices. The observational survey found that 61% of visitors took photographs inside the VC, and many of them used more than one device to record their experience (Figure 16.3). 80% of the devices used at the fort had potential for internet or network connectivity such as smartphones and tablets.

These early observations informed on the design of Phase 2 of the VC as well as improvements to the day-to-day running and Phase 1 content. An interactive table has been installed in the environment room which should encourage people to engage more with this topic. To encourage visitors into the kid's area, some large wall-mounted panels will be installed in autumn 2014 so the activities are more visible; they already are popular once families have found them.

Thanks to the data collected on the number of Wi-Fi enabled devices, increased amounts of data available for download will also be made available in the fort and this facility advertised more clearly. This will allow visitors to access further information on the site, latest updates

Devices used for photography

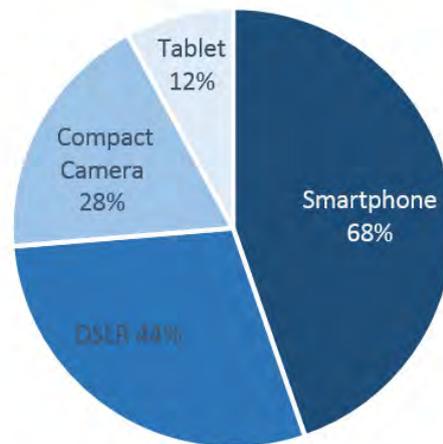


Figure 16.3: Devices used for photography. Some visitors used more than one device to record their experience.

on the research or facilities, as well as content in a variety of different languages. These early observations informed on the design of Phase 2 of the VC as well as improvements to the day-to-day running and Phase 1 content. An interactive table has been installed in the environment room which should encourage people to engage more with this topic. To encourage visitors into the kid's area, some large wall-mounted panels will be installed in autumn 2014 so the activities are more visible; they already are popular once families have found them. Thanks to the data collected on the number of Wi-Fi enabled devices, increased amounts of data available for download will also be made available in the fort and this facility advertised more clearly. This will allow visitors to access further information on the site, latest updates on the research or facilities, as well as content in a variety of different languages.

16.4 EDUCATION AND OUTREACH

Over the past year, as awareness of the site has grown and the school programme has become more established, the demand for school tours of the site has increased significantly. In 2012-2013, guided tours were given to more than 1000 children while the QIAH team were on site; in the 2013-14 season, this has increased to over 1700 (Figure 16.4). These include tours of the site where children can see archaeologists and conservation specialists at work. A dedicated education centre opened in January 2013 as part of the Zubarah Research Station. The centre provides a focus for education activities where children can see historic objects close up. Al Zubarah also welcomed a wider range of visitors in this season, with visits from groups as varied as Cambridge University and the Qatar Polish Community. The QIAH team is increasingly working to integrate its activities with the QM Archaeology Section outreach team by sharing of resources and streamlining of programmes.

The successful education programme will continue as before, and links are being forged with other educational organisations in Qatar in order to further integrate the activities at Al Zubarah with other opportunities. Alongside the QM's Archaeology Section, support and material will be produced and made available for teachers, allowing schools to teach lessons on the site independent of or before a visit.



Figure 16.4: QIAH organised school tour numbers at Al Zubarah.

16.5 VISITOR NUMBERS

Visitor numbers are now collected by G4 Security and passed on to the QIAH team and QM on a daily basis, which allows us to follow visitor trends, gauge the success of new exhibits and compare numbers to other attractions in Qatar. It is clear from the volume of visitors in the first half of 2014 that opening the VC has had a huge effect on Al Zubarah's status as a tourist attraction, with a 170% increase in visitor numbers in January 2014 compared to the year before (Figure 16.5).

It is likely that there are factors other than the opening of the VC for this impressive increase in numbers. QM Archaeology Section held weekend activities at the fort until the end of March which included camel rides, traditional Qatari food and henna. Al Zubarah's increased media profile, thanks to its UNESCO World Heritage inscription and continued coverage of activities at the site in the local press, have also raised awareness of the site to potential visitors.

It is important that the site maintains this level of visitors, but also that any growth in visitors is sustainable, and that facilities are increased and improved to protect the archaeological site and its surrounding environment. In order to maintain the site's media profile, a press release will be created each month for QM Archaeology Section based on activities at Al Zubarah. Negotiations are in progress with organisations such as Mathaf and the British Council's (Doha) education department to hold events at Al Zubarah in the autumn.

16.6 ARCHAEOLOGICAL SITE

The archaeological site is now open to the public every day and although less popular than Al Zubarah Fort, it is already attracting a significant number of visitors (Figure 16.6). The collected visitor data suggests that the vast majority of the visitors self-guide themselves around the site rather than visiting as part of an organised tour either via QIAH or with tour companies. Unsurprisingly, numbers have dropped as temperatures began to rise in April and the QIAH team began winding down archaeological activities for the season.

Efforts are already underway to promote the archaeological site alongside the VC. These include new signage on the road and around the fort to mark the route to the site more clearly.

However, it is important that the number of visitors to the site grows sustainably so as not to damage the site. Plans are underway to install raised driving and walking tracks on the site, but until these are in place, high visitor numbers may start to damage the remains.

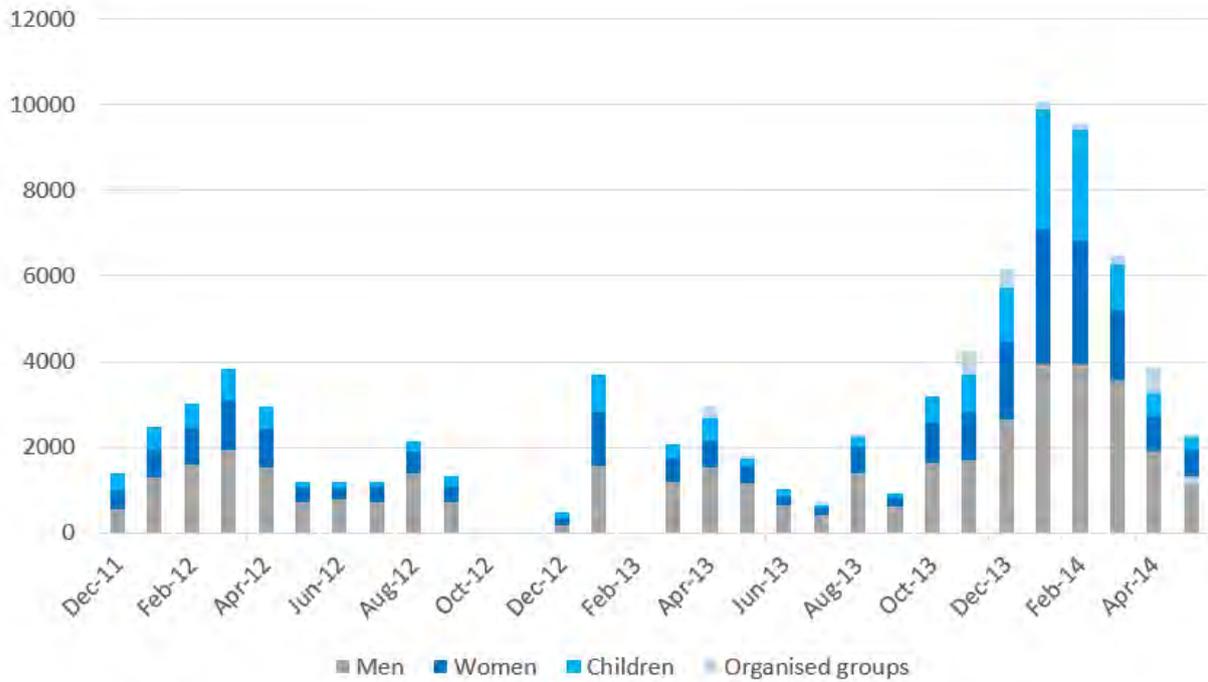


Figure 16.5: Visitors to Al Zubarah Fort since December 2011. Some of the data from 2012/13 is missing or incomplete.



Figure 16.6: Visitors to the archaeological site. Note that the site was only open to the public during weekends in April, May, October and November 2013.

16.7 COOPERATION WITH MAERSK OIL QATAR

The QIAH project has enjoyed a fruitful cooperation with Maersk Oil Qatar since May 2013. This support has enabled the creation of the Visitor Centre and the development of a cutting-edge mobile application to allow visitors to explore the site through their smartphones or tablets.

Cooperation between specialists from Maersk Oil Qatar and the QIAH project team has allowed geologists and ceramicists working on material from Al Zubarah access to high tech equipment and expertise. The results from Maersk Oil's Digital Core Lab in Qatar has provided an unparalleled insight into the provenance of ceramics and stone objects excavated at the site.

16.8 CONCLUSIONS AND RECOMMENDATIONS

The past year has been pivotal for Al Zubarah as a visitor attraction in the wake of its inscription on the UNESCO World Heritage list in June 2013. Increased media attention as well as the requirements of the World Heritage inscription have enabled the QIAH team to create a much-needed and very popular Visitor Centre in Al Zubarah Fort. The archaeological site is now open to the public full-time with a self-guided walking tour. Visitor numbers have risen by up to 170% compared to 2013, which indicates the success of both the facilities at Al Zubarah and the media and promotions strategy employed in conjunction with QM.

Over the next year, focus will shift onto popular publications following the success of three short picture books already on sale at Al Zubarah. Widening participation is also important over the next year, with plans to increase the array of languages that visitor and education material will be available in. Further streamlining activities in collaboration with relevant QM departments and the provision of support and training where required are also of the utmost importance for further development.

17. SUMMARY

Sandra Rosendahl

Many milestones were reached during the 2013/2014 season, of which the official opening of Al Zubarah Archaeological Site was only the first. An active UNESCO World Heritage site brings with it not only the benefit of increased publicity and awareness of local history, but also new challenges in the maintenance of the exposed remains and the requirement for a better understanding of the archaeology.

17.1 ARCHAEOLOGY

All archaeological work areas have been expanded and have revealed remarkable new discoveries for the history and economy of Al Zubarah town. The exposure of 15 new date presses in a small area by the beach (ZUEP02), adding to the already known number and the ones left unexcavated, indicate the scale and specialisation of the date processing and storage operation that took place in this market and light industrial area. Even more intriguing are the considerable changes that are clearly visible in the stratigraphy of the architecture and deposits by the beach: hints of pre-Phase 5 activity had already been detected in spring 2013 (House 2013), and could be seen again underneath the earliest surfaces of the street through the date press area as well as, tentatively, in the pre-construction activity in the palatial compound (ZUEP04). It is hoped that further exposure of this Phase 6 occupation will elucidate the mechanics and chronology of the first settlement of Al Zubarah, whether there was a village pre-dating the establishment of the town, and the time frame for manifesting the grand building plan that clearly underlies Al Zubarah.

The date press rooms in ZUEP02, in addition, show that their initial function was not that of storing and processing dates, indicated by evidence of the later addition of the *madbasa* superstructure. Short of removing a date press in order to investigate the underlying surfaces, this evidence is visible only in small sections. It is tempting to postulate that the change of the beach front area into a centralised date processing quarter, albeit one likely operated on a household level judging by the high degree of individualism in the design and maintenance of each *madbasa*, is directly reflected in the removal of the date press function in the domestic courtyard house in ZUEP01 (see Yeomans 2011). Further analysis of material culture associated with this phase of activity may shed further light on this development, which may represent a change in population and leadership dynamics with the influx of Wahhabism towards the end of the 18th century (Hakima 1965).

In Freiha, the limited excavations on the exterior of the mosque have raised more questions than could immediately be answered, particularly in regards to the building history of this central structure in the village. Final investigations in the autumn will aim to clarify the number of building phases reflected in the many masonry changes, and attempt to correlate the history of the mosque with the development of the domestic area (FREP04).

Studies of the material culture from Freiha has moved ahead considerably, with significant results reported from the preliminary stratigraphic analysis of fish and non-fish bone, shell and botanical remains. Ceramic analysis has so far provided an extensive catalogue of wares found in the village, and will proceed towards a spatial and chronological analysis next. Studies of special finds and other find groups are forthcoming.

17.2 HERITAGE CONSERVATION

The challenge of preserving and maintaining the exposed architecture in Al Zubarah town is being tackled by various methods of consolidation, using predominantly local materials and, where possible, traditional techniques. Nevertheless, problems persist due to salts and humidity in the air and soil, attacking the masonry and plasters and causing additional damage. The conservation team are working relentlessly to counteract these effects of the harsh environment, but in some cases, constant exposure to the elements of fragile and delicate features cannot be maintained. This is particularly the case for the fine plasters of the date presses in ZUEP02.

These issues are raising questions regarding the plans for the expansion of visitor access, which is intended to run through the historic *souq* area. Alternative presentation methods may need to be evaluated in the near future that find a compromise between preserving the original architecture and providing a meaningful and educational experience for tourists.

Work in Al Zubarah Fort is nearing completion. With the finishing of the works in the interior of the fort, focus can now be put to the repair of the exterior facades and the finalisation of the staircase in the northwest tower. Issues regarding drainage of the courtyard will be addressed in the autumn.

Of particular interest in the fort this season were the results from preliminary building history studies that arose in the course of the repairs of the entrance gate, the flagpole and a staircase. Despite its young age, the fort has undergone a number of structural changes that are still visible today, and any further repair works should aim to preserve this history.

17.3 OUTREACH

The popularity of the outreach programme, particularly the educational programme for school groups, has been increasing every season. For a large number of international schools, Al Zubarah Archaeological Site is now a fixed part of the curriculum. In forthcoming seasons, we aim to expand our tour programme to Arabic-speaking schools.

The establishment of the first Tourist Track in 2012 has also proven successful, and plans for the expansion of the site tour via a second track are now being made. Weather permitting, this will allow visitors to follow guided paths with abundant information on the archaeology, history, conservation and environment of the site, and provide the tangible experience of Qatar's history that is introduced in the Visitor Centre.

During the summer, QIAH also participated in a number of academic conferences. A paper was presented on the topic of "Al Zubarah Archaeological Site and the Qatar Islamic Archaeology and Heritage Project: Outreach and Presentation Strategies in an Open-Air Museum" at the Museums in Arabia Conference in June 2013, organised by UCL Qatar. A further two papers were accepted for the Seminar of Arabian Studies in July at the British Museum in London: an exploration of the early Islamic horizon identified during field survey, entitled "Abbasid Rural Settlement in Northern Qatar: Seasonal Tribal Exploitation of an Arid Environment?"; and an in-depth study of the dhow etchings in the palatial compound, titled "Boat and ship engravings from Zubarah, Qatar: the *dāw* exposed?".

17.4 RECOMMENDATIONS

The next field season will begin in October 2014 and run to the middle of December. In this time, the main excavation areas will be continued to be investigated: extending the warehouse

in ZUEP02; opening excavations in the eastern wing of Precinct Section 8 and in the corridor in ZUEP02; and finalising the excavation of the mosque in Freiha.

Specialist analysis will continue on priority material from Freiha, and move towards study of material from ZUEP01 where this is finished.

Conservation work will concentrate on the repairs of the facades of Al Zubarah Fort, while final consolidation works are to be undertaken in QMA4.

We continue to benefit from and appreciate the support of Qatar Museums in our work.

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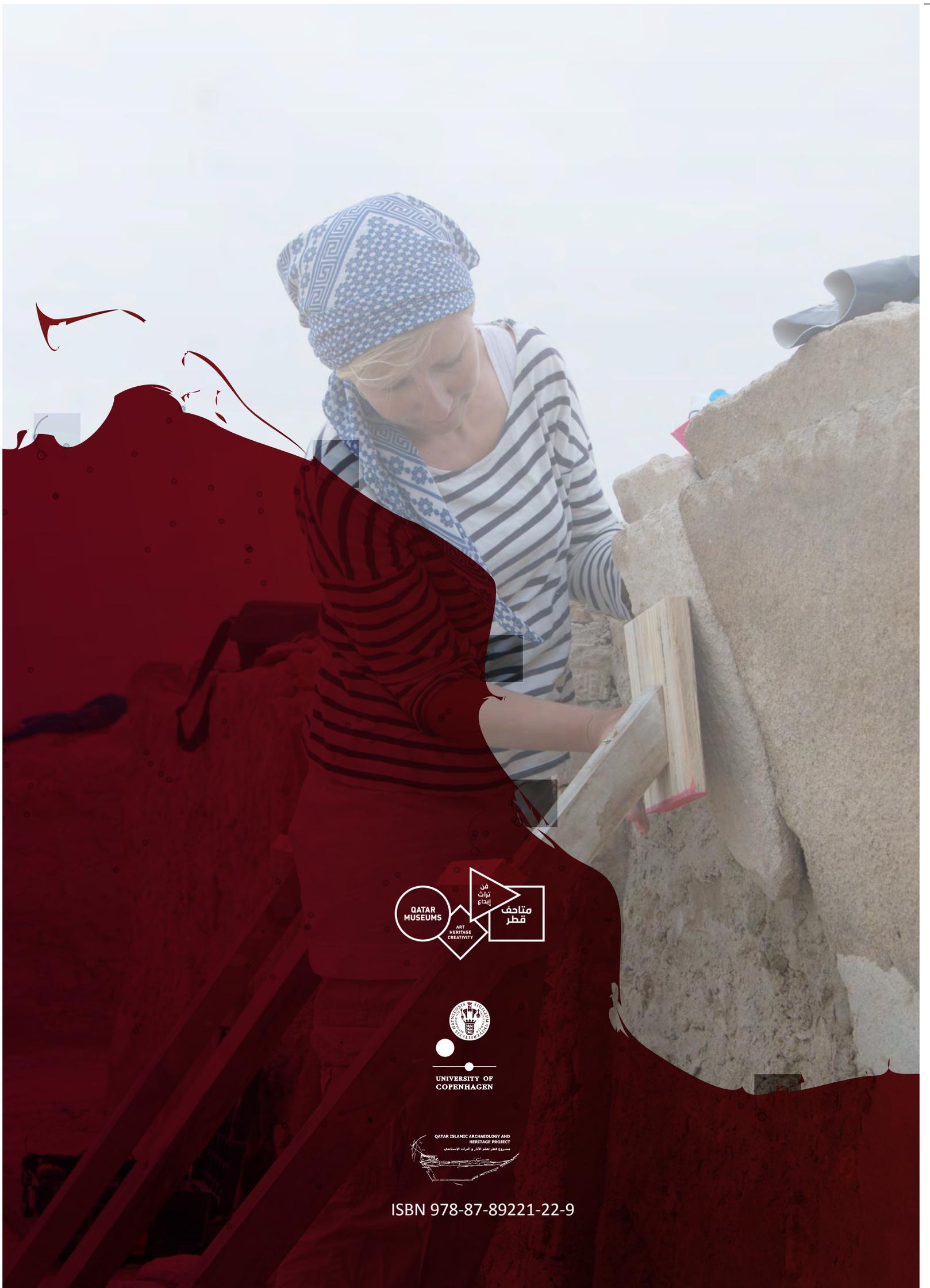
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