Proceedings of the Seminar for Arabian Studies

VOLUME 49 2019

MBI AL JABER Foundation

IASA International Association for the Study of Arabia
الرابطة الدولية لدراسة الجزيرة العربية

Proceedings

of the

Seminar for Arabian Studies

Volume 49

2019

Papers from the fifty-second meeting of the
Seminar for Arabian Studies
held at the British Museum, London,
3 to 5 August 2018

Seminar for Arabian Studies

Archaeopress
Oxford

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ISSN 0308-8421
ISBN 978-1-78969-230-3
ISBN 978-1-78969-231-0 (e-pdf)

The Steering Committee of the Seminar for Arabian Studies is most grateful to the
MBI Al Jaber Foundation
for its continued generosity in making a substantial grant towards the running costs of the Seminar and the editorial expenses of producing the *Proceedings.*

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Guidelines and Transliteration

Guidelines for Authors
For details on the submission of papers and the preparation of papers for publication, authors are requested to consult and follow the latest *Guidelines for Authors.* These are available on the The International Association for the Study of Arabia website at www.thebfsa.org/content/psas-guidelines. Please contact the editors on PSAS@thebfsa.org for further information.

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1. Arabic

ء	M	ج	j	ذ	dh (dh)	ش	sh (sh)	ظ	Ξ	ق	q	ن	n
ب	b	ح	ḥ	ر	r	ص	ṣ	ع	K	ك	k	ه	h
ت	t	خ	kh (kh)	ز	z	ض	ḍ	غ	gh (gh)	ل	l	و	w
ث	th (th)	د	d	س	s	ط	ṭ	ف	f	م	m	ي	y
Vowels		a i u ā ī ū		Diphthongs		aw	ay						

The underlined variants can be used to avoid any ambiguity, e.g. *lam yushir* vs. *lam yushir.*
Initial *hamzah* is omitted.
Alif maqṣūrah is transliterated as ā.
The *lām* of the article is not assimilated before the 'sun letters', thus the form should be *al-shams* but not *ash-shams*.
The *hamzat al-waṣl* of the article should be shown after vowels except after the preposition *li-*, as in the Arabic script, e.g. *wa-ʾl-wazīr*, *fīʾl-bayt*, but *li-l-wazīr*.
Tāʾ marbūṭah (ة) should be rendered *-ah*, except in a construct: e.g. *birkah*, *zakāh*, and *birkat al-sibāḥah*, *zakāt al-fiṭr*.

2. Persian, Urdu, and Ottoman Turkish

Please transliterate these languages using the system set out for Arabic above with the additional letters transliterated according to the system in the *Encyclopaedia of Islam* (http://referenceworks.brillonline.com/entries/encyclopaedia-islamica/system-of-transliteration-of-arabic-and-persian-characters-transliteration) except that *ž* is used instead of *zh*. There is a useful table to convert Ottoman Turkish to modern Turkish characters on http://en.wikipedia.org/wiki/Ottoman_Turkish_language.

3. Ancient North and South Arabian Consonants:

ʾ	b	t	ṯ	ḥ	g	ẖ	d	ḏ	r	z	s^1	s^2	s^3	ṣ
ḍ	ṭ	ẓ	ʿ	ġ	f	q	k	l	m	n	h	w	y	

4. Other Semitic languages

Please use the transliteration systems outlined in the *Bulletin of the American Schools of Oriental Research* (BASOR) 262 (1986), p. 3. (www.jstor.org/stable/i258780).

Editors' Foreword

The Seminar for Arabian Studies is the principal international academic forum for research on the Arabian Peninsula. First convened in 1968, it is the only annual academic event for the study of the Arabian Peninsula that brings together researchers from all over the world to present and discuss current fieldwork and the latest research. The Seminar covers an extensive range of diverse subjects that include anthropology, archaeology, architecture, art, epigraphy, ethnography, history, language, linguistics, literature, numismatics, theology, and more besides, from the earliest times to the present day or, in the fields of political and social history, to around the end of the Ottoman Empire (1922).

The Seminar meets for three days each year, with an ever-increasing number of participants coming from around the globe to attend. In 2018 the fifty-second meeting took place, in which fifty-seven papers and posters were presented in London at the British Museum, where this prestigious event has been hosted since 2002.

The Proceedings appear each year as a result of intense and effective cooperation between the editorial and production team, the Editorial and Steering Committees, peer reviewers, and the many contributors to the volume. The patience and support of the authors is to be applauded despite very tight production deadlines, particularly when authors are also engaged in fieldwork and/or in remote locations during the production period. Thanks to the dedicated and enthusiastic editorial and steering committees the papers presented at the Seminar, having been subjected to an intensive review process, are published in time for the subsequent Seminar. The rigorous nature of the reviews undertaken by a range of specialists ensures that the highest academic standards are maintained, and consequently not all papers are accepted for publication in the Proceedings.

This year the editorial team consisted of four excellent assistant editors: Orhan Elmaz, Harry Munt, Tim Power, and Julian Jansen van Rensburg. Many thanks are due to Rajka Makjanic and David Davison of Archaeopress, who are a pleasure to work with and continue to deal with all aspects of the production of this journal professionally. Finally, I would like to thank our outstanding copy-editor, Helen Knox, whose attention to detail and patience cannot be faulted.

For more information about the Seminar for Arabian Studies please contact Daniel Eddisford (seminar.arab@thebfsa.org), Seminar for Arabian Studies, The British Museum, Middle East Department, Great Russell Street, London WC1B 3DG, UK, or visit the Seminar website at www.thebfsa.org/seminar. The International Association for the Study of Arabia (IASA), formerly the British Foundation for the Study of Arabia, is a charitable organization that exists to advance public knowledge through the promotion of research relating to the cultural and natural heritage of the Arabian Peninsula. The IASA publishes an annual bulletin in the spring; for further information about the IASA, please contact Carolyn Perry, Chair of the BFSA, by emailing contact@thebfsa.org or visit the BFSA website at www.thebfsa.org/.

Daniel Eddisford
April 2019
e-mail: psas@thebfsa.org

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In memoriam
Paolo M. Costa, 1932–2019

Paolo M. Costa died on 13 January 2019. One of the big names of Arabian archaeology since the 1970s and a regular participant at the Seminar for Arabian Studies, he is a great loss to the field and will be much missed.

He was born in 1932 in Turin where he obtained his degree in Roman archaeology. From 1964 to 1969 he lived in Baghdad where he was secretary of the Italian Institute of Archaeology and a professor at the University of Baghdad. He cooperated with the Directorate General of Antiquities of Iraq to organize the archaeological collections in the new Iraq Museum and carried out several surveys on Islamic sites.

Between 1970 and 1975 he served as archaeological adviser to the Yemen Arab Republic. During this period, he established the archaeological section of the National Museum of San'a, carried out several surveys, and was in charge of the first comprehensive study and conservation programme of the Great Mosque of San'a. He also drafted the first antiquity law to control the research and conservation of the Yemeni cultural heritage.

From 1972 to 1976 he cooperated with the Middle East Centre of the University of Cambridge (UK) and carried out research on early Islamic architecture in the Arabian Peninsula. In 1976 he worked with the World of Islam Festival Trust to organize the exhibition 'Nomad and City' at the Museum of Mankind in London.

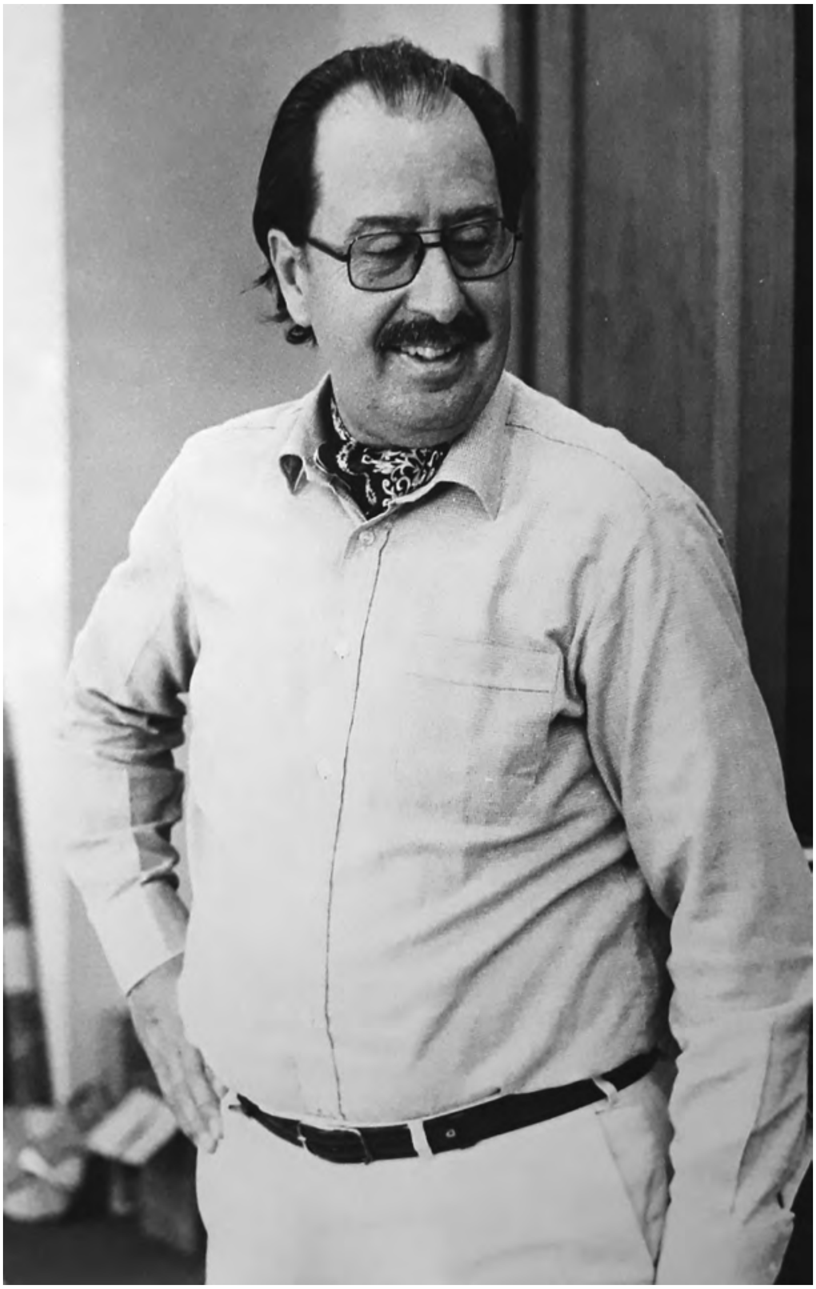
In 1976 he was appointed as an adviser for archaeology in the Sultanate of Oman, where he resided until 1986. Over this decade, he organized the Department of Antiquities (now Ministry of Heritage and Culture). He started a regional inventory of archaeological sites and buildings of historic interest and directed excavations at sites in Salalah, Arja, Bawshar, Saruj, and Ghafat. He conducted exploratory works on the Jebel Akdhar and in the areas of Muscat, Bahla, Ibra, Wādī Tanuf, and Wādī Ma'awil.

Costa was the deputy chairman of the first 'International Conference on Oman Studies' held in Muscat in November 1980, which was attended by over 100 scholars. He was also the coordinator of the 'Heritage of Oman Festival' held in Muscat by the Ministry of Heritage and Culture in the same year. He was appointed as editor-in-chief of the *Journal of Oman Studies*. At the end of his term of service Costa was awarded the Civil Order of Oman by His Majesty Sultan Qaboos bin Said Al-Said.

He is the author of numerous scientific publications including several monographs, such as *Yemen: A land of builders* (1977), *Musandam Architecture and Material Culture of a Little Known Region of Oman* (1991), *Studies in Arabian Architecture* (1994), and *Historic Mosques and Shrines of Oman* (2001).

He is survived by three children and his wife Germana.

Dennys Frenez



Paolo M. Costa, 1932–2019

Proceedings of the Seminar for Arabian Studies 49 (2019): 1–6

A documentation of Old Jiddah's Ottoman *arbiṭah*: selected case studies (poster)

Hidaya M. Abbas

Summary
Old Jiddah has a variety of historic buildings that are spread in the city's four neighbourhoods: al-Shām, al-Yaman, al-Mazlūm, and al-Baḥr. Its rich architectural heritage includes houses of different sizes, mosques, governmental buildings, souks, and educational and pious foundations. The *arbiṭah* are significant examples of pious foundations in the city. This paper traces the history of the *arbiṭah* in Old Jiddah through the illustration of specific examples. The architectural analysis of each *ribāṭ* is preceded by an introduction on the *ribāṭ*'s location, importance, and brief history. Principally used as shelters, the functions of the *arbiṭah* are also described. This study aims to contribute an understanding of a relatively unknown part of the city's architectural heritage.

Keywords: Ribāṭ, Jiddah, pious foundation, Ottoman

Introduction

The *ribāṭ* (pl. *arbiṭah*) is a significant Islamic pious foundation. They have existed in different Islamic cities since the ninth century. Although the *ribāṭ* began as a military foundation for soldiers, it was soon adopted for other functions related to education, mysticism, and shelter for the less fortunate. *Arbiṭah* were similar to other pious foundations, such as *takāyā* (sing. *tekkiya*) or *khānqāwāt* (sing. *khānqā*). They were always endowed by the wealthy and were popular in Jiddah and other Ḥijāzī cities, such as Medina and Mecca, in the eighteenth and nineteenth centuries. They were also common in other significant cities in the region, such as Cairo, Damascus, and Baghdad. According to the Sālnāme of the Ḥijāz *vilāyet* of 1301/1884, Jiddah had twelve Ottoman *arbiṭah* (Sālnāme 1301/1884: 134). These *arbiṭah* had different functions and were mainly designed as an open courtyard with surrounding cells.

More research has been done on Mecca's *arbiṭah* than on those of Jiddah. It is believed that they had several functions even before the Ottomans annexed the Ḥijāz in 1517. There were fifty-nine *arbiṭah* in Mecca before the Ottoman domination (Mortel 1998: 30). Although many of these *arbiṭah* were shelters for the needy, some were educational and even had libraries. A good number of *arbiṭah* in Mecca were specifically used as pilgrims' hospices (al-Shafiʿī 2005: 19). More *arbiṭah* with similar charitable functions were built in Mecca during the Ottoman era (2005: 37). Jiddah's Ottoman *arbiṭah* were of the same idea and function. Like those of Mecca, they were named either after the people who built them or after those who lived in them (al-Thaqafī 2015: 199).

This study analyses three examples of Jiddah's historic *arbiṭah*, their history, function, and architecture. It illustrates their similarities and differences. The selected *arbiṭah* are Ribāṭ Bānāja, Ribāṭ al-Khunjī al-Kabīr, and Ribāṭ Shiḥāta, all built in the nineteenth century. The *arbiṭah* of Jiddah were similar in their functions to contemporary ones in Mecca. They were, in many cases, endowed either for the less fortunate in society or for pilgrims. The latter was popular in Mecca at various times and were usually endowed for pilgrims of specific ethnicity. For instance, the Ribāṭ Muḥammad Ḥusayn al-Sindī was endowed in 1892 for the pilgrims of Bahawalpur (al-Shafiʿī 2005: 120). Despite their historic importance, Jiddah's remaining *arbiṭah* have received very little attention.

Ribāṭ Bānāja

Location and importance

Ribāṭ Bānāja is located in Maḥallaṭ al-Shām, just behind Bāb Jadīd in northern Old Jiddah. Today there is a large empty space in front of it on its northern side. It is located among many wealthy buildings, such as the Bānāja and Batarjī houses.

This *ribāṭ* was built by one of the most distinguished Ḥijāzī businessmen, ʿAbd Allāh Pāshā Bānāja. He was born in Jiddah in the early 1850s. His father, Yūsuf Bānāja, was one of many merchants who were expatriated from Jiddah to Cyprus after the British attacks on Jiddah following an incident during which the British vice-consul, the French consul, and other foreigners were killed. This occurred during the controversial 1858 troubles that were probably related to the fact that the British consul stepped on the Ottoman flag (*The Church of England Quarterly Review* 1858: 218–219). ʿAbd Allāh lived in Cyprus with his family for several years until his father died. The family then moved back to Jiddah. ʿAbd Allāh subsequently relocated to Istanbul and created a successful jewellery business. He was given the title of Pāshā by Sulṭān ʿAbd al-Ḥamīd and was one of the very few Ḥijāzīs to take this title (Maghrabī 1984: 245).

ʿAbd Allāh returned to Jiddah when his eldest brother died and became the head of the family. Together with his other brother ʿAbd al-Raḥmān, ʿAbd Allāh bought many buildings in Jiddah to establish his business and set up an appropriate house for the family. He bought a small house next to the Ḥanafī Mosque, one of Jiddah's oldest mosques, and converted it into a *maqṣūra*, which was a private praying area linked to the mosque. Family members prayed in it on weekdays and it received rulers and royalty, such as Sharīf Ḥusayn ibn ʿAlī, the Ottoman Sulṭān Mehmed VI Vahideddin, and Sulṭān al-Quʿayṭī of Ḥaḍramawt, for Friday prayers and special occasions. ʿAbd Allāh also bought some buildings in Mecca, including a huge palace near the al-Masʿā area. It was built by the Egyptian authorities in the early 1800s and hosted Khedive Ismāʿīl when he came for the hajj. In 1915 ʿAbd Allāh Pāshā Bānāja moved to Cairo, probably due to the political transition to Sharīf Ḥusayn's rule, although Ḥusayn made ʿAbd Allāh's nephew, Aḥmad Afandī Bānāja, his minister of finance. In Cairo ʿAbd Allāh also bought many properties; the most famous were his palace in ʿAbbāsiya and a building he built in Maydān Falakī. The family moved to Cairo some years later. ʿAbd Allāh died in Cairo in the early 1920s and by 1925 his family had returned to Jiddah. As he did not have any children, his brother and partner, ʿAbd al-Raḥmān, inherited his fortune (al-Ansari 1982: 389). ʿAbd Allāh owned many properties in the northern neighbourhood of Jiddah, Maḥallat al-Shām, most notably houses that were rented by consulates. Ribāṭ Bānāja was first built as a caravanserai for pilgrims and later dedicated to widows and needy women. It was built at the end of the nineteenth or early twentieth century.

Architectural analysis

Following the typical design of Ottoman *arbiṭah* in the city, this *ribāṭ* has a rectangular layout with a courtyard in the middle and rooms, or cells, surrounding it. This one-storey building is accessed from the western side. The entrance is flanked by windows, two on each side. The first style is the typical trilobed window found in many buildings in Jiddah. The second is also common and is the slightly pointed arched window. The arrangement is symmetrical, suggesting that the window on the far right is shorter because of recent renovation. On the upper register there is a series of ten smaller round-arched windows. The entrance itself has an obviously renovated door with a rounded arch and a slightly pointed arch encompassing it. There is a typical window between both arches that increases ventilation and provides light.

The building's southern side has two registers: the upper register has the roof's small windows and the lower register has eight large rectangular windows. Each of these large windows opens into a cell. The windows are in a bad state of repair and only a few of their features remain, such as the polylobed design. The eastern and northern facades continue with the same pattern of small windows in the roof and larger ones in the lower register (Fig. 1).

The entrance of the *ribāṭ* leads to a small *dihliz* (entrance lobby), with *maksalāt* (benches; sing. *maksala*) on both sides. This leads to the spacious courtyard whose cells open on the sides. Each cell has a large window and built-in shelves. There are two toilets near the staircases, each in the centre of the longer side of the plan. The stairs lead to the roof that is surrounded by the smaller series of windows (Fig. 2).

Ribāṭ al-Khunjī al-Kabīr

Location and importance

Built in the early 1900s and endowed to widows and poor women, Ribāṭ al-Khunjī al-Kabīr is located in Abū ʿInaba Lane in the neighbourhood of al-Shām in Old

FIGURE 1. *Ribāṭ Bānāja* — **left to right:** *the main (western) facade; the southern facade; one of the windows.*

FIGURE 2. left: *Dihliz (*entrance lobby*)* — **centre:** *the courtyard;* **right:** *example of a cell.*

Jiddah (al-Thaqafī 2015: 200). It was built by one of the city's merchants, Maḥmūd Khunjī Afandī (Sālnāme 1301/1884: 134).

Architectural analysis

The *ribāṭ* adopts an irregular rectangular layout where its longest side is the northern one, followed by the southern side. The other two sides are almost of the same length. The main, western, facade faces Abū ʿInaba Lane. As at Bānāja, the facade has a symmetrical design in which the main entrance is flanked by windows of trilobed and slightly pointed arches. Here the windows are built in two storeys and decorated with vegetal and knotted designs. These are made of *nūrah*, a local plaster, which is used to whitewash buildings and create these carvings. The structure, as others in Old Jiddah, is built of local *mangabī* coral stone that is supported by wooden beams. Although the original door was removed, the main entrance still has the double arched design with a small window to increase ventilation. The eastern facade is similar to the western one, although it has a middle *minwar* (pl. *manāwir*) for light and ventilation. The northern and southern facades are similar to each

Figure 3. *Ribāṭ al-Khunjī al-Kabīr* — **left to right:** *the main facade; the entrance; the eastern facade.*

Figure 4. *Ribāṭ al-Khunjī al-Kabīr* — **left to right:** *the inner porch; example of an ʿuzla; a dikkah. Note the variety of arches.*

Figure 5. *Ribāt Shiḥāta* — **top, from left to right:** *the main facade, entrances to cells, and a view of the courtyard;* **bottom:** *an inscription showing the date of the building.*

other. Both have a very uniform design of windows: six at ground level and four in the upper level. There are three *manāwir* in each of these two facades (Fig. 3).

The main entrance of the *ribāṭ* leads to a covered lobby leading to a courtyard surrounded by complex living units traditionally referred to as *ʿuzlah*. There are fourteen *ʿuzlāt* on the ground floor and four on the upper floor. Each *ʿuzlah* has a lobby, kitchen, bathroom, and multi-functional room. On the ground floor there is an inner porch between the living units farthest from the entrance and a courtyard that provides more shade to the units and increases ventilation. There are many interesting decorative elements on the upper floor, including a significant variety of arches. In addition to the typical trilobed arch seen in Jiddah, there are other unusual ornate arches. There is also evidence of a *rushan dikkah* (seating area) although the *rushan* itself is missing (Fig. 4).

Ribāt Shiḥāta

Location and importance

This *ribāṭ* is also located in Maḥallat al-Shām, not very far from Ribāṭ Bānāja. It is dated 1254/1838. The building is very damaged and badly neglected. Before the *ribāṭ* reached this condition five kitchens were built inside, probably used for charitable events. According to the *waqfiyya* of this *ribāṭ* it was dedicated to needy women (al-Thaqafī 2015: 208).

Architectural analysis

The general layout of this *ribāṭ* is very similar to Bānāja. The main, southern, facade has the entrance in the middle and a series of large windows on both sides. There is only one staircase in this *ribāṭ*, located in a corner rather than in the centre and cells open onto the central courtyard. Because this *ribāṭ* is a small one, its cells are smaller than those in other *arbiṭah*, but they still have built-in shelves. The main entrance lobby is smaller here but is also covered. This building, like others in Jiddah, is built of *mangabī* coral stone and wooden beams and covered with *nūrah* (Fig. 5).

Conclusion

Old Jiddah had many *arbiṭah* that developed over time. Most of these were in Maḥallat al-Shām and if not used by pilgrims, were endowed to serve the needy. These *arbiṭah* were typically designed with an open courtyard in the middle and a covered entrance. They might have simple cells or more complex living units, known locally as *ʿuzlah*. In terms of their building materials and aesthetic features, they followed the traditional methods used in the old town. Their layouts resembled those of other pious foundations in the region, either *arbiṭah*, *takāyā*, or *khānqāwāt*. Ribāṭ al-Aḥmadī and the Egyptian Tekkiya in al-Madīnah had a similar layout although they were used for different functions.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 7–24

Initial results of a research programme on Iron Age II pottery production in the al-Ḥajar mountains: compositional analyses of pottery vessels used in a domestic context, in a reception building, and in a ritual area at Masāfī (Fujairah, UAE)

Anne Benoist, Sophie Méry, Steven Karacic, Maël Crépy, Louise Purdue & Sophie Costa

Summary
This article explores the results of petrographic and neutron activation analysis (NAA) of Iron Age II pottery groups from the region of Masāfī with reference to their location and use. The analysis compares vessels collected in a domestic context, vessels collected in a context of reception, and vessels deposited in a ritual area. The results are discussed in the light of the local geological background.

Keywords: south-east Arabia, Iron Age, pottery, petrographic analyses, NAA analysis

Introduction

At the beginning of the first millennium BC, the archaeological record provides ample evidence for a significant change in social and economic practices within south-eastern Arabia. Following several centuries with scarce evidence for settlements, there is a proliferation of sites throughout the Oman peninsula, here defined as the United Arab Emirates and the northern extent of the Sultanate of Oman. Changes in subsistence strategies such as the development of *falaj* irrigation and the domestication of the dromedary camel — both clearly in use by this period although the inception of both remains to be determined — must have contributed to the floruit of settlements. Additional attention has been paid to trade networks that connected the region to other parts of the Arabian Gulf and recent research on the circulation of goods — and among the latter, pottery vessels — has mainly focused on the identification of long-distance patterns of circulation (Magee et al. 1998; Magee 2010; Benoist & Méry 2012). Relatively less attention has been paid to more quotidian matters of pottery production and consumption within a single settlement. The focus of this paper is to look inwards with the specific aim of understanding how pottery was produced and utilized within a single settlement.

Masāfī is located in the northern Ḥajar mountains at the boundary between the Emirates of Fujairah and Ras al-Khaimah. The French Archaeological Mission in the United Arab Emirates, under the supervision of Anne Benoist, first explored the area in 2006. This team identified an Iron Age occupation in the southern part of the Masāfī area within Fujairah. Excavations were carried out between 2007 and 2016 with the support of the Fujairah Authority for Tourism and Antiquities, leading to the discovery of three contemporaneous Iron Age II sites scattered around a central cultivation area under the present palm grove (Fig. 1).

To the north-west, Masāfī-2 is a rectangular settlement surrounded by a fortification wall extending for an area of 100 x 90 m on the eastern slope of Jebel Halyan. Masāfī-2 is divided into two sections. The upper part, located to the west, consisted of at least two small buildings and a large courtyard that might have served as a vantage point and place of defence. Lower on the slope was an area with houses set side by side along a network of pathways and alleys organized in an orthogonal pattern. Excavations conducted in the northern part of this settlement brought to light partly preserved floors with layouts attesting to domestic activities — for example, fireplaces, storage areas, wooden installations, stone slabs used as supports or thresholds, post holes, etc. (Benoist 2013).

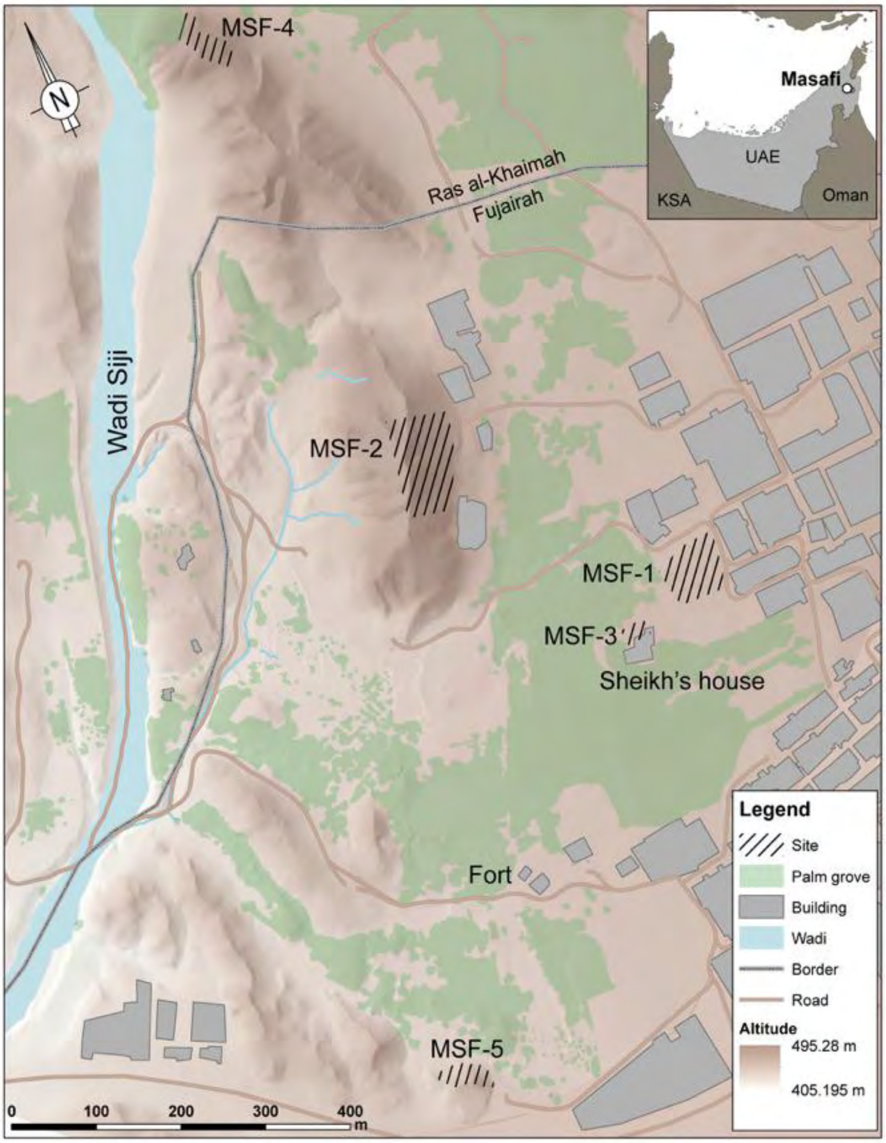

Figure 1. *A map showing the location of Masāfī (© French Archaeological Mission in the UAE).*

To the east, Masāfī-1 has provided a succession of three superimposed buildings consisting of a large central room with column bases and traces of a white render on the wall and floors and several lateral rooms used for storage and domestic or craft activities (including possible metallurgy in a small room). These structures were interpreted as collective buildings used by the Iron Age community for meetings, festivities, and the storing of valuable goods such as metal ingots (Benoist et al. 2011; 2012). Such buildings are attested at several Iron Age II sites (Muwaylaḥ, Rumaylaḥ, Bidaᶜ Bint Saᶜūd, etc.) and their collective function has been extensively discussed (Benoist 2002; Boucharlat & Lombard 2001; Magee 2003; Benoist 2010).

Masāfī-3, which is 60 m south-west of Masāfī-1, was a small building excavated under the courtyard of a traditional house recently restored by the Fujairah Authority for Tourism and Antiquities and belonging to the Fujairah ruler's family. Masāfī-3 was open on the western side, in the direction of the central cultivation area and measured around 5 x 4 m. Four squared podiums or bases were installed outside in front of the entrance. This small building was interpreted as a ritual area where ex-votos in copper and pottery were deposited

(Benoist et al. 2011; 2012). Similar small buildings with deposits inside have been documented at other Iron Age sites such as al-Quṣayṣ and Biṭnah (Benoist 2010; Benoist, Skorupka & Pillault 2013).

The pottery from Masāfī

A different pottery assemblage was collected in each of these three areas (Fig. 2). In Masāfī-2, the pottery included a majority of storage vessels (large storage jars and large opened vessels with lids, medium neck-jars with suspension lugs around the body, basins, and large bowls). In Masāfī-1 a large quantity of small spouted jugs and bowls in fine or common ware, often painted, was found in the central room in each building, together with a few braziers heavily burnt inside, decorated with snakes, birds, and camels whereas large storage jars were collected in the lateral rooms. This evidence would point to collective banqueting activities hosted in these central rooms, an interpretation that finds parallels from Building II of Muwaylaḥ. In Masāfī-3, the pottery was almost exclusively represented by braziers, some with a foot, others with a horizontal handle at the base. A large number of these braziers were decorated with snakes in appliqué relief, but very few of them showed traces of burning. Moreover, braziers included vessels of very small size, which could be interpreted as miniature vessels intended as representations rather than vessels designated for use. All these elements led the excavators to interpret the majority of the Masāfī-3 assemblage as ritual deposits.

Technically, the pottery collected in these three different areas of Masāfī is consistent with Iron Age II wares known throughout the region. Vessels are not wheel-made but appear to be handmade and coiled. Tiny horizontal or sub-horizontal lines visible on the surface, generally in the upper part of the vessels, point to finishing with quick, rotational movements consistent with the use of a slow wheel. Large storage vessels might have been shaped in several parts made with large coils of clay and often have ribs where the coils come together. There are no traces of burnishing or polishing on the vessels. Surfaces are matt, sometimes covered with a thin red or black slip or whitened during the process of firing. Some vessels are decorated with incisions (especially storage jars and large vessels), others with dark red or black paint (especially small vessels such as bowls and spouted jugs). Decorations in appliqué relief representing a snake appear on braziers from Masāfī-3 (more than 200 examples recorded) and more occasionally from Masāfī-1 (around ten examples recorded). The snakes vary from one vessel to the next and are made from coils of clay or larger bands and affixed to the vessel using different methods on the clay. Many snakes are decorated with round impressions made with a tubular tool.

With only a few exceptions, the pottery collected in different areas of Masāfī appears to be made in a light to bright orange fabric, generally soft, often reducing to powder when handled. This orange fabric has numerous variants, some with a fine temper, not macroscopically visible, others with only a few fine white grits, and others still with medium or coarse grits visible in the paste. This latter variant is composed of mainly red and white grits sometimes associated with vegetal impressions.

During the macroscopic classification of pottery made in the field by A. Benoist, it was obvious that the common orange ware was not a homogeneous group, not only because of the variants of the size and quantity of temper visible in the paste but also because of variations in texture and apparent degree of firing. Although boundaries between different possible pottery groups within the common orange wares could not be precisely defined, differences were noticed in the texture of the pastes between the assemblage of Masāfī-1 (where the pottery often appears a bit finer and better fired), the assemblage of Masāfī-2 (where the pottery is often coarse and soft), and the assemblage of Masāfī-3 (where the pottery often appears to be fine but soft and apparently fired at a lower temperature than at Masāfī-1). However, the limits between possible sub-groups based on texture or degree of firing remained vague and difficult to determine and the reasons for such differences in texture remained unclear. Were they really illustrating different ware composition or different processes of firing and thus specialized production? Or did they result from different conditions of preservation? This is particularly relevant for the material from Masāfī-3, which, unlike Masāfī-1 and Masāfī-2, appears to have been regularly inundated by water. Ultimately, during the macroscopic study it was decided not to sub-divide the common orange wares with the exception of a distinction between 'coarse', 'medium', and 'fine' variants based on the size of the temper.

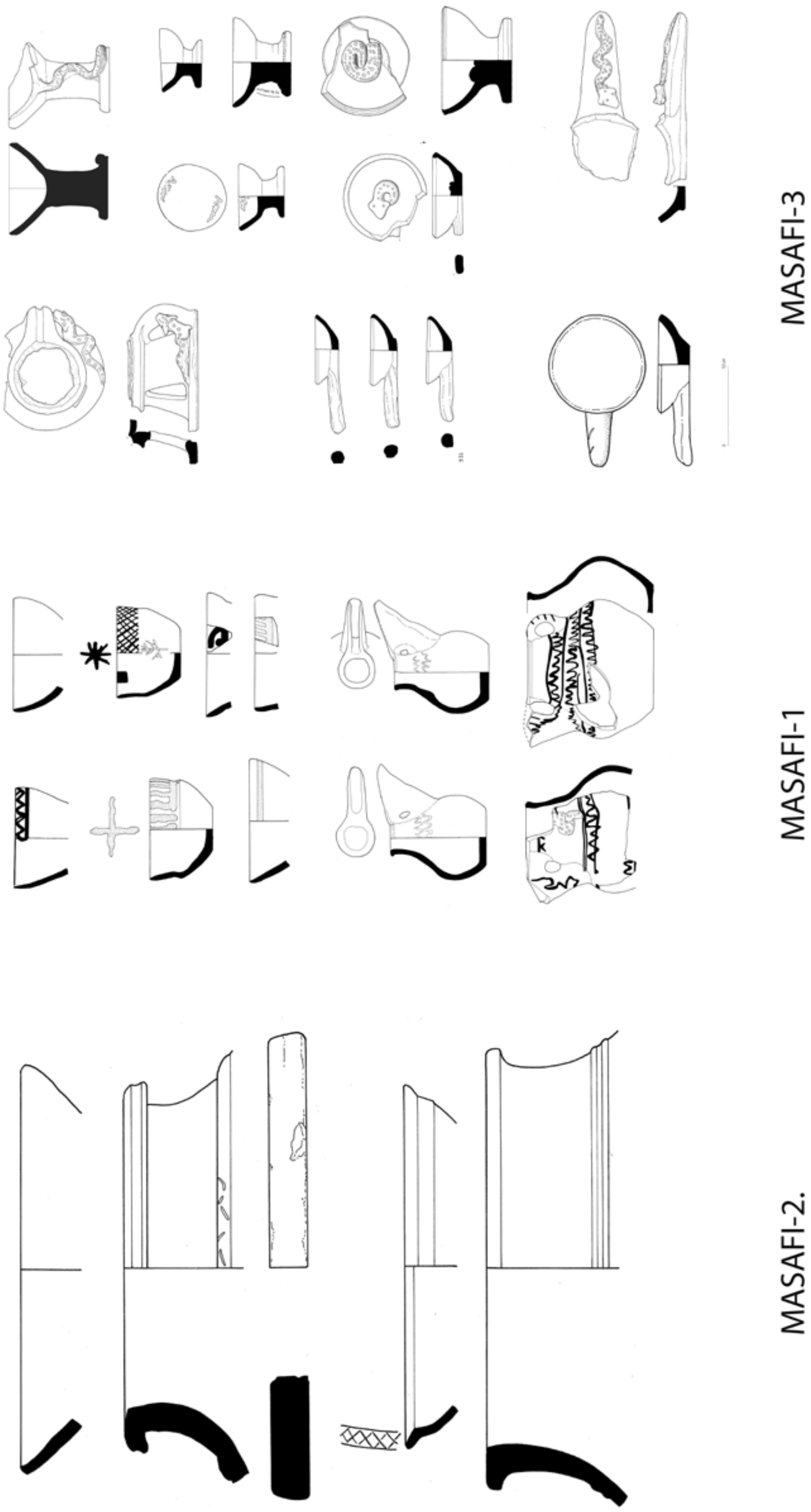

FIGURE 2. *Different kinds of vessel assemblages observed at Masāfī.* **Left:** *storage jars and basins from a domestic context at Masāfī-2;* **centre:** *drinking sets from the columned hall at Masāfī-1;* **right:** *braziers from Masāfī-3 (© V. Bernard).*

But these archaeological observations about the distribution of pottery at Masāfī raised the question: were different potters supplying each of these areas of the site with different pottery? Could we draw a link between the use of the vessel and a particular *chaîne opératoire* involving different workshops or different ways of firing? To test this question, we carried out a programme of research combining petrographic and chemical analyses of the pottery.

Sherds from each site were selected in collaboration with the Fujairah Department of Tourism and Antiquities. In total eighty-four pottery samples were exported to France. They included thirteen samples from Masāfī-2, forty-five samples from Masāfī-1, twenty samples from Masāfī-3, and five samples collected on the surface or in levels excavated inside the palm-grove area.

Geological framework

Masafi is located in the Ḥajar mountains, dominated by the Semail Ophiolite complex (gabbros, peridotite, serpentinite, copper veins) and Cretaceous limestones. In the oasis itself, the ophiolite, locally composed of harzburgite and serpentinite, is in contact with a metamorphic window. While these metamorphic rocks are generally dominated by pale grey, greenschist to amphibolite facies and quartz-rich metasedimentary rocks (Roberts, Thomas & Jacobs 2016), in Masāfī they are mainly composed of quartzite, quartz-mica schist, and chlorite-quartz schist (Fig. 3) (Grantham et al. 2003).

From a petrographic standpoint, harzburgites are mainly composed of olivine (70–90%), ortho-pyroxenes (10–30%), and clino-pyroxenes (<3%) (Tegyey 1990).

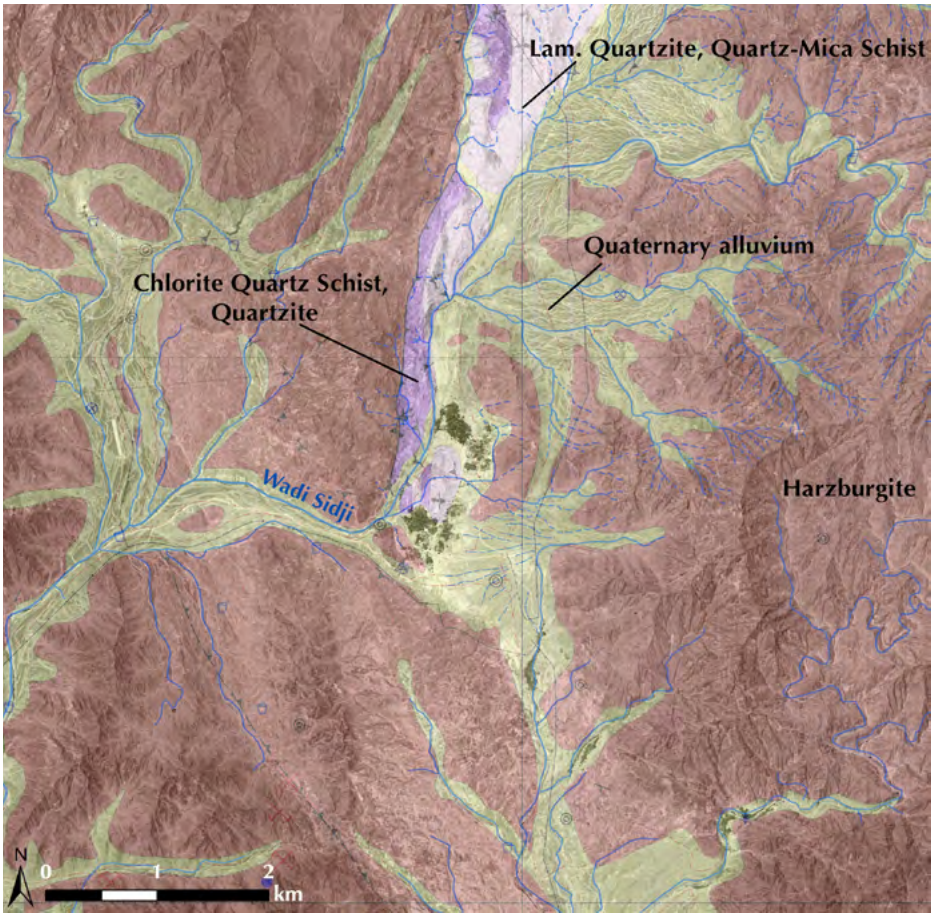

Figure 3. *A geological map of the Masāfī area after Grantham et al. 2003 (© M. Crépy, L. Purdue and S. Costa, OASIWAT Project; base map: CORONA 1971).*

Metamorphic rocks in Masāfī are principally composed of quartz, chlorite, mica, feldspar, and amphibole (Pomerol 2011; Roberts, Thomas & Jacobs 2016; Searle et al. 2014).

Geomorphic and geoarchaeological surveys conducted since 2011 have allowed us to identify three types of quaternary formations surrounding the palm grove and in the oasis itself (Charbonnier, Purdue & Benoist 2017; Charbonnier et al. 2017; Purdue 2011; Crépy 2017; Crépy & Costa 2016):

— on hillslopes and their piedmonts, east and north of the oasis of Masāfī, colluvium has been encountered. It is composed of silt-sized to plurimetric blocks of weathered harzburgite, metamorphic rocks and, more occasionally, limestone;
– alluvial fans and wadi deposits have been encountered on low to moderate slopes east and north of the palm grove but also in its centre, covering the geological bedrock. These deposits are composed of millimetric to decimetric colluvial gravels and blocks of harzburgite, white gravels and blocks of limestone, as well as aeolian sands and silts. More or less cemented (depending on their period of deposition), the deposits are reworked during gullying episodes and sheet-flow erosion, and transported to low-lying areas, such as in the deeply incised Wādī Sidji, west of the oasis;
– aeolian deposits (originating from the Rubᶜ Al Khālī) are composed of very fine silts and sands (5–200 μm), comprising quartz grains, limestone, and micritic grains, as well as minerals from regional watersheds (olivine, serpentine, amphibole, feldspar, etc.). These deposits can be found either in primary position (strict aeolian deposits) or in secondary position (reworked by run-off or human activities); they have been found as relict pockets in the upstream watersheds, east and north of the oasis, but also as extensive deposits in the oasis itself.

The petrographic analysis

A total of thirty samples were selected for petrographic analysis, performed at the University of Rennes (Fig. 4). Petrographic investigations (by S. Méry) of these thin sections conformed to previously employed analytical techniques developed by Benoist and Méry (2012). These samples were selected from Masāfī-1 (n = 12), Masāfī-2 (n = 3), Masāfī-3 (n = 13), and from the surface collection conducted on a nearby farm (n = 2).

All the pottery originates from the same petrographic environment. Despite a degree of heterogeneity, it is possible to define five variants, termed variants A–E, according to the aspect of the matrix and the composition of the fine mineral fraction. These variants are discussed from coarse (variant A) to fine fabrics (variants B, C, D, E).

ID	Site	Pottery Classification	Petro VARIANT	NAA Group
S02	Masafi.3	one-handled bowl with snake	A	1
S03	Masafi.3	pedestalled bowl with snake	E	1
S04	Masafi.1	medium necked jar	D	3
S06	Masafi.1	bowl	B	1
S07	Masafi.1	bowl with marked shoulder	B	1
S08	Masafi.1	small jar	B	N/A
S10	Masafi.1	undulating bowl	C	2
S12	Masafi.1	bowl with marked shoulder	B	3
S13	Masafi.1	basin	E	3
S14	Masafi.1	medium jar	B	2
S15	Masafi, palm grove	medium necked jar	D	N/A
S17	Masafi, palm grove	storage jar	A	2
S20	Masafi.3	medium jar with snake	E	3
S21	Masafi.3	body sherd with snake	A	N/A

ID	Site	Pottery Classification	Petro VARIANT	NAA Group
S22	Masafi.3	body sherd with snake	A	1
S27	Masafi.2	storage jar	B	1
S30	Masafi.2	jar	A	2
S31	Masafi.3	pedestalled bowl with snake	A	1
S32	Masafi.3	unclear shape with snake	B	1
S33	Masafi.3	body sherd with snake	A	N/A
S34	Masafi.3	body sherd with snake	E	2
S36	Masafi.3	pedestalled or handled bowl with snake	B	N/A
S37	Masafi.3	pedestalled bowl with snake	A	No Group
S38	Masafi.3	pedestalled bowl with snake	A	1
S39	Masafi.3	pedestalled or handled bowl with snake	C	2
S57	Masafi.2	undulating bowl	C	N/A
S68	Masafi.1	carinated bowl	C	1
S70	Masafi.1	bowl	D	No Group
S71	Masafi.1	bowl	B	1
S77	Masafi.1	jar	C	1

Figure 4. *A table showing the origin, description, petrographic variants, and NAA groups of each sample analysed.*

1. Coarse fabrics

Variant A

S02, S17, S21, S22, S30, S31, S33, S37, S38

These samples are macroscopically characterized by a bright orange colour. Some of the samples (S02, S17, S30, S33, S38) have a greyish to grey core, the other samples are fully oxidized.

Brown-red in plane polarized light (PPL) and red-brown with low optical activity in cross polarized light (XPL), the *matrix* is characterized by its low optical activity. It shows signs of a strong contraction during the drying and the beginning of the firing of the vessel, creating elongated porosities along aggregates of clay and tiny micas.

The *fine mineral fraction* (under 500 µm) is mainly composed of quartz and micritic rounded carbonates (sometimes including vestiges of recrystallized fossils). Quartz and other white minerals (plagioclases and alkali feldspars) are small, unsorted, often sharp and irregular in shape. Their extinction is mainly undulatory, and some of the crystals are tectonized. Sub-rounded to rounded fragments of ultramafic rock types, mainly serpentinites and harzburgites, are visible (note that the amount of ophiolitic fragments in the fine fraction is higher in S17 and S30 than in the other samples). The serpentine is strongly coloured in orange to dark red. Isolated sub-automorphic pyroxenes and basaltic hornblendes are few. Polycrystalline quartz is present, as well as some elongated white micas (muscovite) and a few radiolaria.

The other characteristic of the samples is the presence of a *coarse added temper*. This coarse temper fraction is more or less abundant (even in the same sample), in some cases rather large (up to 3–4 mm) and non-sorted. It mainly comprises sub-angular to sub-rounded fragments of ultramafic rock types (including serpentinite and harzburgite). The serpentine is very strongly coloured in orange to dark red; the relics of the primary minerals (olivine, pyroxene, and plagioclase) are uncommon. Fragments of marls are also present, some of them include vestiges of bioclasts (recrystallized fossils), quartz and feldspar monocrystals, or even fragments of serpentinite. A few fragments of metamorphic rocks as quartz-schist and mica-schist were also identified (Figs 5–7).

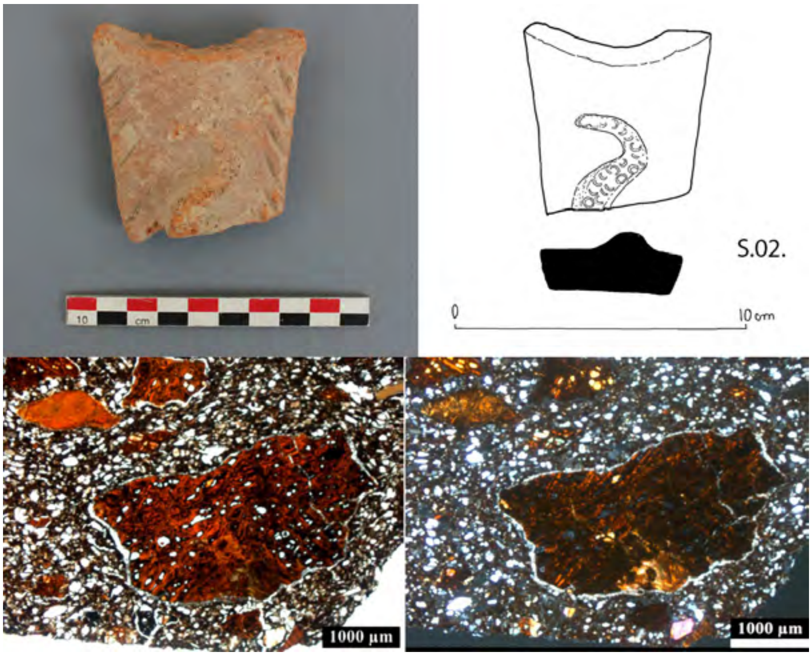

Figure 5. *Variant A, sample S02.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *plane polarized light (PPL);* **bottom right:** *cross polarized light (XPL) (© S. Méry). The fragments of serpentinite and harzburgite are strongly coloured due to the oxidized firing of the pottery.*

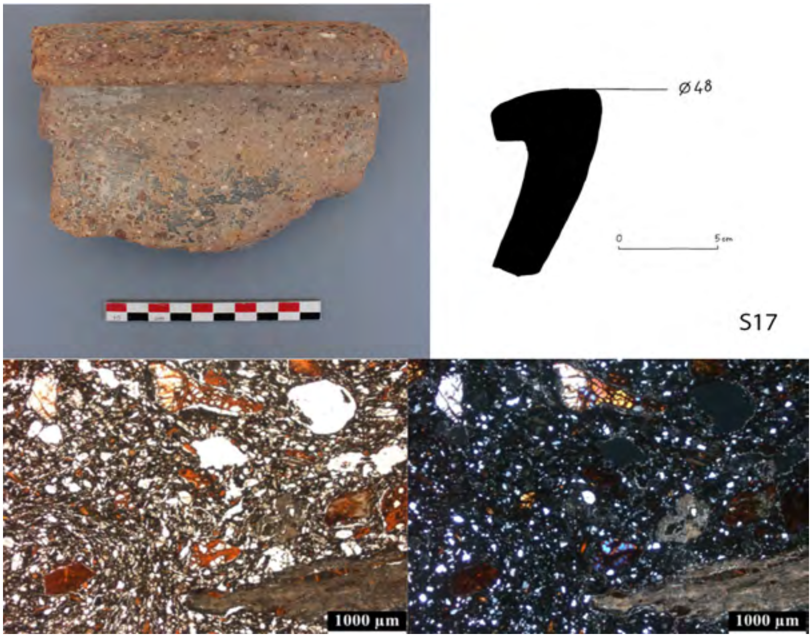

Figure 6. *Variant A, sample S17.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (© S. Méry). The elongated porosities along aggregates of clay and tiny micas are well visible in PPL, as well as the fragments of serpentinite and harzburgite. An elongated patch of marl is visible in the bottom right-hand corner of the photographs.*

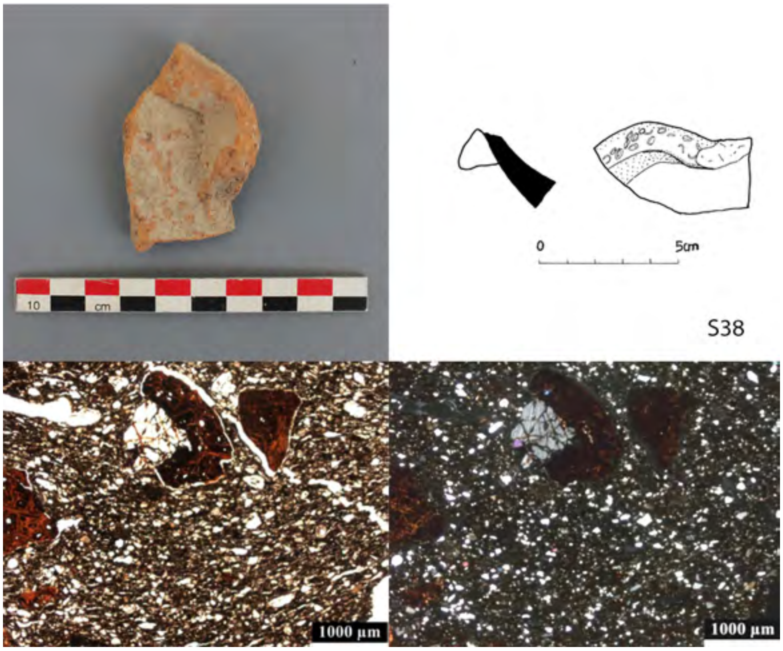

FIGURE 7. *Variant A, sample S38.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (© S. Méry). At the top centre of the photographs, a pyroxen is visible partly embedded in a highly serpentinized olivine.*

2. Fine fabrics

Variant B

S06, S07, S08, S12, S14, S27, S32, S36, S71

The matrix and fine temper have the same composition (mineralogy, granulometry, angularity of the grains, etc.) as those of the variant A samples. The mineral inclusions over 500 µm are rare. The matrix of S27 has a slightly different aspect than the other samples, with two phases (one is red-brown and argillaceous, the other is pale brown-greenish and marly). S12 contains more and bigger marly fragments than the other samples (Fig. 8).

Variant C

S10, S39, S57, S68, S77

The difference with the previous samples consists in the aspect of the matrix which is more micaceous and less porous, and the abundance of tiny minerals (as quartz, feldspars, etc.) in the matrix. Sample S39 also differs by its very high proportion of added fine vegetal temper. All samples are fully oxidized except S68, with a black grey core (Fig. 9).

Variant D

S04, S15, S70

Fully oxidized, the *matrix* is pale brown-grey under PPL and pale brown, marbled, with low optical activity under XPL. The matrix is a mix of two phases (one is argillaceous, the other is marly). It is characterized by numerous elongated vacuoles along the aggregates of clay phyllites. The paste-ware is deeply impregnated by tiny secondary carbonates.

The *fine mineral fraction* (mainly under 500 µm) is mainly composed of beige to grey micritic rounded carbonates. Among the latter, vestiges of recrystallized fossils are visible. Quartz monocrystals (sometimes with undulatory extinction), are slightly more abundant in the fraction 300–500 µm than in the previous samples from variants A–C. They can be very irregular in shape, but rounded. Sub-rounded to rounded serpentinite and harzburgite fragments are also frequent, with a mix of beige to brown or orange-red colour. Isolated radiolaria, fragmented plagioclase crystals, and a few white micas (possibly muscovite) are also present.

A *coarser mineral fraction* (up to 1–1.5 mm long) is moderate (S70) to abundant (S15), unsorted, and comprises sub-rounded to rounded serpentinite and

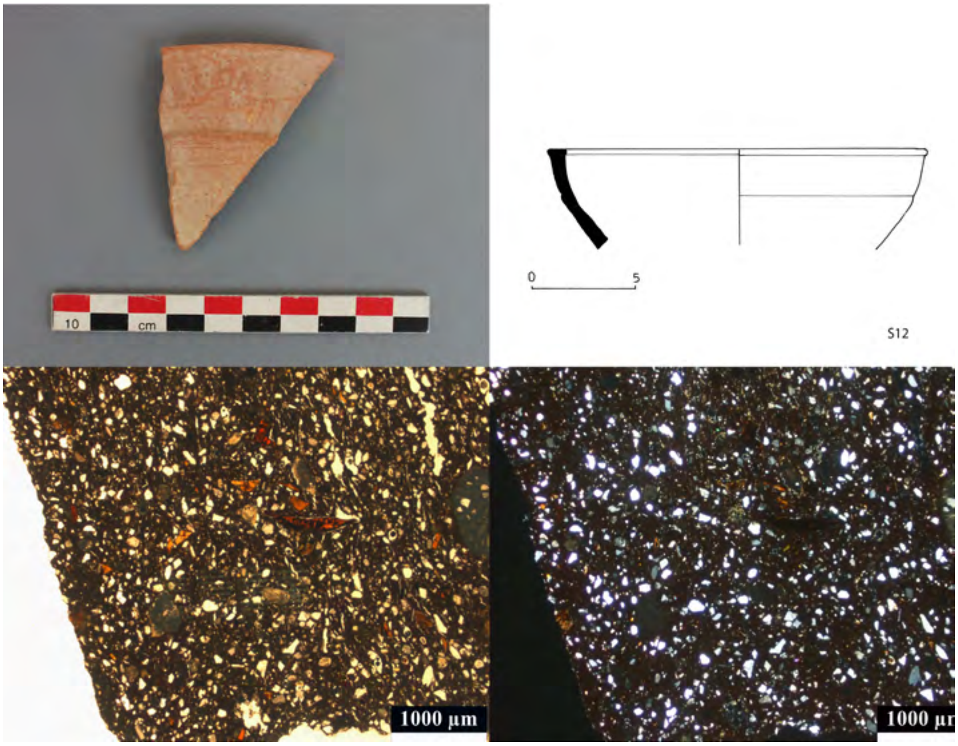

Figure 8. *Variant B, sample S12.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (© S. Méry).*

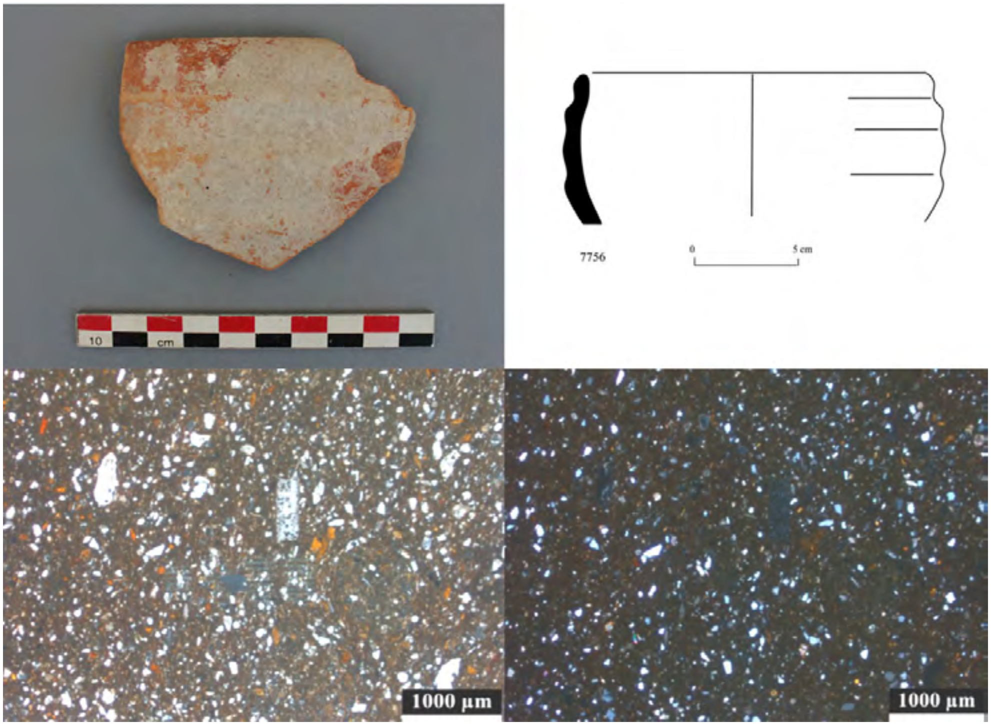

Figure 9. *Variant C, sample S57.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (© S. Méry).*

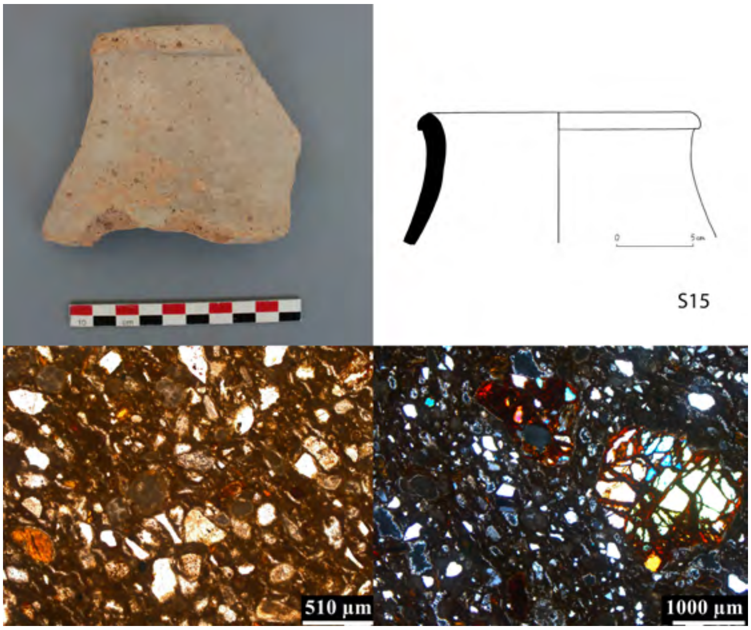

FIGURE 10. *Variant D, sample S15.* **Top:** *macroscopic view (© A. Benoist) and drawing (© V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (©S. Méry). In variant D, rounded grains of beige-greyish micrite dominate the fine mineral fraction.*

harzburgite (with serpentinized olivines) fragments strongly coloured in orange to dark red, and fragments of micritic limestones including recrystallized fossils. Some fragments of quartz-schist or mica-schist are present (Fig. 10).

Variant E

S03, S13, S20, S34

The matrix of these samples is also different from the previous ones. It is characterized by a finer and more micaceous composition than the other samples, and a meshed structure.

The *fine temper fraction*_(mainly under 500 µm) is mainly composed of clear quartz monocrystals, sub-angular to sub-rounded and rather well sorted. Potassium feldspars, plagioclases, and rounded opaque minerals are present as well as vestiges of sub-rounded micritic carbonates including very recrystallized fossils, and fragments of sparry calcite or single crystals of calcite. The quartz is bigger, better sorted, and more regular in shape and rounded than that of the other samples.

A *coarser temper fraction* of (up to 1–1.5 mm long) is very moderate to moderate in quantity. It mainly comprises sub-rounded to rounded fragments of serpentinite and harzburgite, plus fragments of micritic limestone with vestiges of bioclasts (including recrystallized fossils), a few quartz crystals, and occasional feldspars. A few fragments of quartz schist and mica schist are visible as well as polycrystalline quartz (Fig. 11).

Broader implications for the petrography

Intentionally added mineral temper is almost certain in the case of the coarse fabric samples. It can be also the case for S04, S15, and S70, as well as for S03, S13, S20, and S34.

Intentionally added vegetal temper (fine to very fine) is frequent, but very abundant in only four samples (S02, S17, S27, S30, and S39). Generally, oxidization is complete, and the degree of firing, according to the aspect of the primary calcite fragments, very moderate (S03, S13, S20, S34) to moderate.

Patterns of distribution for these five variants are tentative given the relatively small size of each group. Variant A is more frequently found among the pottery collected in the small ritual building of Masāfī-3, and variant B, which includes two vessels with snake appliqué decorations from Masāfī-3, is more commonly found at

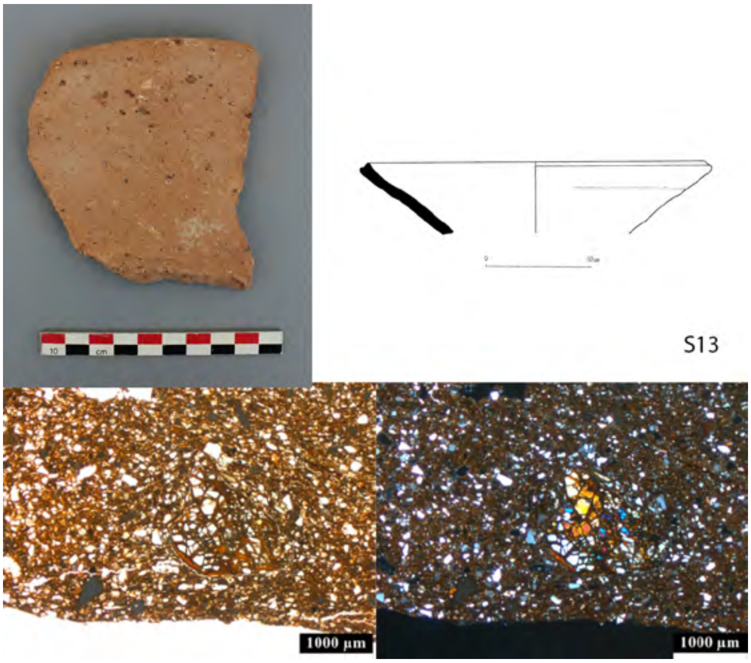

Figure 11. *Variant E, sample S13.* **Top:** *macroscopic view (©A. Benoist) and drawing (©V. Bernard);* **bottom:** *microscopic view;* **bottom left:** *PPL;* **bottom right:** *XPL (©S. Méry).*

Masāfī-1 in the form of bowls. Besides these two more common variants, it is noteworthy that the pottery decorated with snake representations occurred in variants C and E, and both of these groups were found at Masāfī-1 and Masāfī-3. Although there do appear to be some correlations between variants and site distribution (variant A and Masāfī-3, variant B and Masāfī-1), and variant A seems to be more commonly found among the pottery decorated with snakes mainly used during ritual practices at Masāfī-3, nevertheless the larger picture points to a relatively even distribution of the variants within Masāfī. It also appears that four of the five compositional variants were used for the production of snake appliqué pottery.

Neutron activation analysis

Neutron activation analysis (NAA) was conducted on sherds from Masāfī-1 (n = 11), Masāfī-2 (n = 2), Masāfī-3 (n = 10), and from the surface collection conducted on a nearby farm (n = 1). All sherds analysed with NAA were included in the petrographic study. The specific aim of the NAA was to determine whether geochemistry could shed additional light on groups defined by macroscopic and microscopic analyses.

The University of Missouri Research Reactor (MURR) conducted the NAA according to established laboratory protocols and analytical conventions (Glascock & Neff 2003; Glascock, Neff & Vaughan 2004). The analysis yielded data for the following suite of elements: arsenic, lanthanum, lutetium, neodymium, samarium, uranium, ytterbium, cerium, cobalt, chromium, cesium, europium, iron, hafnium, nickel, rubidium, antimony, scandium, strontium, tantalum, terbium, thorium, zinc, zirconium, aluminium, barium, calcium, dysprosium, potassium, manganese, sodium, titanium, and vanadium (Fig. 12). The geochemical data generated by NAA were examined according to analytical conventions that combine principal component analysis, Euclidean cluster analysis, Mahalanobis distance, and bivariate plots using the GAUSS 8.0 software developed by MURR (Glascock & Neff 2003; Glascock, Neff & Vaughan 2004). Calcareous inclusions and sand were visible in the samples. These inclusions have high concentrations of calcium and silicon respectively and have the potential to decrease the apparent concentrations of other measured elements because the geochemical data are reported in a fixed-sum matrix (Boulanger & Glascock 2015; Cogswell, Neff & Glascock 1998; Perlman & Asaro 1971: 190–191; Sterba et al. 2009). Dividing the quantitative results by scandium is a proven method for accounting for the diluting effect (Dias & Prudêncio 2008; Grave et al. 2014). Both calcium and strontium were removed from the analysis, the former because of the diluting effect and the latter because it is a known chemical substitute for calcium. The statistical analysis proceeded solely according to geochemical concentrations and is, therefore, independent of the archaeology and petrography.

Principal components 1–3, which account for 61.3% of the cumulative variation, tentatively divide the data into geochemical group 1 (n = 12), geochemical group 2 (n = 6), and geochemical group 3 (n = 4) (Fig. 13). Two additional sherds cannot be placed within one of the groups. High concentrations of iron, manganese, cobalt, and nickel characterize geochemical group 2. In contrast, geochemical group 3 has elevated levels of potassium and aluminium as well as the trace elements ytterbium, thorium, and rubidium. Geochemical group 1 is not distinguished by particularly high or low concentrations of any element. The low number of samples in each group makes statistical tests of group membership uncertain. This is further complicated by the compositional similarities between the groups. The overlap evident in this data would suggest that the three groups were produced from geochemically similar raw materials. It is possible that this dataset is evidence of multiple workshops combining similar raw materials in slightly different recipes. Unfortunately, there is no meaningful correlation between the geochemical groups and variants that might provide further support for such an interpretation. Unlike the variants, which indicate a greater consumption of variant A at Masāfī-3 and variant B at Masāfī-1, the geochemical groups are more evenly distributed. It is also of note that each of the three geochemical groups included at least one example of a ritual vessel.

Discussion: organization of pottery use and pottery production in the Masāfī area

Emerging from these three disparate lines of evidence is a preliminary picture of pottery production and consumption in the Masāfī area. There is no clear correlation between our geochemical groups and our petrographic variants. This is a normal result in a situation where groups that we could define are not significantly different, suggesting similar raw materials being slightly differently mixed. We have to keep in mind the differences between both methods: NAA yields chemical compositions whereas petrography provides a series of sections showing mineral inclusions mostly in the fraction over 5 µm. Some elements, calcium or aluminium for example, could be parts of many types of minerals, in which case they would appear as numerous in the NAA result whereas they would almost 'disappear' from the picture offered by the thin section. Moreover, in the same type of mineral (e.g. olivines), the chemical composition may vary (e.g. the content of magnesium) due to the rock type (the olivines may be more magnesian in the harzburgites than in the dunites).

These minor discrepancies aside, our results allow us to underline two aspects of the Iron Age II pottery production at Masāfī. First, the material used during ceramic production was *not* standardized. The degree of compositional variation evident in both the petrography and the NAA strongly suggests the use of multiple sources with similar compositions. This non-standardization of the material could come from a variation of the potter's sources related to environmental conditions (heterogeneous composition of the clay source — a likely possibility in such a complex environment), or to the potter's practices (preparation or mixing of different clays and addition of different kinds of temper owing to a result expected by the potter following a recipe that can also change from one group of vessels to the other). What kind of production can we imagine from these results — a domestic production by families? One or several workshops using a variable clay source? At this level of interpretation we must admit that we still cannot be certain. To have a better idea of the pottery production, we need a more precise technological study that would allow us to reconstruct more clearly the different *chaînes opératoires* of shaping and finishing, to relate these data with the ware composition variability we observe, and to follow each one from the beginning to the end in its proceedings and variations. Such a study requires further work on pottery sampling and geological specimens.

Nevertheless, the link that we can draw between both petrography and NAA results and the local geology of Masafi strongly suggest that the potters — whoever they were and whatever their organization — probably worked with local material present in the geological environment that surrounds Masāfī. We do not yet know where the sources of clay and temper used in each

	S02	S03	S04	S06	S07	S10	S12	S13	S14	S17	S20	S27
As	2.92	1.94	2.83	3.20	0.00	2.94	3.77	1.85	1.74	3.09	2.47	6.93
La	22.03	17.06	20.86	20.77	22.97	16.89	19.59	20.91	18.43	16.18	18.86	23.53
Lu	0.31	0.27	0.29	0.28	0.33	0.23	0.32	0.31	0.27	0.22	0.29	0.32
Nd	19.86	16.99	18.08	19.99	17.98	13.62	15.75	17.87	13.58	12.02	16.10	21.34
Sm	4.25	3.50	3.89	4.04	4.33	2.96	4.02	3.97	3.54	3.06	3.75	4.45
U	1.73	1.47	1.60	1.27	1.38	1.35	1.20	1.40	1.52	0.81	1.17	1.50
Yb	2.05	1.80	1.97	1.78	2.14	1.50	2.13	1.97	1.66	1.49	1.83	2.38
Ce	48.96	40.84	44.26	47.08	49.45	42.73	45.82	46.06	43.92	38.09	44.64	55.73
Co	52.11	45.30	28.07	65.61	63.48	59.69	36.27	26.71	81.04	67.68	31.66	57.92
Cr	1706.87	1482.60	1221.48	1743.01	1034.98	1322.89	1312.80	1566.28	2199.21	1501.20	1851.91	1974.42
Cs	10.33	4.47	4.86	4.29	6.84	8.37	5.59	6.09	9.60	11.10	3.76	5.25
Eu	0.93	0.78	0.93	0.91	0.98	0.64	0.91	0.87	0.83	0.70	0.82	1.05
Fe	44435.45	44080.52	33050.87	47791.13	46443.32	49003.30	42719.52	34691.52	61465.19	52068.76	31319.27	56460.41
Hf	4.90	4.56	4.45	4.85	4.48	4.48	5.47	5.72	4.84	3.91	6.02	5.58
Ni	590.85	498.89	287.28	789.60	587.17	621.22	319.76	249.49	822.40	753.97	276.08	618.54
Rb	54.67	48.00	48.68	52.55	62.62	52.17	57.90	50.52	53.40	52.30	39.03	57.80
Sb	0.42	0.34	0.39	0.36	0.40	0.39	0.48	0.45	0.33	0.36	0.42	0.52
Sc	15.16	13.76	12.93	15.46	15.88	14.68	15.05	14.32	16.63	13.42	12.08	17.58
Sr	307.36	270.14	629.39	256.37	268.93	153.28	276.80	620.74	303.05	344.27	286.24	117.13
Ta	0.79	0.76	0.78	0.73	0.90	0.75	0.88	0.88	0.72	0.75	0.79	0.96
Tb	0.56	0.52	0.51	0.48	0.57	0.37	0.59	0.66	1.00	0.45	0.50	0.55
Th	6.50	6.06	6.04	5.59	6.72	5.93	6.59	7.17	5.64	5.10	6.18	7.39
Zn	77.42	72.83	63.39	74.46	84.95	72.42	66.11	70.90	67.36	56.81	62.80	74.59
Zr	162.44	138.24	133.20	148.46	118.07	107.14	153.15	166.29	146.77	98.26	184.51	166.91
Al	55509.11	52655.88	53082.26	53945.92	66412.72	55296.71	61238.64	64707.18	56681.76	50960.21	53005.48	62544.11
Ba	412.11	315.83	290.05	218.33	271.00	233.81	280.10	295.53	247.02	294.05	289.78	330.12
Ca	19456.95	28317.15	48640.26	17831.92	26464.70	9236.72	29171.58	23350.64	13936.97	34906.95	23196.76	9295.79
Dy	3.21	2.98	3.24	3.09	3.45	2.47	3.61	3.21	2.84	2.48	2.87	3.33
K	16290.05	12052.07	16151.95	13545.80	12925.93	15843.19	16560.97	16935.33	15795.28	13318.73	13460.20	15733.41
Mn	449.40	457.22	369.18	353.25	438.11	482.43	341.19	329.10	463.26	500.91	319.25	524.96
Na	10411.18	6897.48	7085.06	9922.88	7869.37	9545.34	7255.22	7391.03	11234.33	8291.53	8745.55	7158.09
Ti	3324.16	3784.94	3710.49	3664.22	3832.85	3344.32	4370.19	4410.33	3254.43	3300.65	3927.91	4027.33
V	93.58	78.00	67.84	89.60	90.90	66.91	94.29	84.70	79.90	89.09	73.08	107.62

Figure 12. *A table showing the results of the NAA conducted by MURR on the samples from Masāfī.*

variant were located and if they were in the vicinity of Masāfī or in the broader region characterized by a similar geological background. But none of the samples has provided a petrographic or chemical composition that contradicts the geology of Masāfī.

The second result that this preliminary study has produced is that the different petrographic variants do not seem to be strictly related to the shaping of the vessel or to its use. In fact, the petrography points to a possible correlation between Masāfī-1 and variant B and Masāfī-3 and variant A. However, the distribution of compositional groups does not follow the same tendency, suggesting that the different groups of vessels were utilized at various locations within Masāfī. Thus, if the village of Masāfī appears to have been organized into multiple spaces that hosted distinct activities, resulting in clearly distinct assemblages of shapes, we have no evidence yet for a strict specialization of the

	S27	S30	S31	S32	S34	S37	S38	S39	S68	S70	S71	S77
As	6.93	3.49	2.91	1.99	2.36	4.28	1.85	0.00	3.05	0.00	4.56	0.00
La	23.53	16.76	23.93	20.12	17.93	21.10	24.04	14.01	25.33	16.15	23.78	21.77
Lu	0.32	0.21	0.33	0.33	0.25	0.30	0.33	0.19	0.33	0.21	0.31	0.31
Nd	21.34	13.94	22.96	17.58	17.35	18.70	22.32	9.87	22.49	12.10	19.40	18.18
Sm	4.45	3.13	4.68	3.84	3.44	3.95	4.32	2.48	4.65	3.08	4.47	4.24
U	1.50	1.17	1.41	1.66	1.73	1.14	1.55	1.29	1.46	1.63	1.72	1.31
Yb	2.38	1.51	2.11	1.95	1.71	1.94	2.08	1.32	2.10	1.41	2.21	2.01
Ce	55.73	38.54	52.44	46.96	39.82	46.69	54.64	29.91	54.23	33.38	51.89	51.89
Co	57.92	56.93	45.86	38.57	48.11	47.97	60.47	59.20	54.44	25.31	45.93	45.93
Cr	1974.42	2093.37	1197.32	980.73	2139.00	1600.52	952.24	1253.63	1292.88	721.55	1221.87	1221.75
Cs	5.25	5.20	5.83	5.81	4.07	6.36	7.21	8.36	5.75	3.57	8.20	8.20
Eu	1.05	0.72	1.06	0.85	0.78	0.91	0.96	0.54	1.06	0.72	1.05	1.05
Fe	56460.41	53227.25	47772.87	42253.61	48340.18	44203.87	48445.06	51953.52	46386.04	38415.18	47729.56	47724.79
Hf	5.58	3.97	5.00	5.32	3.72	3.93	5.10	3.35	4.77	3.67	5.05	5.05
Ni	618.54	647.30	400.26	411.87	563.76	512.07	488.88	590.85	471.68	195.01	397.14	397.10
Rb	57.80	34.09	63.35	54.15	44.51	57.94	55.15	44.50	62.87	60.25	64.71	64.71
Sb	0.52	0.36	0.43	0.43	0.38	0.36	0.39	0.34	0.42	0.41	0.46	0.46
Sc	17.58	14.53	15.52	14.48	14.89	15.54	15.62	14.62	15.54	13.33	16.18	16.18
Sr	117.13	199.27	153.18	353.89	430.23	277.98	211.35	264.82	327.93	668.20	318.01	317.98
Ta	0.96	0.66	0.82	0.80	0.57	0.70	0.88	0.65	0.77	0.64	0.83	0.83
Tb	0.55	0.42	0.67	0.49	0.49	0.56	0.50	0.59	0.52	0.45	0.62	0.62
Th	7.39	5.85	7.01	6.40	5.14	6.46	6.93	5.24	6.73	4.61	6.80	6.80
Zn	74.59	68.92	73.75	68.70	76.83	66.10	70.26	58.50	66.04	74.46	67.27	67.26
Zr	166.91	121.48	163.05	136.73	96.26	113.62	126.32	106.44	162.73	116.97	105.12	105.11
Al	62544.11	49329.38	62990.11	58111.04	52215.79	23190.78	61805.34	50090.68	60604.08	48663.75	59848.09	56774.36
Ba	330.12	400.11	247.55	376.33	361.71	284.99	314.80	274.89	433.30	296.77	348.43	310.26
Ca	9295.79	18214.66	14662.91	32541.92	24193.01	16004.38	11521.82	28241.26	20622.29	83301.07	23101.84	22581.87
Dy	3.33	2.36	3.50	3.00	2.71	3.23	3.25	2.09	3.59	2.62	3.45	3.45
K	15733.41	11645.97	15332.09	14771.17	10301.64	12640.03	17823.50	13767.80	13714.54	14263.41	16112.34	12917.24
Mn	524.96	438.04	466.14	448.62	502.81	485.60	503.45	418.57	410.43	509.54	386.46	544.01
Na	7158.09	6871.24	9684.02	8960.57	7668.36	7220.63	10672.40	8812.30	11031.63	8763.33	10079.13	8936.31
Ti	4027.33	3393.75	3713.31	4083.49	2862.93	2879.78	4415.10	3364.61	3893.81	2865.85	3672.47	3675.02
V	107.62	85.00	81.78	86.45	88.47	48.27	84.39	88.16	96.30	85.93	82.77	85.64

potter's choices of materials related to the shaping or use of the pottery. Further research will be conducted on this material in order to elucidate the possible causes of the 'tendencies' observed in the distribution of the different petrographic variants and to obtain a more precise picture of the different functional assemblages.

Archaeological investigations at Biṭnah, less than 20 km from Masāfī, present a similar division of spaces within the Iron Age II settlement. Future analysis will be applied to a corpus of material from Biṭnah to test for comparable patterns of production and consumption. The results from Biṭnah will also provide an opportunity to test for examples of exchange between these two nearby settlements, moving from the analytical scale of a single village to a larger scale of inter-village exchange.

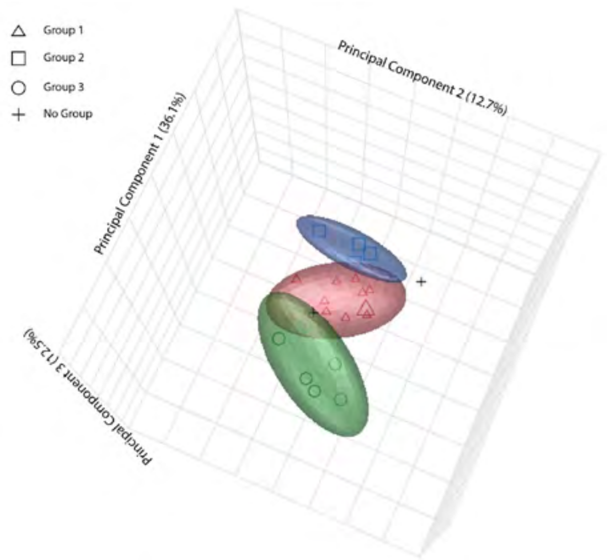

FIGURE 13. *A scatter plot of the principal components 1–3 for the Sc-normalized NAA data after excluding calcium and strontium. Ellipses are drawn to the 90% confidence interval.*

Acknowledgements

Excavations in the Masāfī area have been carried out by the French Archaeological Mission in the United Arab Emirates (Dir. S. Méry) under the supervision of A. Benoist (until 2016) and J. Charbonnier (since 2017) with funding by the French Ministry of Foreign Affairs. Since 2016, geoarchaeological and palaeoenvironmental research has also been conducted in the Masāfī area in the framework of the OASIWAT project, under the supervision of Louise Purdue, with support from the Agence Nationale pour la Recherche (ANR, project ANR-16-CE27-008). Both teams have largely benefited from the kind support of His Highness Shaykh Hamad bin Mohammed al Sharqi, ruler of Fujairah, and from the assistance of the Fujairah Authority for Tourism and Antiquities and the Fujairah Museum. Thin sections for petrographic analyses and neutron activation analyses were financed by a grant from the British Foundation for the Study of Arabia. Neutron activation analysis was conducted at the University of Missouri Research Reactor with the partial support of a grant from the United States National Science Foundation (#1621158). Data were collected by Brandi Lee MacDonald and Michael D. Glascock.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 25–31

An overview of the latest prehistoric research in Qumayrah Valley, Sultanate of Oman (poster)

Marcin Białowarczuk & Agnieszka Szymczak

Summary
This paper concerns the prehistoric part of a project run by the Polish Centre of Mediterranean Archaeology and the Ministry of Heritage and Culture of Oman, in the micro-region of Qumayrah. The project, instigated in 2016, includes a survey, testing, and excavations of selected sites. During two seasons of investigations, archaeological sites of varied chronology were recorded, three of which were attested to late Stone Age occupation. The largest site (QA 2), although deflated, yielded a rich collection of lithics found in the context of a stone hearth, a platform, and the remains of a shelter. The lithics included simple tools produced by direct-scaled retouch, rare tanged projectile points made on flakes, and bifacial foliated pieces. Tubular beads of stone and shell (including Akab-type beads), and worked seashells, attest to connections with coastal regions. The two other sites (QA 6 and QA 12) are less well preserved, but surface collection and limited testing yielded lithic collections, including tanged spear points. At this stage, techno-typological analysis of materials is the only means of establishing a chronology of these sites. However, new information from this region of Oman is significant considering the disproportion between the state of research at coastal areas and inland territories.

Keywords: Neolithic, Oman, al-Hajjar mountains, campsites, lithics

In 2016, the Omani-Polish Qumayrah Archaeological Project, a co-operation between the Polish Centre of Mediterranean Archaeology (PCMA), University of Warsaw, and the Ministry of Heritage and Culture of the Sultanate of Oman, was set in motion. The project, headed by Prof. Piotr Bieliński, aims at investigating the Qumayrah Valley in the al-Hajjar mountains (Al-Dhahirah Governorate, Wilayat Dhank) (Fig. 1). The valley is a *c.*10 km-long, L-shaped area between the villages of Ayn Bani Sa'dah (locally known as al-Ayn), Qumayrah, and Bilt.

The project includes an archaeological survey of this poorly researched part of the mountains, as well as soundings and excavations at selected sites of various chronology (Rutkowski 2017). Five Bronze and Iron Age sites close to al-Ayn and Bilt were the only archaeological sites known to the Omani Department of Antiquities at least since 1998, when parts of the valley, designated as Wadi al-Fajj, were surveyed (Costa 2006), but no remains of Stone Age date were reported then. Archaeological investigation by the PCMA team concentrated first on a reconnaissance of the southern entrance to the valley. Selected parts of this area were explored on foot, with the focus on terraces and alluvial fans spreading along the wadi. Concentrations of artefacts and/or structural remains were registered by GPS and marked on a Google Earth satellite map. Single finds, including a few artefacts without architectural context, were defined as traces of occupation while larger concentrations and architectural features were defined as settlement remains. Samples of lithic materials were taken for preliminary techno-typological analysis and schematic plans of the remains were made. Finally, selected sites were sounded with test trenches to check for potential stratigraphy.

Two seasons of the current project led to the recording of a number of new archaeological sites. Three of them (Fig. 1/b) proved particularly interesting for the Stone Age leg of the project, since they provided materials indicating a Neolithic-period occupation of this area.

The first site to be registered was QA 2 (QA = Qumayrah-Ayn), and it was also the main focus of work in 2016 and 2017. It is a campsite with an area of *c.*0.3 ha.

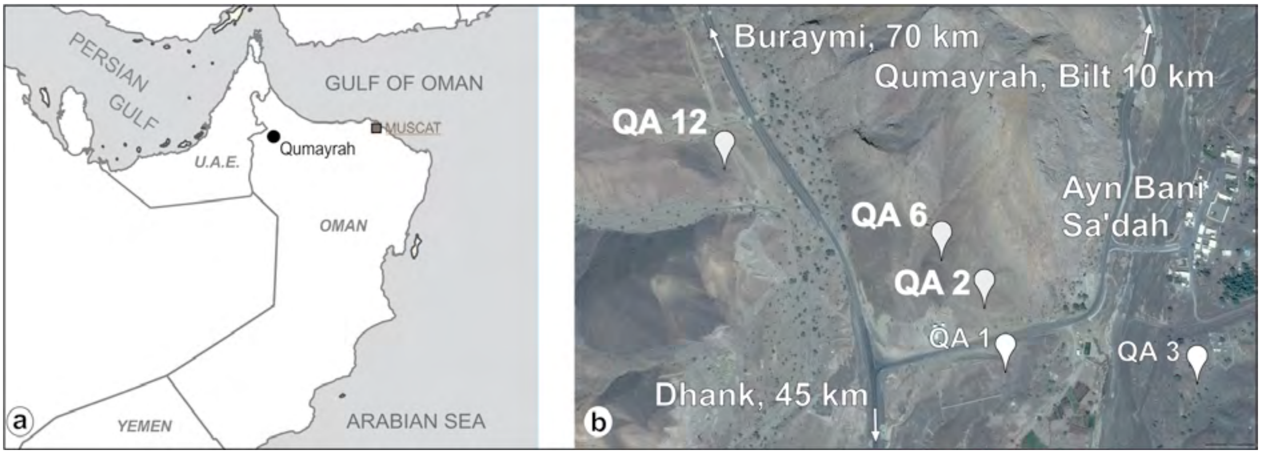

FIGURE 1. a. *The location of the project area in the Oman peninsula;* **b.** *the location of the principal sites investigated within the project (map M. Puszkarski; satellite image Google Earth; processing M. Momot).*

The bulk of the excavation work was concentrated in the central part of the site, in four neighbouring trenches covering a total area of 70 m^2. Four small test pits were dug on three flanks of the site (Fig. 2). Although the site is strongly deflated, it yielded a rich collection of lithics: 2585 artefacts, including 576 retouched tools. They were

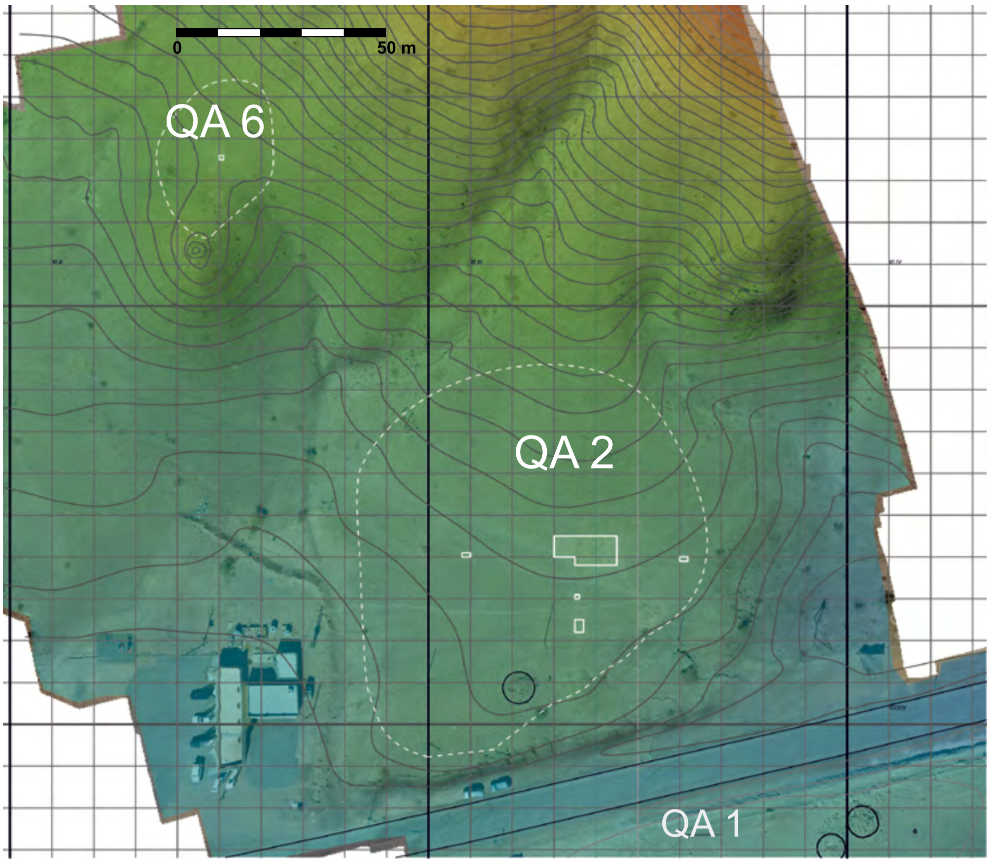

FIGURE 2. *A digital elevation model of the Neolithic campsites of QA 2 and QA 6, showing the location of the test trenches and an approximate extent of observed surface lithic scatter (satellite image Microsoft Bing; processing O. Bagi and M. Antos).*

Figure 3. *Site QA 2, a top view of the main trench, with remains of, among others:* **a.** *a stone platform; and* **b.** *a hearth, both pictured after sectioning;* **c.** *the outline of a circular shelter (photograph A. Oleksiak/PCMA).*

found in the context of archaeological features, such as a well-preserved stone hearth and platform, remains of ash pits, and at least one circular shelter (Fig. 3), proving that cultural deposits survived there, at least in part. They were approximately 15–20 cm thick, but gradually thinned towards the south and eastern edges of the site (Białowarczuk 2017; Białowarczuk & Szymczak 2018).

The QA 2 lithic assemblage relies on local raw materials — flint, chert, and radiolarite — available in the vicinity. Flake and blade technologies were used simultaneously. Blanks were obtained from simple barrel-shaped (Fig. 4/l) or discoidal cores, while less numerous blades were obtained from single-platform conical cores (Fig. 4/m). Blanks were used to make simple tools by direct-scaled retouch, featuring side scrapers (Fig. 4/n), end scrapers (Fig. 4/a–c), retouched flakes and blades, notched pieces, perforators, and borers (Fig. 4/d–g) accompanied by rare tanged projectile points (Fig. 4/h–j), bifacial foliates, and small bifacially retouched points (Fig. 4/k). The tanged points are simply made on short, wide flakes, giving the points a robust appearance. The points have a short tang fashioned by direct or inverse retouch. Their distal extremity is naturally sharp and was sometimes reworked by the intentional breaking of an edge or by a series of short, marginal retouches (Białowarczuk 2017: 550–553). Bifacial foliated points are regular, short and wide, characterized by an almond-shaped, biconvex section and straight convergent edges (see Fig. 4/k).

The appearance of two completely different types of point seems a clear indicator of a multi-phase occupation of the site. From a techno-typological point of view, all the tanged points exhibit the same simplicity as the Fasad points of the al-Haddah tradition (Charpentier & Crassard 2013: 32–34), yet morphologically they are closer to some late examples from Wādī Sana in the Hadramawt Plateau, Yemen (cf. Crassard 2008: fig. 152). These similarities may confirm a relationship between the QA 2 tanged points and the latest Fasad techno-complex, but not necessarily with the pre-Neolithic one, as is the case with the classic types (Białowarczuk 2017). On the other hand, a few bifacial foliated pieces, including two fragments of implied fusiform points (Fig. 4/k) might indicate a much later occupational phase. Significantly, other examples of this type, including two complete forms, were also found on the neighbouring site of QA 1. The points from both sites closely resemble those from Wādī Dhahr in Yemen (Kallweit 2003: fig. 4:14), and fusiform points from Suwayh SWY-1 (Biagi & Nisbet 2006) and Mundafin (Edens 1982: pl. 101, B.18).

The appearance of a few stone and shell beads is also chronologically significant. Among the latter, there was one crafted from a holed *Engina mendicaria* shell (Fig. 5/a) and an *Olividae* sp. shell (Fig. 5/b). The soft-stone tubular beads (Fig. 5/d–e) included an Akab-type specimen (Fig. 5/e) (Charpentier & Méry 2008) which, along with the bifacial foliates, seems to corroborate a Late Neolithic date for some of the site's occupation (Charpentier 2008: 66–75; Charpentier & Méry 2008). Other finds of interest include fragments of marine shells (Fig. 5/f–g). Three of them are objects made of worked *Conus* or *Strombus* sp. shells. The shoulders of the shells were cut off and the

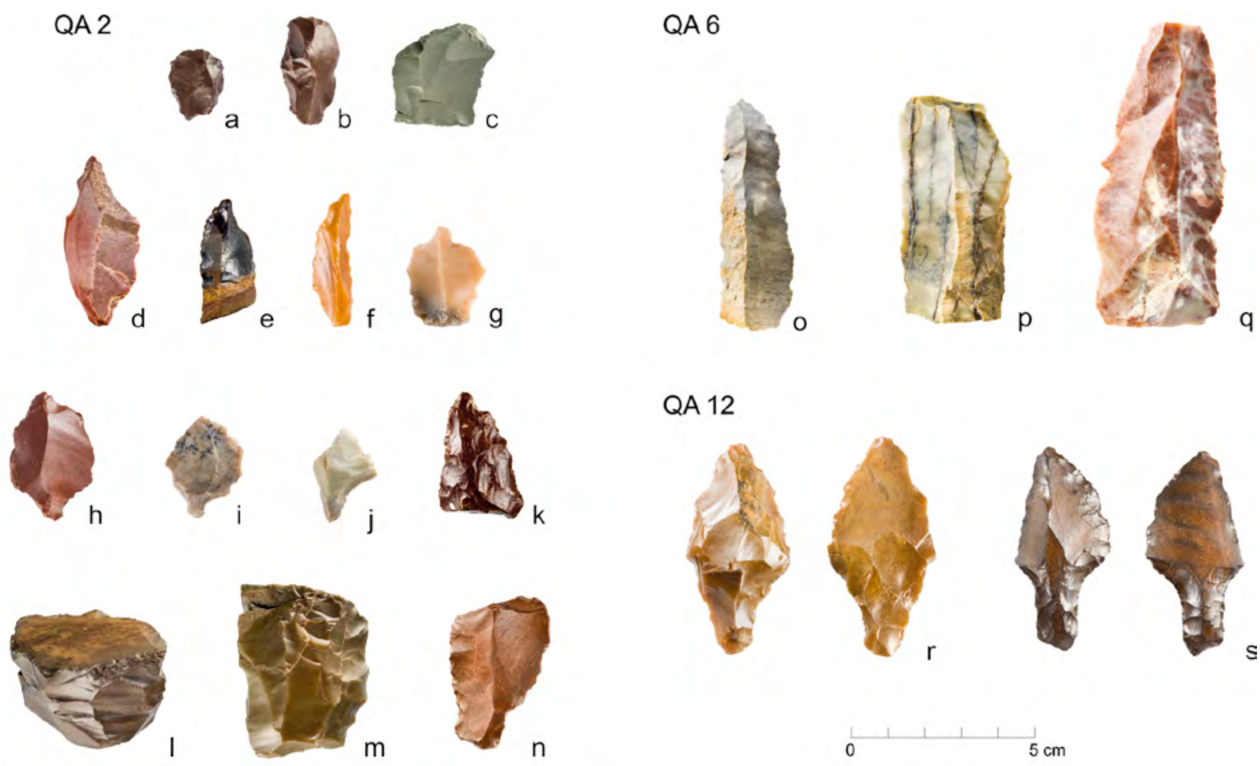

Figure 4. *A selection of lithics from the investigated sites. QA 2:* **a–c.** *end scrapers;* **d, f–g.** *perforators;* **e.** *borer;* **h–j.** *tanged arrowheads;* **k.** *bifacial foliated piece;* **l–m.** *cores;* **n.** *side scraper; QA 6:* **o–q.** *massive retouched blades; QA 12:* **r–s.** *spear points (photographs A. Oleksiak/PCMA).*

apex removed — a usual procedure in the preparation of shell discs or rings, or short tubular beads known, among others, from manufacturing sites on the Arabian Gulf shoreline (Reiche 2013; Bieliński et al. 2015; 2016). However, at QA 2, the apexes were then halved and in one case, the resultant section was made straight and smooth (Fig. 5/g). In this object, the hole left after the removal of the apex was also halved, resulting in a half-open 'channel', perhaps deep enough to allow for some kind of fastening, possibly making it a decorative object; yet the smoothness of the section may have also resulted from some kind of practical use. Parallels for this half-circular straight-edged shell object have so far not been encountered. Moreover, at this stage of investigation it is only possible to speculate on the chronology of the shell artefacts. Their appearance on a campsite lying almost 100 km from the Gulf of Oman coast, however, attests to connections with the coastal areas, which might imply a micro-nomadism model, with human groups moving seasonally from the coast to the mountains (Cavulli & Scaruffi 2013).

Another investigated site is QA 6. It covers a flat saddle of *c.*1000 m^2, between two hills in close proximity to QA 2 (see Figs 1/b & 2). Limited testing confirmed the existence of a *c.*30 cm-thick deposit there. The lithic assemblage from the test trench and surface collection contains sixty artefacts, including twenty-four retouched tools. They are mostly side scrapers, denticulated pieces, and a few retouched blades made on massive blanks (Fig. 4/o–q). The appearance of a macrolithic flint industry points to a date towards the end of the Neolithic period (Charpentier 2008: 75). A similar industry was identified in Suwayh SWY-2 and 5 (cf. Charpentier 2008: fig. 11), Wadi Shab (Tosi & Usai 2003: 12–14), and Ra's al-Hadd (Charpentier 2001).

The only non-lithic artefact at QA 6 was a shell barrel bead with biconical drilling (Fig. 5/c). It has parallels at the Neolithic cemeteries of Buhais 18 and FAY-NE15

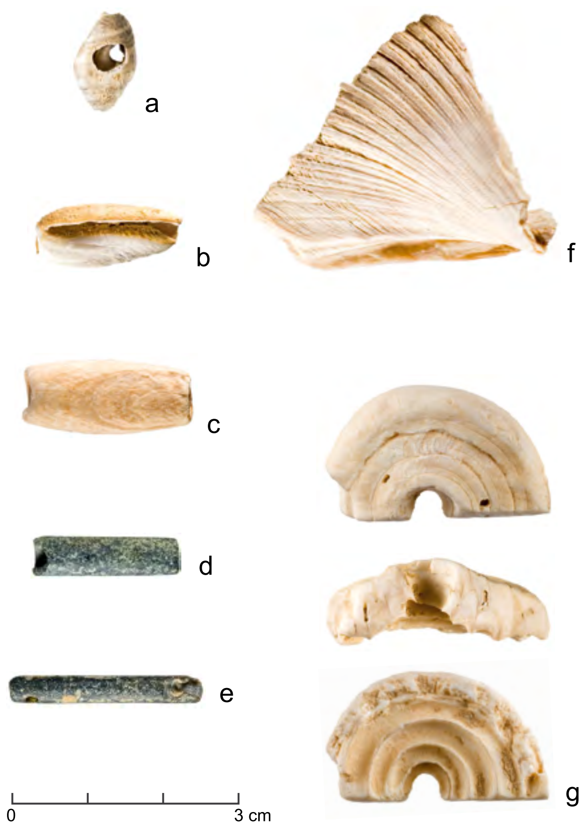

Figure 5. *A selection of small finds from QA 2 and QA 6:* **a.** *bead of* Engina mendicaria *shell;* **b.** Olividae *sp. shell bead;* **c.** *barrel-shaped shell bead*; **d.** *tubular stone bead;* **e.** *Akab-type stone bead;* **f.** *marine shell fragment;* **g.** *half-circular straight-edged shell object of worked* Conus/Strombus *(?) sp. shell (photographs A. Oleksiak/PCMA).*

(de Beauclair, Jasim & Uerpmann 2006: 179–180, fig. 5; Kutterer & de Beauclair 2008: 141, fig. 14).

The third investigated site, QA 12, is located north-east of the entrance to the Qumayrah Valley, on a flat alluvial fan (see Fig. 1/b). Soundings confirmed the site to be completely deflated. The lithic assemblage collected on the surface consists of forty-five objects, mostly retouched flakes and blades, a few side scrapers and perforators, and one borer. The most interesting are three tanged spear points (Fig. 4/r–s). Two were probably shaped by stone-hammer percussion, given the deep knapping scares observed on the surface. Techno-typological parallels relate at least one of them (Fig. 4/r) to type 1B from the Hadramawt Plateau in Yemen, dated to *c.* the mid-sixth millennium BC (cf. Crassard 2008: 141, 144). Another specimen, however, seems to represent a completely different bifacial technology of production based on the pressure technique, given the shallow, subtle knapping scares and smoother surface (Fig. 4/s). Based on the mentioned technique, this point should be associated rather with the Late Neolithic. Similar forms, related chronologically to the aforementioned Neolithic phase, were recently discovered in Sharbithāt in the Sultanate of Oman (Maiorano et al. 2018).

Remarks on chronology and interpretation

At this stage of the investigations, a techno-typological analysis is the only means of establishing a tentative chronology of the discovered sites. Given the character of these materials, their dating cannot be precise and must remain speculative. There are, however, some premises to suggest at least two, if not three, stages of (probably seasonal) occupation based on the parallels to the Qumayrah Valley materials mentioned above. The oldest stage would be represented by the lower deposits from QA 2 and the materials from QA 12. With the appearance of the simply tanged arrowheads the small campsite at QA 2 could thus be dated to the Early Neolithic (see Fig. 4/h–j), a date which is also in place for the two spear points from QA 12 (see Fig. 4/r). Then there is the more obvious evidence of the bifacial technology and the Akab-type bead from the surface and subsurface layers from QA 2, and possibly also of the third tanged spear point from QA 12 (see Fig. 4/s), indicating a Late Neolithic occupation of the site as well. The latest occupational period of the newly discovered cluster of campsites seems to be represented by the QA 6 macrolithic blade and flake technology (see Fig. 4/o–q), which finds parallels in the final stage of the Neolithic period.

The settling of Qumayrah Valley in the above-mentioned stages of prehistory seems to have been strictly connected with general climatic and environmental changes observed in the Arabian Peninsula beginning with the eighth millennium BC. Climatic archives from the Early and Middle Holocene indicate increased precipitation, which in the case of southern Arabia is the result of increased monsoonal influence (Fleitmann et al. 2003). During the Terminal

Pleistocene the Inter-Tropical Convergence Zone (ITCZ), the driving force behind the Indian Ocean Summer Monsoon, was located south of the Arabian land mass. A northward shift in the ITCZ occurred during the Early Holocene, between 9000 and 4000 BC, and was accompanied by a northward extension of the monsoon belt to about 17°N (Drechsler 2009: 71). However, there is evidence that at this time a vast majority of Arabia up to nearly 28°N was receiving significant summer rainfall (Sanlaville 1992). The closest evidence for moister climatic conditions in northern Oman during the time interval between 8000 and 4000 BC came from the Hoota cave (Burns et al. 1998), located at nearly the same 23°N latitude as the Qumayrah Valley. These climatic changes made inland zones more attractive for hunter-gatherers as well as pastoral groups, resulting in a proliferation of campsites (Cleuziou & Tosi 2007: 45–47) in areas like the Qumayrah Valley. The climatic factor could have been particularly important in the case of earlier Neolithic settlements. In the Late Neolithic period this process seems less obvious because the Holocene Moist Phase was not consistent through time. Many scholars argue that in various regions of the Arabian Peninsula the intensity of the monsoon declined slowly, beginning around 6000 BC (Magee 2014: 43). However, there is no absolute agreement on when the ITCZ migrated south again bringing about a more arid climate. Because this process is not fully corroborated, it is difficult to speculate on its influence on Qumayrah Valley's settlement during the late and final Neolithic phases. Still, there is another factor that may have played a role in the development of settlement in the area discussed, especially during the Late Neolithic period and the Bronze Age. This is the wide range of resources available in the al-Hajjar mountains that could be exploited once appropriate technologies became available. Two of the most commonly exploited materials were soft stone (steatite and chlorite), which was carved into vessels, beads, and other ornaments, and copper for which this area was famous in antiquity (2014: 16).

Taking these factors into consideration, the appearance of marine shell artefacts on sites in the Qumayrah Valley may reflect an influx of new settlers from coastal areas or development of trade with local populations. Due to the largely preliminary nature of the reconnaissance in the Qumayrah Valley, these conclusions must be treated as hypotheses to be verified in the course of future research, including palaeoenvironmental studies. Nonetheless, they still contribute to the body of knowledge regarding the prehistory of this region. This is of particular significance especially in light of the continuous disproportion between the state of research of coastal areas and that of inland territories.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 33–50

Pottery from al-Zubārah, Qatar: reference collection and ware typology

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Summary
Between 2009 and 2014, archaeological excavations at al-Zubārah, Qatar, uncovered a large late Islamic pottery assemblage, of which 68,000 sherds were fully recorded and studied. The analysis of the al-Zubārah ceramic assemblage offered an insight into the social, cultural, and economic structure of this eighteenth- to nineteenth-century pearl-trading centre, and enabled a reconstruction of the widespread trading and cultural links of the once prosperous town. Six phases of occupation were recorded from the stratigraphic sequence, covering a historical span of a maximum 140 years.

Keywords: Islamic archaeology, late Islamic pottery, eighteenth-century pottery, Qatar

Introduction

The ruins of al-Zubārah are situated on the north-west coast of the Qatar peninsula. The once prosperous pearl merchant trading centre now covered with a thin layer of sand, covers *c.*61 ha of fortified remains of houses, mosques, markets, and streets. The town grew substantially in the 1760s with the arrival of ʿUtub tribes from Kuwait (Abu-Hakima 1965; Al Khalifa & Hussain 1993; Warden 1865; Rahman 2005). The inhabitants of al-Zubārah built its substantial wealth on pearl fishing and trade. The town was destroyed in 1811, then briefly reoccupied and gradually abandoned in the early 1900s.

In 2008 Qatar Museums (then the Qatar Museums Authority) launched a project in collaboration with the Department of Cross-Cultural and Regional Studies at the University of Copenhagen, to begin archaeological excavations at the site. The project undertook seven seasons of large-scale fieldwork, with regional survey and conservation programmes, historical research, and community outreach (Rosendahl & Nymann 2015). In June 2013, UNESCO recognized al-Zubārah as ‘an outstanding testimony to an urban trading and pearl-diving tradition which sustained the major coastal towns of the region from the early Islamic period or earlier to the 20th century,’ and the site was inscribed on the UNESCO World Heritage List. Over the course of all archaeological seasons, several large and smaller excavation areas were explored (Fig. 1).

The main volume of ceramic material came from seven excavation areas at al-Zubārah, covering *c.*7000 m^2. The studied sample consisted of 68,194 sherds (1089 kg). This article presents the analysis of pottery from al-Zubārah Excavation Point 01 (ZUEP01). In total, 15,344 ceramic sherds from 112 phased contexts were recorded. The largest number of sherds was recorded at ZUEP01, and here, a full study was undertaken of the three earliest phases (Phases 6, 5, and 4). Only the ceramics have been studied in full from the recorded strata; further research on other finds, in particular coins, should support and confirm the dating.

Phasing

Six occupational phases were identified at the site. Phase 6 (before the arrival of ʿUtub merchants, pre-1760) was the period of the town’s establishment and construction. Excavations and pottery analysis have clearly identified two major architectural phases (Phases 3 and 5). Phase 5 was the major phase of construction of al-Zubārah dated from the 1760s up to 1811, with a defensive outer town wall, large houses with courtyards, and a palatial compound. The town reached its maximum extent of *c.*60 ha during this short period of prosperity. Phase 4 was characterized by the destruction and abandonment of the town (recorded evidence of fire destruction dated 1811–1820). Phase 3 was characterized by construction of the town within

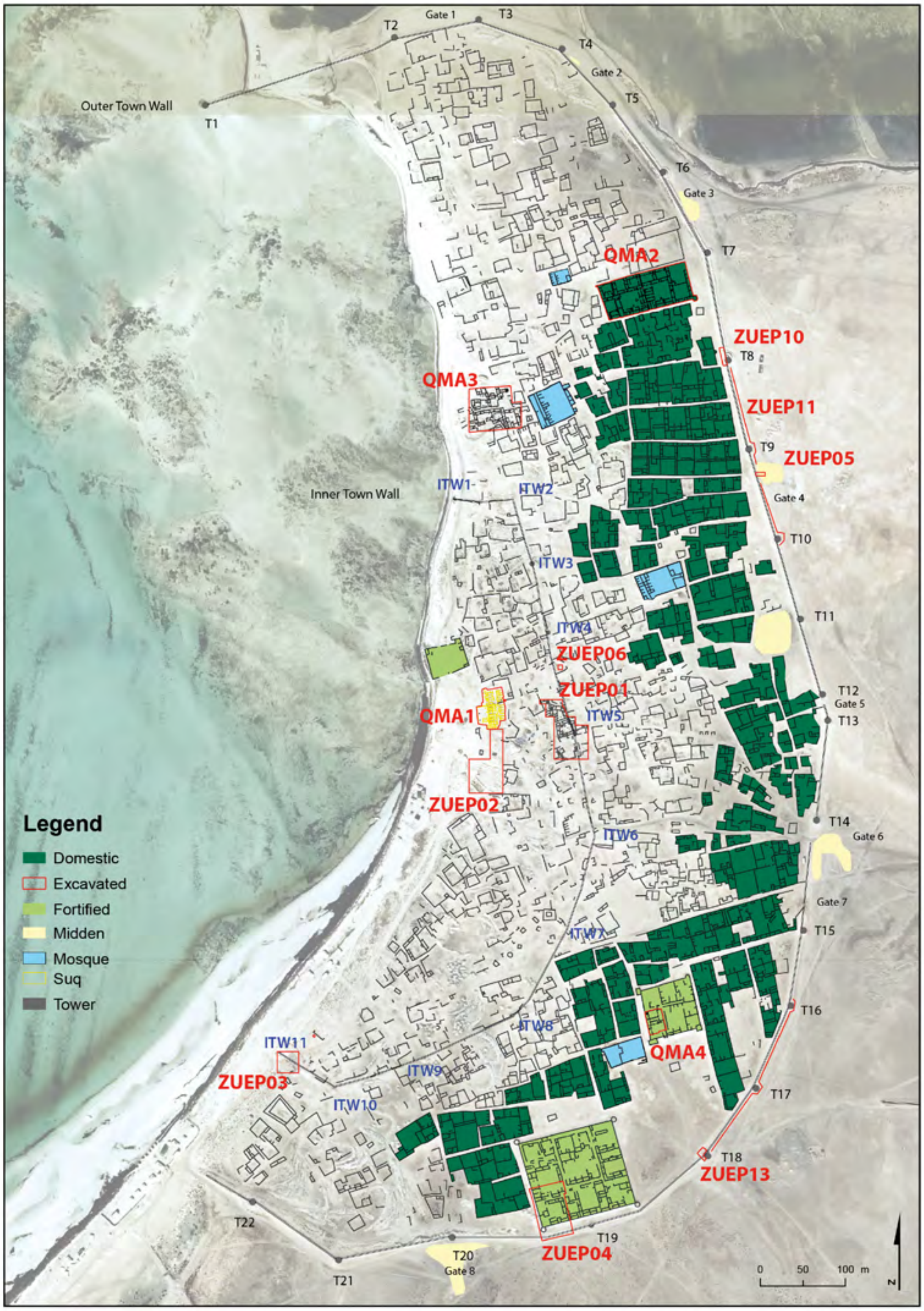


FIGURE 1. *A plan of al-Zubārah showing the excavation locations. ZUEP01: courtyard houses; ZUEP02: the suq with shops, storage spaces, and date-press structures; ZUEP03: a temporary camp with tents; ZUEP04: a palatial compound; ZUEP05: a midden mound; ZUEP06: a sondage trench; ZUEP10: a trench adjacent to the outer town wall; ZUEP13: investigation of the architecture of Tower 8 and Tower 17 (source: Qatar Islamic Archaeology and Heritage project (QIAH).*

an inner town wall, with beach-stone architecture of low-quality courtyard houses. The Phase 2 occupation, dated to the early twentieth century, was characterized by occasional camps with *tanānīr* (sing. *tannūr*, oven). Phase 1 includes all activities post-1950s, with sporadic camping within the site area.

The unexpected termination of the project prevented an in-depth analysis of the reoccupation of al-Zubārah in the later nineteenth century (Phase 3), the early twentieth-century Phase 2, and Phase 1 when the site was used sporadically. However, a comprehensive site matrix exists to allow later investigation of the material belonging to the nineteenth and twentieth centuries, and particularly diagnostic ware types could be associated with specific later phases, providing a stronger dating profile.

The phasing was based on both archaeological and historical data, with contemporary document sources used to establish and confirm the stratigraphic sequence. Sherd quantification confirmed that locally produced Arabian Gulf wares were the most numerous and popular among the occupants of al-Zubārah. The unglazed wares made up 88.2% of the total ZUEP01 assemblage and these, produced locally but decorated with glaze, made up 6.8%. Imports from the Far East comprised 4.8% of the total ZUEP01 assemblage. The wares brought from Europe made up 0.2% of the sherd collection (Fig. 2).

These proportions did not change much during the first three phases of the town's occupation. There was a significant difference between the size of the assemblage recorded from Phase 5 and those of Phases 4 and 6. The Phase 5 assemblage at ZUEP01 was fourteen times larger than that of the other two phases. The disproportion represents a dramatic demographic change and probably also reflects a change in wealth of the al-Zubārah occupants during this period of the town's greatest prosperity (946 recorded sherds from Phase 6, 12,619 from Phase 5, and 921 from Phase 4).

Historians suggest that al-Zubārah became an important pearl trading port quite rapidly, with a significant influx of wealth in a very short period of time (Rahman 2005: 19). This was reflected in the Phase 5 occupation stratigraphy, with dramatic changes in the volume of pottery material (Fig. 3/b). The analysis of the assemblages also sought to identify major fluctuations such as the intensification of wealth creation during Phase 5. It was expected that expensive, luxury wares would mark the financial heyday of the town. Phase 5, therefore, corresponds to the historical phase during which al-Zubārah flourished as a trading centre.

It must be emphasized that the excavations at ZUEP01 reached Phase 6 of the stratigraphy only in a few places and therefore the pottery assemblage from this phase was relatively small to begin with (Fig. 3/a).

Regional data

Knowledge of late Islamic ceramics is based on a relatively limited number of published archaeological assemblages. The ceramic wares recovered from al-Zubārah were cross-referenced with chronologically correlated ceramics from other archaeological sites around the Arabian Gulf and East Africa (Fig. 4).

Most precise comparisons were achieved with quantified data from al-Muḥarraq in Bahrain; Furayḥah, al-Ruwayḍah, Zekrit, and Doha in Qatar; and al-ʿAyn in the UAE. The ware typology established at Julfār al-Maṭāf, UAE (Kennet 2004: 53) was used to identify and date many of the retrieved wares, especially Julfar Ware. Only the published material was used for this study, and an analysis of the original pottery material was not carried out. The assemblage was also compared with the ceramic collection kept at the Qatar National Museum. Published ceramic material, including survey collections, helped not only to identify the wares but also to understand the regional network of pottery distribution within which al-Zubārah can be included.

Ware typology

There were thirty-nine ware types distinguished in the al-Zubārah assemblage (see Fig. 2/a). The ware was understood as the same 'mixture' of clays and inclusions used to produce a group of pottery forms with similar characteristics (Kennet 2004: 27). For quantitative analysis, the wares were grouped by geographical provenance:

- unglazed classes local to the Arabian Gulf;
- glazed classes local to the Arabian Gulf;
- Far Eastern glazed wares;
- European imports.

It must be stressed, however, that in many cases the ware provenance could not be confirmed and more research is needed.

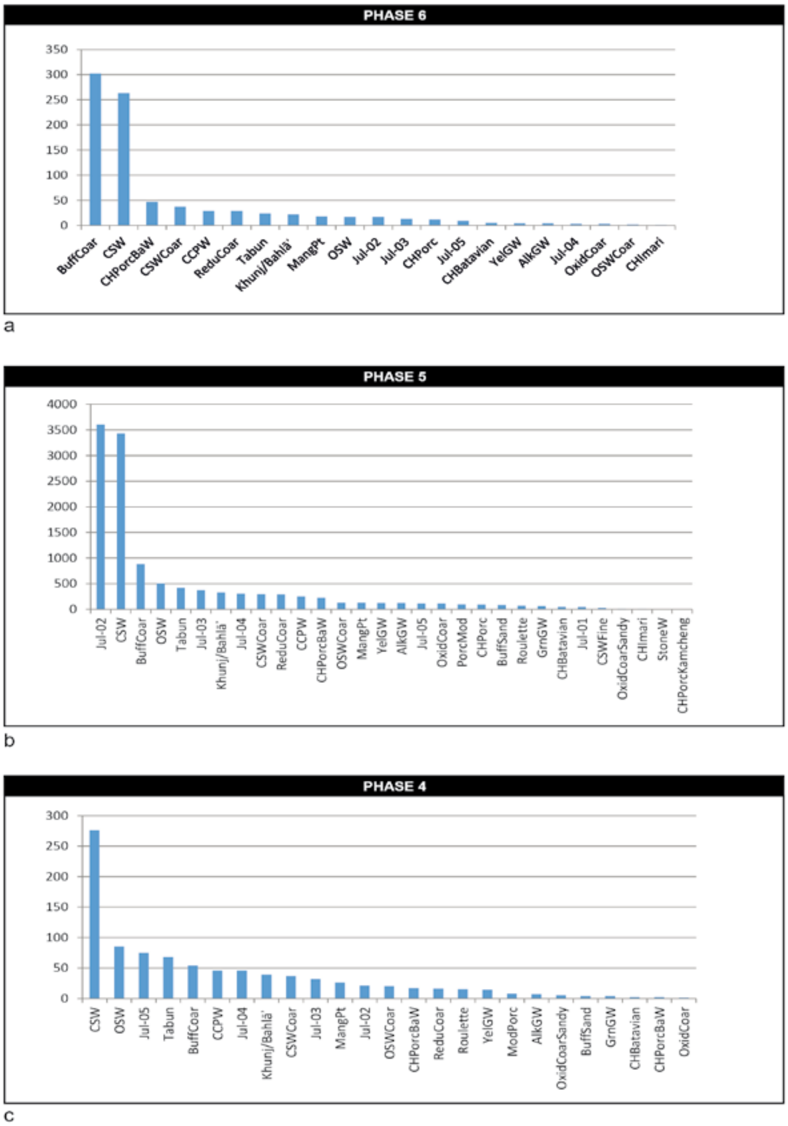
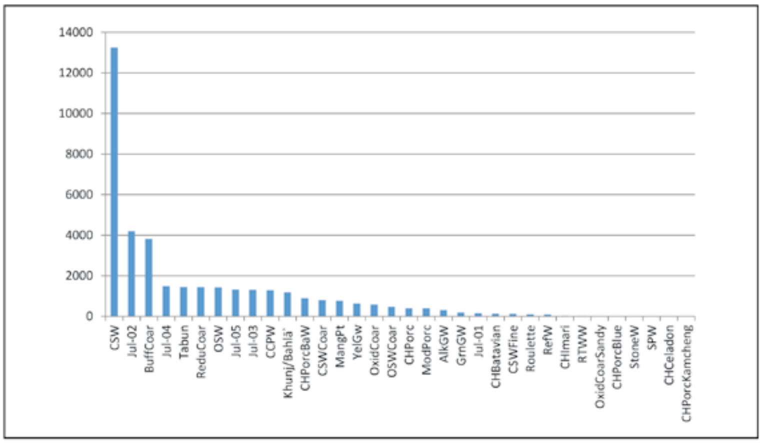


FIGURE 2. *Distribution of wares in the al-Zubārah assemblage by weight and count during:* **a.** *Phase 4;* **b.** *Phase 5;* **c.** *Phase 6 (graphics K. Bąk).*

Sherd quantification confirmed that locally produced Arabian Gulf wares were the most numerous (Figs 2/b and 5/a).

Unglazed classes local to the Arabian Gulf

The local unglazed plain classes or 'common wares' were used on a daily basis in the town's households, and they are the most numerous wares recorded on site (Fig. 5/a). The most frequent wares and forms at al-Zubārah were designed to keep and serve water and to cook food. Through all occupational phases, the most commonly used wares to serve these purposes were **Creamy Sandy Ware** (CSW) used to serve water (accounting for 35% of the total ZUEP01 assemblage); **Buff Coarse Ware** (BuffCoar) used mainly to store water (10% of the ZUEP01 assemblage); **Julfar Ware** used to cook and store food and serve water (21.7% of the total ZUEP01



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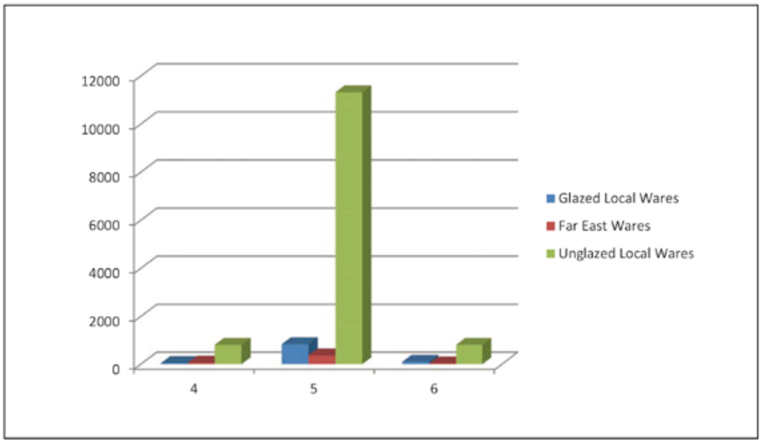


b

FIGURE 3. a. *Distribution of wares in the al-Zubārah assemblage by weight and count; total sherd count: 68,171; total sherd weight: 10,890 kg;* **b.** *percentages of al-Zubārah (ZUEP01) wares (graphics K. Bąk).*

assemblage); and **Tabun Ware** used to construct *tannur* ovens (4% of the total assemblage of ZUEP01).

Creamy Sandy Ware (CSW), provenance in Bahrain and known as A'ali ware, is well reported from archaeological sites around the Gulf (Sasaki T 1990; Sasaki & Sasaki 1992; 2011). The ware clearly dominated the al-Zubārah assemblage (Fig. 5/b).

At ZUEP01, CSW made up 35% of the total sherd number. The recorded assemblage showed that it is possible to distinguish a division of the ware into two general groups: Creamy Sandy Ware (CSW) and Orange Sandy Ware (OSW). The division of CSW was based on the appearance of the ware, mainly the colour of the section and the appearance of the ware's texture. These two classes, together with their Fine and Coarse subdivisions, were the most abundant pottery classes on the site (Fig. 5/c). The high percentage of CSW illustrates the intensity of contacts and trade between Bahrain and al-Zubārah, and can be explained in a number of ways; it was not only geographical vicinity but also political and social contacts that encouraged this connection (Rahman 2005). It was also important that CSW had excellent qualities, as the ware was durable with a wide variety of forms being produced. CSW vessels were transported from nearby areas, so they were probably not expensive and thus affordable for many people. The main forms of CSW recorded at al-Zubārah are illustrated in Figure 6.

The second largest group was **Julfar Ware**, which was subdivided into five classes (Fig. 5/d). The ware made up 21.7% of the total assemblage recovered from ZUEP01, with the largest quantities retrieved from Phase 5 strata. It was produced in the UAE, with production kilns found in Julfār and Ras al-Khaimah, and widely distributed within the Arabian Gulf region (Kennet 2004: 53; Mitsuishi et al. 2013: 225). Most of the cooking pots used at al-Zubārah were imported from Julfār. Cooking pots are extremely valuable dating tools; Kennet proposed that the development of Julfar Ware from Ras al-Khaimah could be used to date these vessels (2004: 55, table 23).

The earliest example of a cooking pot found at al-Zubārah is a vessel with external ridge (Fig. 7/a). The form was an extremely rare find at al-Zubārah, with only six examples registered (2% of all recorded Julfar cooking-pot rims). Kennet dates cooking pots with external ridge (CP1.2) to the twelfth –fifteenth century. Cooking pot sherds found at al-Zubārah cannot be securely compared with these examples because their rims are different, but they hold the main characteristics and resemble CP1.2 from Ras al-Khaimah. The scarcity of recorded sherds found at al-Zubārah suggests that this was the latest stage of a cooking pot with a horizontal external ridge in circulation. We can presume, therefore, that this form already existed before the eighteenth-century occupation of al-Zubārah, since the sherds were found in Phase 6 of the stratigraphic record. They could possibly be added to the chronology of cooking pots proposed by Kennet.

It is uncertain how Julfar ware vessels were obtained in Qatar — directly from the production centres or perhaps through middle markets at Bahrain or elsewhere. The maritime trade with the UAE must have been significant during al-Zubārah's occupational Phase 5, as large amounts of Julfar Ware pottery sherds were recorded from the stratigraphy of this phase.

The data show only two small, flat Julfar lid sherds recorded at the site. Most likely Julfar cooking pots were covered with CSW lids. The CSW lid diameter and rim shape fit perfectly with Julfar cooking pots. That might

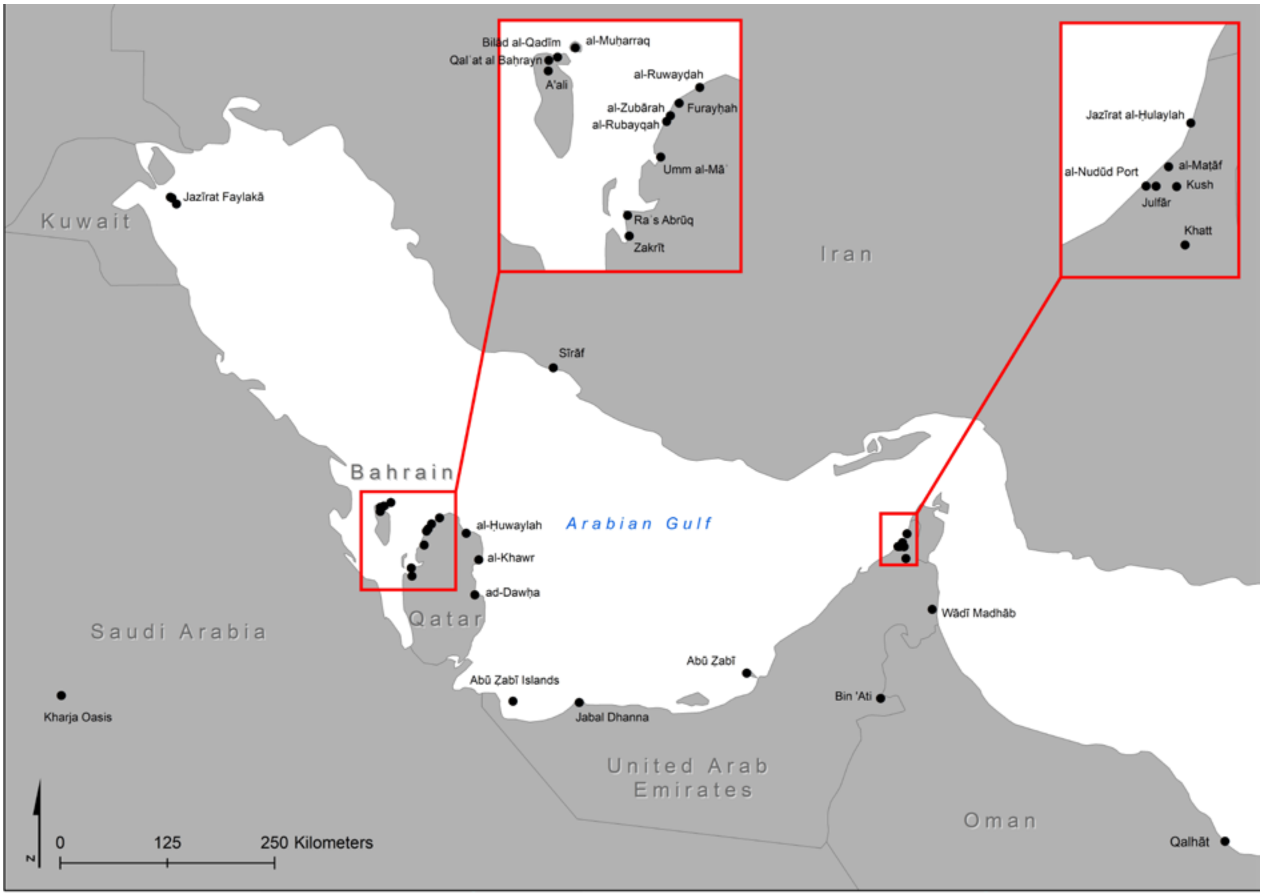


Figure 4. *Arabian Gulf archaeological sites with reported late Islamic pottery assemblages (graphics S. Rosendahl).*

Wares	Unglazed local	Glazed local	Far East	European	Total assemblage
ZUEP01 total assemblage	88.2%	6.8%	4.8%	0.2%	
Phase 4	89.7%	5.2%	7%		6.3%
Phase 5	89.7%	6.6%	3.6%		67.4%
Phase 6	85.4%	11.4%	3%		6.3%

a

Ware	Phase 6 Total number of recorded and phased sherds of all wares in Phase 6: 946	Phase 5 Total number of recorded and phased sherds of all wares in Phase 5: 12619	Phase 4 Total number of recorded and phased sherds of all wares in Phase 4: 921
CSW	29.1%	27.1%	28.5%
Julfar	21%	38.8%	11.7%
MngPt	2.7%	1%	1.9%
Khunj/Bahlā᾽	4.1%	2.5%	2.3%
CHPorcBaW	1.7%	1.7%	5.1%
CHBatavian	0.2%	0.3%	0.5%

b

CSW	21380 (31.20%) 2.28 kg
CSWCoar	1927 (2.82%) 1.9 kg
CSWFine	237 (0.34 %) 3.2 kg
OSW	2866 (4.20%) 8.26 kg
OSWCoar	772 (1.13%) 1.5 kg

c

(*Khunj/Bahlā᾽*) al-Zubārah Total number of recorded sherds: 1742 (2.55%) Total weight: 30.163 kg	
Khunj/Bahlā᾽ **Bowl** (total: 1695) (97%)	*Khunj/Bahlā᾽* **Jar** (total: 47) (2.6%)
Rim sherds: 396	5
Body sherds: 1178	35
Base sherds: 121	4
Handle sherds: -	3

e

	Bowl	Cooking Pot	Jar	Jug	Lid	100% = 6730 sherds
Julfar 1	0.3%			2%		2.3%
Julfar 2		54.8%	7.5%		0.01%	62.4%
Julfar 3	2.8%	3.9%	12.6%			19.3%
Julfar 4		9.1%				9.1%
Julfar 5		6.7%				6.7%

d

FIGURE 5. **a.** *al-Zubārah ceramic wares distribution during occupational Phases 4, 5, and 6;* **b.** *al-Zubārah (ZUEP01) percentage of CSW, Julfar, MngPt, Khunj/Bahla, CHPorcBaW, and CHBatavian during Phases 4, 5, and 6;* **c.** *division of CSW (percentage of wares in the al-Zubārah assemblage and total weight of recorded wares from all excavated areas);* **d.** *the main forms of Julfar Ware and the number of sherds recorded at al-Zubārah (ZUEP01);* **e.** *Khunj/Bahla Ware forms recorded at al-Zubārah (ZUEP01) (graphics K. Bąk).*

indicate some form of cooperation between production centres in the UAE and the kilns in Bahrain, where CSW vessels were produced.

Glazed classes local to the Arabian Gulf

Glazed wares (excluding Far Eastern porcelain and Western glazed wares), sometimes called luxury wares, were occurring on the site in relatively small quantities. The glazed wares made up 6.8% of the total al-Zubārah assemblage and were distributed evenly throughout the three analysed occupational phases at ZUEP01 (see Fig. 5/a).

The glazed wares are characterized by an extremely high level of breakage and did not survive well in archaeological strata that saw a large amount of

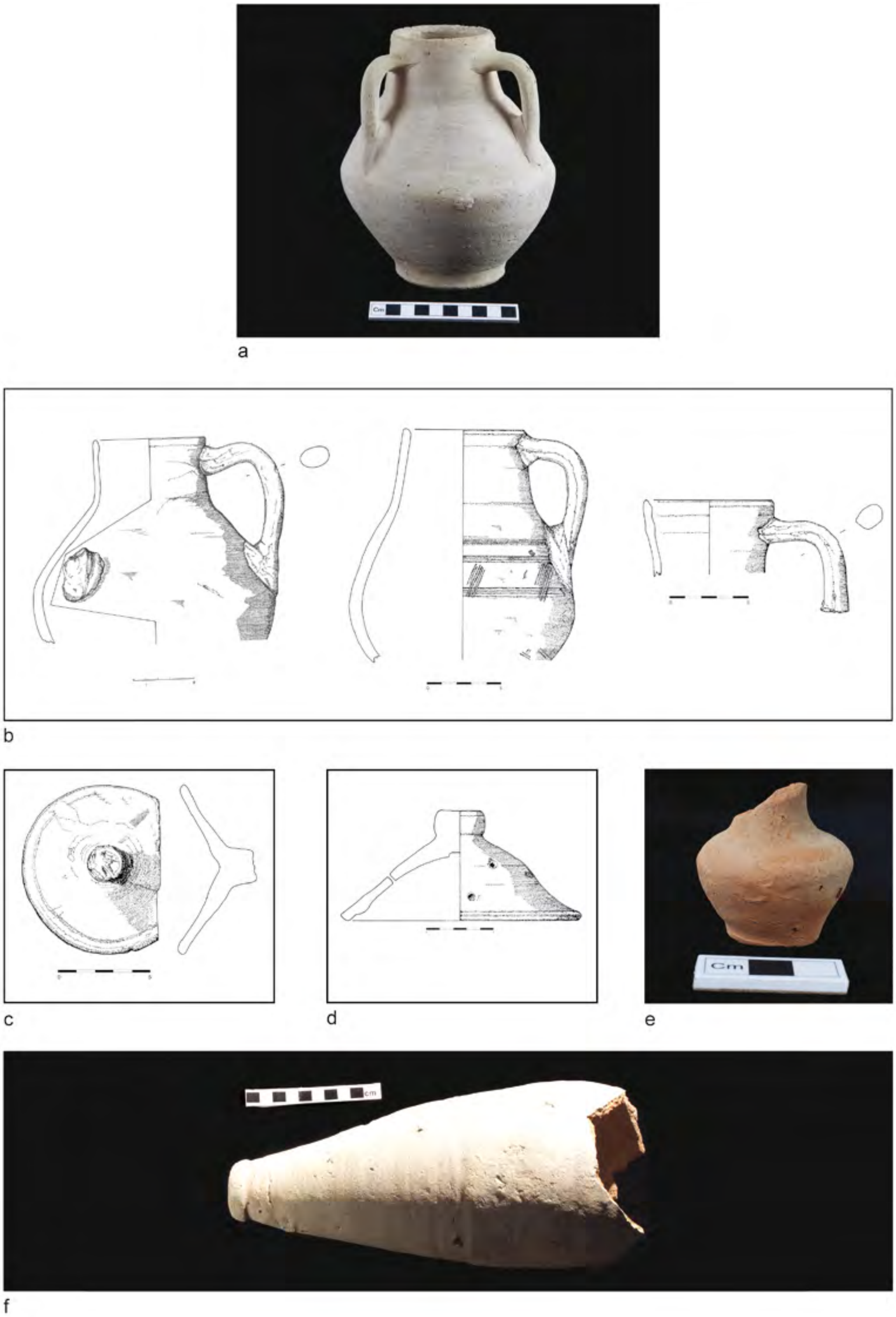


FIGURE 6. a–b. *Creamy Sandy Ware (CSW) jug;* **c–d.** *Creamy Sandy Ware (CSW) lids;* **e.** *Orange Sandy Ware (OSW) small jar;* **f.** *Coarse Creamy Sandy Ware (CSWCoar) torpedo jar (photograph D. Britton/QIAH; drawing C. Hebron/QIAH; graphics K. Bąk).*

Figure 7. a. *Julfar Ware (Julfar 4) cooking pot with external ridge;* **b.** *two Julfar Ware (Julfar 3) jars;* **c.** *Julfar Ware (Julfar 4) cooking pot with external ridge;* **d–e.** *Julfar Ware (Julfar 1) jug (photograph D. Britton/QIAH; graphics K. Bąk).*

disturbance by building, occupation, and destruction or abandonment, while they might have been preserved more preferentially in the soft natural sand where the earliest activities took place. The only glazed ware which was preserved significantly well was Khunj/Bahlāʾ Ware (Figs 5/e and 9).

The most abundant ware was **MngPt** (Manganese Painted Ware) produced in Iran (Carter & Naranjo-Santana 2011: 54). Its main form was a bowl (Fig. 8/a–e), glazed and underglaze decorated with a large flower painted in the middle of the internal surface of the vessel, with thick lines and palmettes radiating from the centre (Fig. 8/a–c). Manganese Painted Ware is well known and reported from Gulf excavations (Kennet 2004: 40; Carter & Naranjo-Santana 2011: 54; Petersen et al. 2014: 28; Power & al-Kaabi 2014: 18).

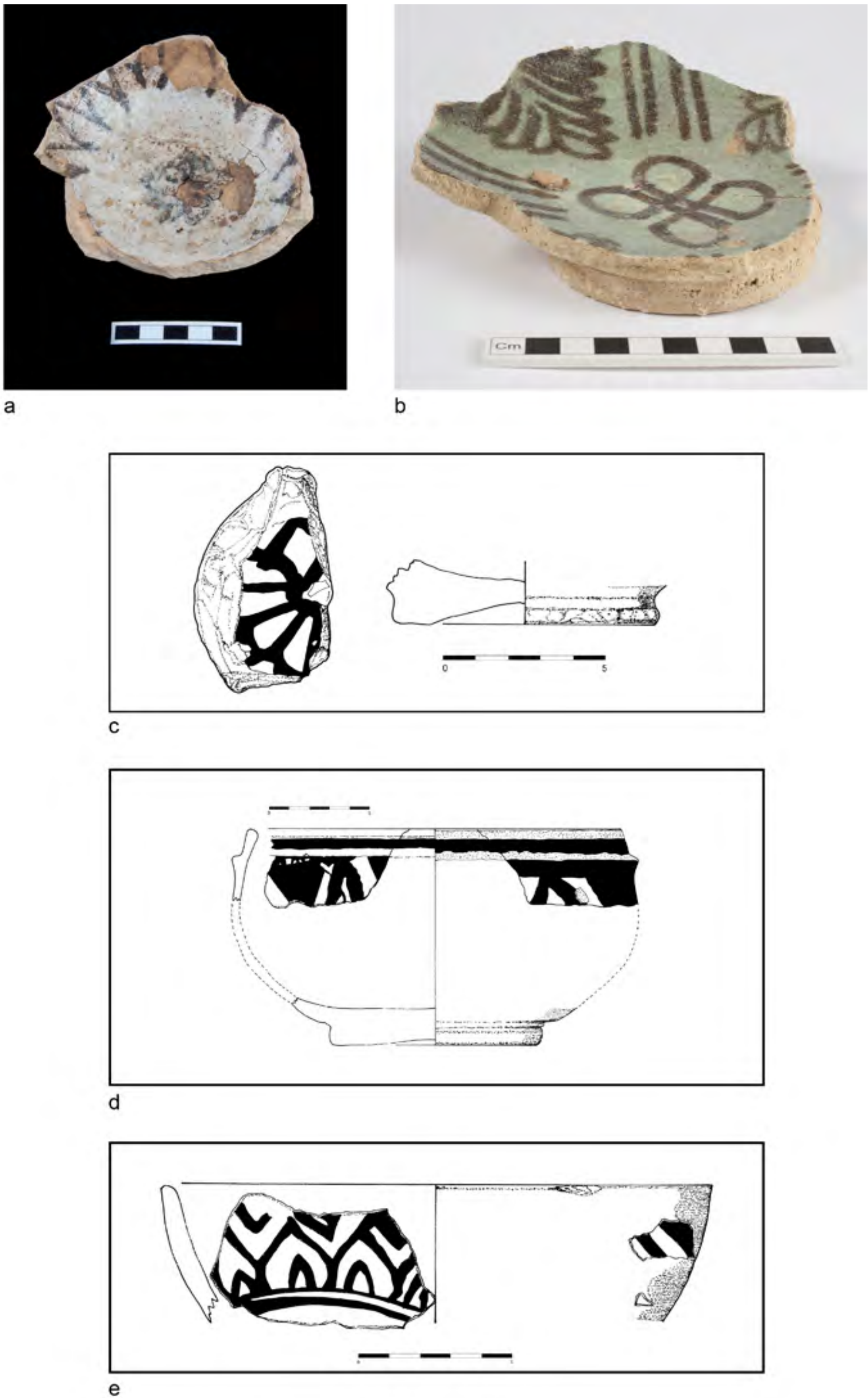


FIGURE 8. *Manganese Painted Ware (MngPt) bowls;* **a–c.** *an open bowl decorated with painted large flower;* **d–e.** *a deep bowl (photographs D. Britton/QIAH; drawings C. Hebron/QIAH; graphics K. Bąk).*

Khunj/Bahlāʾ Ware

Khunj/Bahlāʾ Ware was produced in the southern Iranian province of Fars or Bahlāʾ in Oman (or both) (Hansman 1985: 52; Whitcomb 1975: 129 ; Živković et al. 2019). At al-Zubārah, the ware was the predominant glazed ware from the earliest Phase 6 (eighteenth century) until the mid-nineteenth century of Phase 4. The main form was a bowl, which made up 97% of all recorded Khunj/Bahlāʾ sherds (see Fig. 5/e).

Two main sizes of Khunj/Bahlāʾ bowls were recorded: bowls with a rim diameter of 140–220 mm; and larger diameter Khunj/Bahlāʾ bowls, 240–260 mm. The rims of smaller, deep bowls were plain, rounded, beaded, beveled externally and internally; or incurved with a single groove immediately below the rim interior (Fig. 9/a–c). Larger diameter bowls which were shallow had a flange or incurved rim with a single groove immediately below the rim interior (the depth of the groove can vary) (Fig. 9/d).

Khunj/Bahlāʾ jars were a rare find and only forty-seven sherds found on the site belonged to such a vessel (Fig. 9/e). Jars varied in size and had 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 lead glaze covered both the external and internal surfaces. The base is always a ring base (Khunj/Bahlāʾ small deep bowls have a ring base, larger open bowls a disc base).

Far Eastern glazed wares

Far Eastern glazed wares comprised 6.8% of the total assemblage at al-Zubārah. Six different porcelain ware classes were distinguished among Far East imports. The analysis of ZUEP01 data showed that the most substantial number of porcelain sherds were of **Chinese Porcelain Blue and White** (CHPorcBaW), which made up 2.3% of the assemblage, and were produced at the Jingdezhen kilns (Petersen & Grey 2010: 39). Smoky grey-blue, sometimes pinkish, low-quality porcelain was produced in provincial kilns at Dehua. This pottery is also called 'Kitchen Ch'ing' (Willetts & Lim 1981: 2; Petersen & Grey 2010: 39; Kennet 2004: 51). The fabric of less well-refined porcelain is defined by thicker body sherds with a blistered glaze. The glaze is transparent with applied underglaze decoration and is a deep cobalt blue.

Chinese porcelain bowls and dishes were traded in the largest numbers. This is reflected in the Chinese porcelain assemblage attested at al-Zubārah, where bowls are a dominant form. At al-Zubārah, 84% of Chinese Blue and White porcelain sherds were bowls. The size and profile of recorded bowls were varied with diameters between 36 and 50 mm. Bowls with diameters of 50–80 mm were recorded as 'small bowls'. Rims are plain or externally or internally everted, bases are ring bases.

Large diameter bowls were open vessels with flared or rounded profile, foot-ring bases, plain or rarely slightly flared rims and of varying thickness. Small bowls were deep with rounded sides, plain rims, and foot-ring bases. Bowls from Dehua provenance were made for export and are often heavy-duty vessels, with grey rather than blue poorly finished decoration. They have firing faults: crazed, blistered with air pockets in the glaze, and impurities of the ware are frequent, with sand and grit often attached to the base. High-quality porcelain recovered from al-Zubārah is mostly dated to the eighteenth century; this fine-textured white porcelain was decorated with an intensive blue painted decoration. Sherds with riveting repair holes are common.

Chinese Porcelain Blue and White at al-Zubārah represents a wide stylistic variety of decoration motifs. The assemblage's decoration and design diversity encompass the following:

Flowers, fruits, and plants: peony (Fig. 10/a–c), cherry blossom (Fig. 10/d), chrysanthemum (Fig. 10/e), lotus, Artemisia leaf, iris, peach, *ling chih* fungus (Fig. 10/f–g).

Chinese characters and symbols: *Shou* 'long life' (Fig. 10/h), *Shuang hsi* 'double happiness', OṂ Sanskrit sacred syllable sign (Fig. 10/i–j), *páncháng* endless knot (Fig. 10/k) *Fu* happiness, *wan tzu lan kan* motif of openwork garden fences (Fig. 10/l).

The wide variety of painted motifs provided precise dating when compared with published ceramic material from other archaeological sites or museum collections.

Chinese Porcelain (CHPorc) sherds found in al-Zubārah were of various quality of material, probably from Europe or in many cases China or Japan. The sherds are glazed and many are decorated with overglazed polychrome painted or enamelled decoration. A large variety of forms was recorded: plate, saucer, bowl, cup, lid, coffee cup. This type of porcelain was traded on a massive scale, and was usually well preserved in archaeological contexts allowing direct and precise

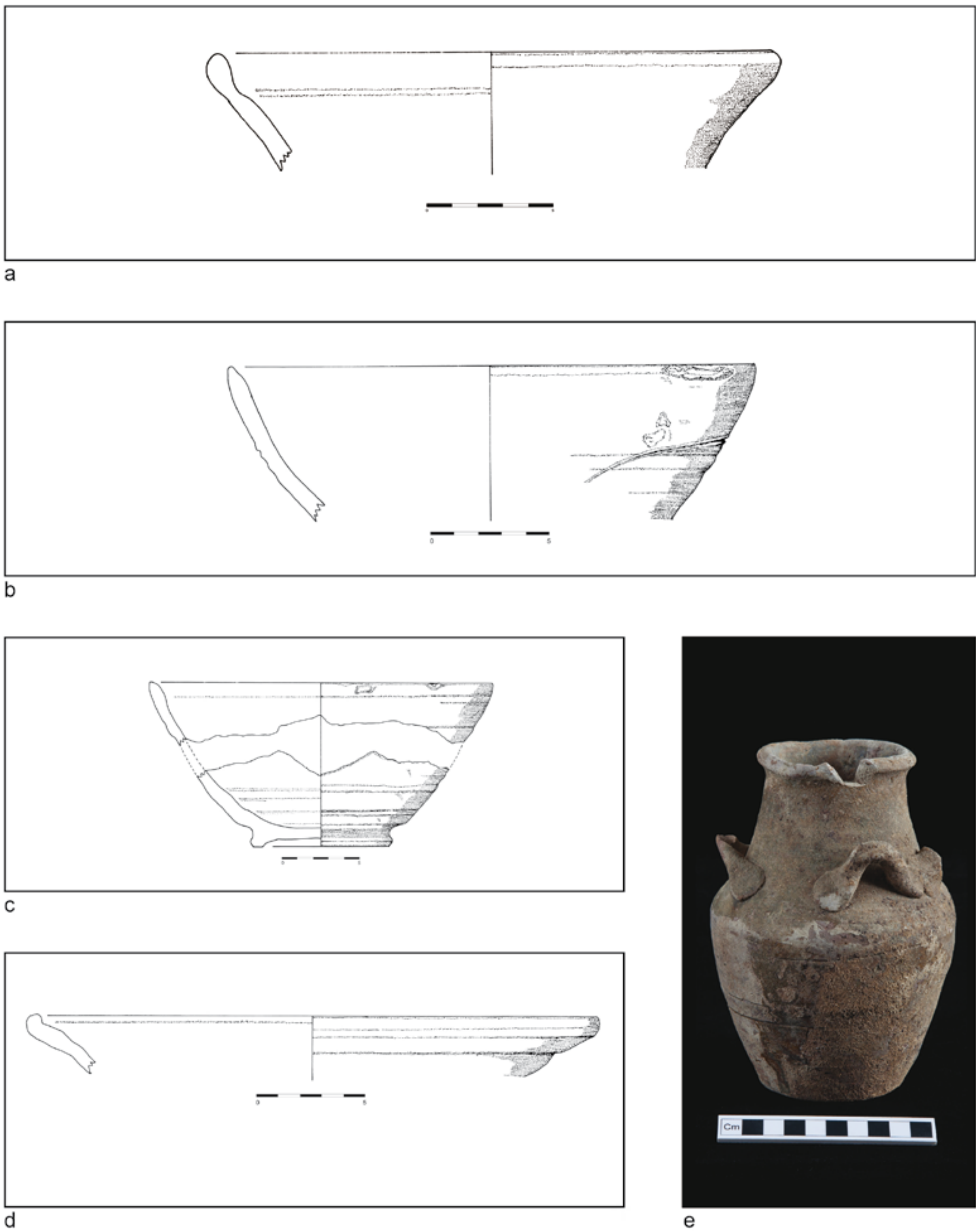
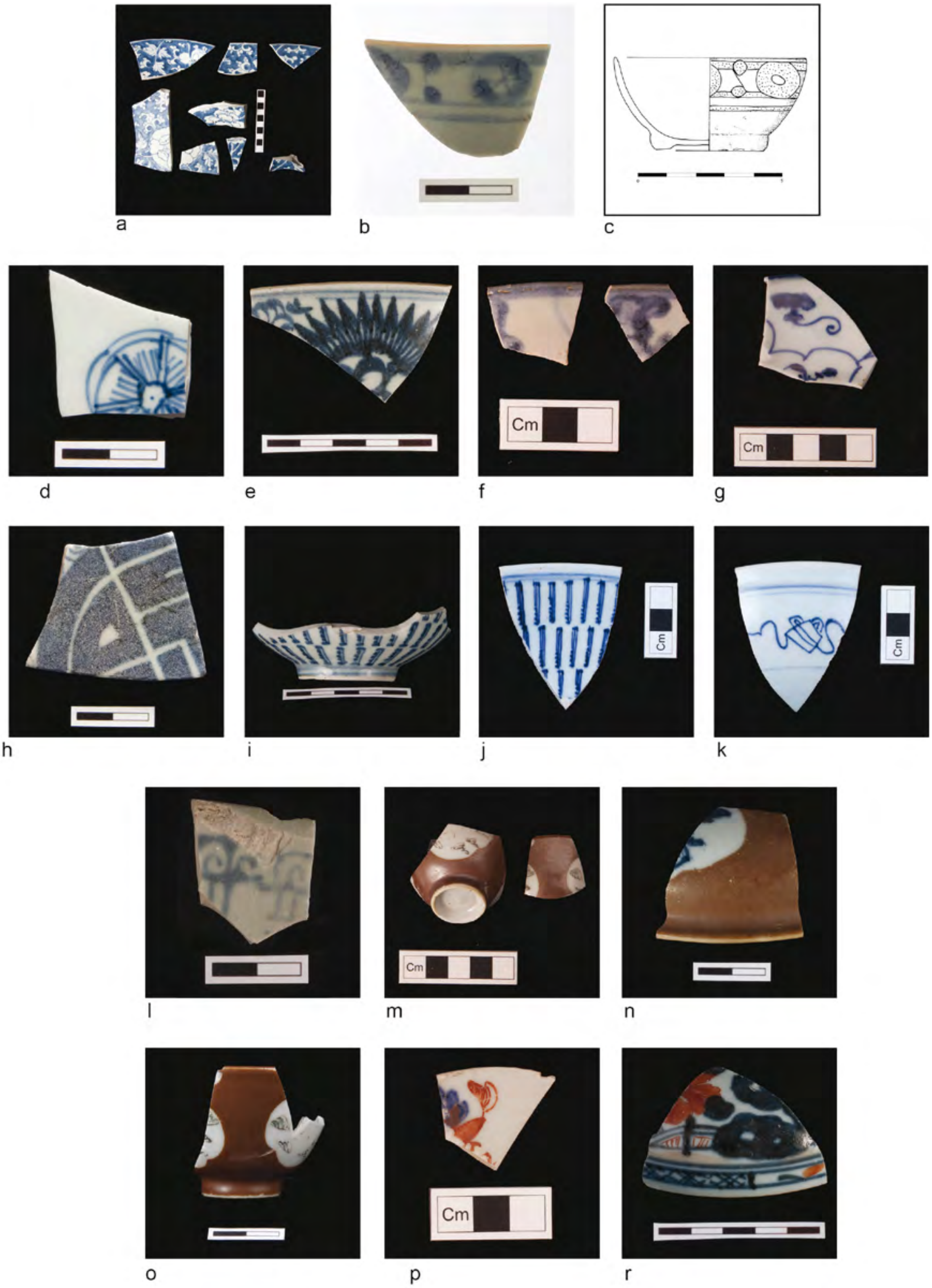


Figure 9. a–d. *Khunj/Bahlāʾ Ware bowls;* **e.** *Khunj/Bahlāʾ Ware jar (drawings C. Hebron/QIAH; photograph D. Britton/QIAH; graphics K. Bąk).*

Figure 10 (page 45). a–c. *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with a peony motif;* **d.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with a cherry blossom motif;* **e.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with a chrysanthemum motif;* **f–g.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with* ling chih *fungus motif;* **h.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with Shou 'long life' character;* **i–j.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with an OṂ Sanskrit sacred syllable sign;* **k.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with* páncháng *endless knot motif;* **l.** *Chinese Porcelain Blue and White (CHPorcBaW) bowl decorated with a* wan tzu lan kan *motif of openwork garden fences;* **m–o.** *Chinese Porcelain Batavian (CHBatavian) cups;* **p–r.** *Chinese Porcelain Imari (CHImari) (photographs A. Pantos, D. Britton/QIAH; drawing C. Hebron/QIAH; graphics K. Bąk).*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comparison (Kennet 2004: 50). Some forms, such as the coffee cup, compare well with fluted cups found in al-ʿAyn Oasis, UAE (Power & al-Kaabi 2014: fig. 6; Power 2015: 13), and from a late context at Doha, Qatar (Carter & Eddisford 2013: 66), al- Muḥarraq, Bahrain (Carter & Naranjo-Santana 2011: 55; Carter 2008: 13), and Wādī Madhāb, UAE (Carter 2008: 38).

Chinese Porcelain Batavian (CHBatavian) (Petersen & Grey 2010: 39) forms at al-Zubārah included cups, small bowls, and lids which are decorated with chocolate brown or cafe -au-lait glaze with white panels with blue and white interiors. Inside of the panels, polychrome floral decoration was applied, sometimes accompanied with under-the-glaze blue and white painted decoration. In many cases, only under-the-glaze cobalt blue painted decoration occurred inside of the white panels. The panel varies in size and shape: it can be shaped like a leaf or have a sharp zigzag outline. The brown iron glaze is thick and occurs in various shades of brown (Fig. 10/m–o).

Sherds of **Chinese Porcelain Imari** (CHImari) (Hansman 1985: 32; Petersen & Grey 2010: 39) were rarely seen in archaeological context at al-Zubārah, with only seven sherds recorded from Phase 5 at ZUEP01 (Fig. 10/p–r). The recorded forms were cups and small bowls of various sizes with an evenly applied glaze, and decorated with an underglaze blue painted decoration and overglaze painted motifs in gold and dark orange colour.

Chinese Porcelain Blue (CHPorcBlue) (Harrisson 1995: fig. 18a,b) sherds were high-quality porcelain with monochrome blue underglaze decoration and painted on the glazed golden motifs. Only eleven sherds were recorded at ZUEP01, none was phased. The main recorded form was a small bowl. The monochrome dark blue porcelain sherds also occurred at Furayḥah and al-Ruwayḍah, where they were an equally rare find (Bystron 2014:108; Petersen et al. 2014: 29).

Chinese Porcelain Celadon (CHCeladon) (Petersen & Grey 2010: 39) sherds excavated at al-Zubārah were nineteenth-century imitations of celadon, and the ware most likely originated in China or Europe. The sherds were not phased. The glaze is pale green/celadon in colour.

European imports, Refined White Ware (RefW)

The wares brought from Europe made up 0.22% of the sherd collection at al-Zubārah and they were recorded only from Phase 1 strata.

Refined White Earthenware (RefW) in the Arabian Gulf was imported in the late nineteenth century from either the Dutch companies of Petrus Regout and Co. of Maastricht or Société Céramique (Maastricht), or from British factories, Staffordshire England and Bell & Co. Glasgow (Harrison 1995: 96–98; Grey 2011: 352). The ware is well reported from archaeological sites with late stratigraphy, and from surface collections at abandoned sites.

Numerous parallels chronologically related to al-Zubārah were excavated and found *inter alia* at al-Muḥarraq, Bahrain (Carter & Naranjo-Santana 2011: 11), al-ʿAin Oasis, UAE (Power 2015: 14), and Doha, Qatar (Carter & Eddisford 2013: fig. 5.52). The ware is also well represented in the ceramic assemblage gathered during surface collection in Rustaq, Oman.

The Qatar National Museum pottery collection holds sherds and complete examples of Refined White Earthenware vessels (Carter 2011: 39), and complete examples of these vessels are relatively common.

The al-Zubārah assemblage contains 469 examples of Refined White Earthenware sherds. The ware is bright white, light in weight, and with a fine appearance. A thin glaze covers both the external and internal surfaces of the vessels.

Refined White Earthenware was decorated with the painted and sponged printing technique and executed with polychrome colours (green, maroon, black, purple, yellow, and blue) (Fig. 11/c). The decorative motifs contained mainly flowers together with leaves and simple stripes. The motifs persisted for many years and therefore in some cases dating is difficult (Kelly, Kowalsky & Kowalsky 2001). For better dating, the design of sherds excavated at al-Zubārah (e.g. like the painted motif of a design called 'Persian rose') was compared with original design plates stored at the museum's archives (e.g. Princessehof National Museum of Ceramics, Maastricht).[1]

At al-Zubārah sherds with maker's marks were recorded to simplify the determination of their date and provenance (the name of the manufacturer appeared on the maker's marks after 1891).

[1] See www.geheugenvannederland.nl/en/geheugen/results?query=Maastricht+earthenware+decorations%2C&page=16&maxperpage=36&coll=ngvn

Figure 11. a. *'JOKO' bowl, Société Céramique (Maastricht) found at al-Zubārah;* **b.** *a porcelain bowl decorated with a painted copy of transfer 'JOKO' design, found during a regional survey surface collection in north-west Qatar; produced in Japan (?);* **c.** *a variety of Refined White Earthenware (RefW) sherds recorded at al-Zubārah (photographs D. Britton/QIAH; graphics K. Bąk).*

Sherds of Refined White Earthenware decorated with transfer-printing technique were a rare find at al-Zubārah (thirty-five sherds). The colour of the print was blue, brown, or red. In some cases, brown print was accompanied by gold lustre-style details (e.g. 'JOKO' bowl Fig. 11/a). Some of the Refined White Ware decoration motifs became so popular that we can see them copied on high-quality porcelain produced in Japan (see sherds decorated with a painted copy of the transfer 'JOKO' design found at Site QIAH 369 in Qatar; Fig. 11/b).

The bowl is the dominant form (67% of the total RefW collection); other forms are plate and cup. The majority of recorded sherds belong to medium-size vessels with a maximum diameter of 180 mm.

All sherds of Refined White Earthenware found at al-Zubārah belong to Phase 1 of the town's occupation and are dated to the nineteenth–twentieth century.

Concluding remarks

The pottery assemblage from al-Zubārah represents the collection of wares used on the site during a relatively short period of occupation spanning up to 140 years. The ceramic wares were sourced locally or regionally but also came to the town from as far as Europe, China, and Japan. Ceramics most likely represent a marginal part of trade as a whole, but their purchase shows the wide reach of the commercial trading links and connections of the merchants in al-Zubārah. The town's wealth was rooted in the political and economic situation of the Upper Gulf region, with its prosperity tightly connected to the major events taking place within the region. The economic heydays and downturns are confirmed by the quantitative distribution of ceramic material retrieved from the site.

Three analysed occupational phases of al-Zubārah mirrored the events of the town's development. Although the stratigraphy of this period was reached only in a few places, thus affecting the size of the recorded assemblage (total number of sherds 946), the Phase 6 assemblage at ZUEP01 showed that locally produced unglazed classes were the most numerous, making up 85.4% of the total collection, followed by glazed local wares (11.4%) and those from the Far East (3%) (see Fig. 5/a). The inventory of ceramics from Phase 6 showed that Unglazed Wares produced locally were dominated by two wares: CSW, which provided the majority of water-serving vessels; and Julfar Ware, mainly in the form of cooking pots.

CSW and Julfar sherds made up 29.1% and 21%, respectively, of the total Phase 6 assemblage (see Fig. 5/b). Of the local, glazed wares, Khunj/Bahlāʾ ware made up 4.1% and MngPt ware twenty-six sherds (2.7% of the total Phase 6 assemblage). The majority of Chinese porcelain sherds were made of CHPorcBaW (total number of recorded sherds: seventeen). CHBatavian in Phase 6 strata was represented by only two sherds.

The pottery quantification clearly identified a sudden influx of ceramic material during Phase 5 (1766–1811). The total number of recorded sherds in Phase 6 was 946, in Phase 5: 12,619.

The assemblage of Phase 5 was dominated by unglazed wares produced locally within the Arabian Gulf (89.7%), but also contained relatively high frequencies of luxury glazed wares (6.6%) (Fig.5/a). During Phase 5 the volume of Unglazed Local Wares rose significantly from Phase 6, marking the pearl industry boom. The recorded 4900 sherds of Julfar Ware sherds dominated the unglazed assemblage, making up 38.8% of the total pottery collection. CSW was a substantial component of this assemblage with 3432 recorded sherds (27.1%). Less numerous luxury glazed items produced locally were mainly bowls, with only two wares having also jug form (Khunj/Bahlāʾ Ware and Yellow Glazed Ware). These local glazed wares were mainly represented by Khunj/Bahlāʾ ware (328 sherds: 2.5%) and MngPt (131 sherds: 1%). In total during Phase 5, glazed wares comprised 6.6% of the total assemblage. This increase in the volume and diversity of imported wares was linked to revenues generated by the pearl industry, which also financed urban architectural expansion and the construction of defensive architecture. A total of 5224 CHPorcBaW sherds were recorded from Phase 5 strata (1.7% of total Phase 5 assemblage). The presence of Chinese porcelain showed long-distance trading activities. The most numerous ware imported from the Far East was Blue and White Chinese porcelain, with the bowl in various sizes being the main form. Interestingly, the stratification of the Chinese imports showed differences between material dated to the eighteenth century, late eighteenth century, and imports of nineteenth-century date. That might explain the rise of recorded sherds during Phase 4, signifying imports of cheap, low-quality porcelain vessels. Further research will certainly provide a basis to date Chinese imports from this period more precisely. In total 921 sherds were recorded from Phase 4 strata. The reduction marked the decline of the pearl industry and the end of al-Zubārah's financial prosperity (see Fig. 3/c). The total percentage of CHPorcBaW was 5.1%. Unglazed, local wares made up 89.7% of the total assemblage, with CSW comprising 28.5% and Julfar 11.7%. The glazed local wares made up 5.2% of the total assemblage, with Khunj/Bahlāʾ ware being the most numerous (2.3%).

It is important to mention that the assemblage at al-Zubārah contained low frequencies of the Refined White Ware produced in Europe, but sherds were only retrieved from occupational Phase 1.

The results of pottery analysis at al-Zubārah revealed a variety of ceramic wares excavated from the houses at ZUEP01. Pottery and other material cultural artefacts discovered during the excavation confirmed that the area was occupied by affluent citizens who could afford to purchase more expensive items.

Significant volumes of both local and imported wares mirror the rise of the pearl trade and of al-Zubārah during the zenith of the pearl trade in the region when Qatar became a pearling centre (Carter 2005: 149). The ceramic wares from later phases also reflect the subsequent decline and collapse of the pearl trade and the decline of al-Zubārah. This analysis could be placed within a bigger picture of regional and interregional trade, showing that al-Zubārah became a commercial hub where cargo from Persia, the Musandam peninsula, the Far East, and Europe was purchased and traded.

Acknowledgements

I am grateful to Faisal Al-Naimi and the QMA, Ingolf Thuesen and The University of Copenhagen, Department of Cross-Cultural & Regional Studies, for their support. Thanks to all team members of the QIAH Project.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 51–67

Production and provenance of Gulf wares unearthed in the Old Doha Rescue Excavations Project

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Summary

In this paper, a science-based study of ceramic wares discovered in the Old Doha Rescue Excavations (ODRE) is presented. The ODRE project, run by Qatar Museums and UCL Qatar, discovered a stratigraphic sequence running from the earliest occupation of Doha in the early nineteenth century until the most recent archaeological levels. A strategic selection of ceramic wares from this sequence was studied to shed light on the technological background and provenance of the pottery utilized in Doha between the late nineteenth and the mid-twentieth century. The petrographic study of these wares has provided insight into their mineralogical and petrological composition and their textural characteristics. The textural elements have been used to understand the technology of production of the ceramics, which come from different places around the Gulf. The identification of components has moved us a step closer to the location of places of production by matching compositions and geological backgrounds. The study of glazes with hhXRF, SEM-EDS, and optical microscopy has given us further insight on technological processes in the application of glaze. Finally, a comparison between the macroscopic and microscopic analyses carried out has been produced to shed some light on the inherent difficulties associated with the identification of wares in Gulf ceramics.

Keywords: Islamic archaeology, archaeological science, Qatar, Gulf archaeology, ceramics

Introduction

In this paper, the preliminary results of a science-based study of ceramics retrieved in the Old Doha Rescue Excavations (ODRE) in Qatar are presented. ODRE is a project developed in tandem by Qatar Museums and UCL Qatar which was designed to explore the urban archaeology of Doha, to characterize the material culture of the town over the nineteenth to mid-twentieth century, and to identify changes therein. All these data are being related to historical sources and anthropological accounts of life in the old town. The objectives of the present study of ceramics are to test the classification of wares, developed during the macroscopic and typological study of the pottery retrieved during the project, and to gain initial data on the provenance of the common varieties of late Islamic ceramics.

The ceramics analysed in this study were found in the excavations undertaken by the ODRE team in the centre of Doha. The location of the excavations was determined by the needs of development projects in the city, and the area of work was therefore chosen because it had been selected to be a metro station by Qatar Rail. The pottery was recovered from the layers of a clear stratigraphic sequence: a series of superimposed houses, occupation debris, courtyard deposits, and alley fills found in about 2 m of stratified remains in several trenches in the historic core of Doha. Coin data and other indicators show that the vast majority of the ceramics date from the very late nineteenth century (1890s) to the 1950s. The poorly preserved bottom of the sequence indicates earlier phases of disturbed occupation going back to the beginning of the nineteenth century, in accordance with historical records. Many of the wares identified in these excavations go back to this period and earlier. It is assumed that these ceramics were produced outside Doha, possibly outside Qatar itself, in different areas of the Gulf. In consequence, the main aim of this study is the characterization of a number of selected key wares to allow for future comparisons with other assemblages and, if enough research is conducted in the future, with materials from excavated kilns or from studies of potential clay resources.

Ware Name	Ware and Form Description	References	Dating and other comments
JW: Julfar Ware	Red-brown, brown or grey fabric with frequent sub-angular grits, and whitish inclusions. Quite coarse but can be thin-walled. Generally appears hand-made but sometimes signs of turning on slow wheel. Red-brown or grey slip often visible. Red-brown or purplish paint which is sometimes hard to distinguish against fabric and slip of similar colour. Rare whitish slip (JULFAR.1, more common in earlier centuries). Outside Ras al-Khaimah it usually occurs as cooking pots and multi-purpose globular jars, also barrel-shaped vessels, more rarely small bowls, spouted pouring jars.	Kennet 2004: 70–76. Power 2015: 7–10. Stocks 1996. Mitsuishi et al. 2013.	Twelfth to mid-twentieth century. Kennet divides into four subclasses (JULFAR.1-JULFAR.4) according to surface treatment and fabric colour. Cooking pot rims are chronologically indicative. Manufactured in and around, Wādī Ḥaqīl, Ras al-Khaimah.
RGGW: Red/Grey Gritty Ware	Red-brown, brown or grey fabric with frequent sub-angular grits, and whitish inclusions. Often uneven colouring around large vessels. Similar to Julfar but thick-walled and very gritty. Dark slip sometimes visible. Signs of slow wheel turning at rim. Used for storage jars, often with incised decoration and impressed cordons around the body, sometimes small handles.	Carter 2011: 34, fig. 8 (Coarse Gritty Ware). Costa 1991: 107, 113–114, 139, 151–152, 212–214. Lancaster & Lancaster 2010: figs 17–22, 32–33, 59, 97, 122. Petersen & Grey 2012: 287 (Reduced Coarse Ware and Oxidized Coarse Ware).	Eighteenth to mid-twentieth century, likely earlier origins. Similar to PGGW and PGW but grittier, darker, more variable in colour. Designation originally intended as a catch-all category for related gritty fabrics which are hard to separate into clear wares, though some examples are so similar to Julfar they could be arguably described as Julfar Ware storage jars. Some forms resemble products different kiln sites in Musandam, however.
PGW: Pale Gritty Ware	Brown or buff with moderate or frequent sub-angular dark grits, also rarer whitish inclusions. Appears to be wheel-turned, at least at the rim. Brown, dark brown or reddish slip, which is sometimes absent in areas. Used for storage jars, sometimes with cordons or impressed cordons around the body; also for basins. A slightly finer version (with finer and smaller grits) used for small spouted jars with handle, also medium-sized water jars with handles and no spout.	Carter 2011: 36, fig. 1:1–4, fig. 4: 1–4; fig. 7. Carter & Naranjo-Santana 2011: 49–52.	Nineteenth to mid-twentieth century. Some variability in colour and frequency of grits, especially on large storage jars, and therefore sometimes hard to separate from RGGW and PGGW.
PGGW: Purplish-Grey Gritty Ware	Coarse but dense and hard-fired fabric with moderate or frequent sub-angular grits, and whitish inclusions. Usually dark grey or purplish, sometimes with reddish or purplish core. Storage jars and bowls. Signs of wheel-turning.	ODRE	Can resemble Late Sasanian/Early Islamic gritty wares (Kennet's LISV and Clinky). Denser and more highly fired than RGGW, but often hard to separate and not clearly a separate category.
SW: Sandy Ware	Abrasive-feeling fabric with frequent medium-to-coarse quartz sand, usually with whitish speckles and inclusions. Cream, reddish or buff, often reddish/orange core with cream surfaces. Used for medium-sized jars with pointed bases, large handle fragments (from same jars?), also lids.	Carter 2011: 36, fig. 3: 1–2.	Seventeenth (?) to twentieth century. Note that a very similar sandy ware exists in the early Islamic period, and perhaps intervening centuries (e.g. the example illustrated in Carter 2011 fig. 3: 1 may actually be early Islamic). Some macroscopic overlap and shared forms with coarse examples of A'ali Ware. Not identifiable in Kennet's 2004 typology.
FBW: Fine Brown Ware	Fine brown fabric with fine speckling. Comb-incised decoration on shoulder and body. Used for small jars with handle(s), sometimes spouted.	Carter 2011: 33, fig. 2: 1–2. Petersen et al. 2016: 342.	Twentieth century. Cf. Grey's 'Brown Silty Ware' (in Petersen et al 2016). Same as 'Brown A'ali' in Carter (2011: 33) but that name should be discarded.
BW: Bahla Ware	Thin speckled glaze, usually brown or olive, sometimes green or dark brown. Fine reddish fabric with grey areas, usually with fine speckling. Generally bowls with footed or ring bases, occasional small jars, also wider dishes before the nineteenth century.	Kennet 2004: 54–55. Power 2015: 10, figs 7–8. Priestman 2005: 269–270.	Fifteenth to twentieth century. Formerly sometimes referred to as 'Khunj' ware, a designation which should be discarded. Power's Al-Ain sequence indicates that Bahla was still common in the early-to-mid twentieth century, though it was rare outside Oman and the UAE during and after the nineteenth century.

Ware Name	Ware and Form Description	References	Dating and other comments
AW: A'ali Ware	Fine cream or buff fabric, sometimes tending to orange or red-brown. Close examination reveals moderate or rare quartz sand and whitish or rusty inclusions. Comb-incised decoration. Distinctive forms, usually small water jars with three handles; also lids and occasionally small bowls.	Garlake 1978: 166. Carter 2011: 33. Petersen & Grey 2012: 287.	Eighteenth to mid-twentieth century, perhaps starting earlier. Not clearly identified by Kennet, but likely to correspond to BUFF (2004: 81).
MUPW: Manganese Underglaze Painted Turquoise Glazed Ware	Soft cream fabric, fine but often porous and grainy. Thin, speckled turquoise glaze, sometime with panels of darker turquoise glaze, glaze often flaked off, over black paint with geometrical and rosette motifs. Used for bowls with footed or ring bases.	Kennet 2004: 51–52, MGPAINT.2. Priestman 2005: 261–262, MGP.2. Power 2015: 11–12, fig. 7, MANGA.	Seventeenth to twentieth century for this variety.
PFN: Pale Fine Ware	Fine pale brown or buff fabric, sometimes with signs of a brown slip. Small water jars with handle(s) and sometimes spout.	ODRE	Resembles small jars in Pale Gritty Ware, but grits not visible.
FCW: Fine Cream Ware	Fine, whitish or cream ware, no visible inclusions but sometimes fine pores. Sometimes with rouletted decoration or surface-treatment. Used for small, tall water jars, sometimes with handles, and rarely spouted.	Carter 2011: 34–35, fig. 2: 3–8 (Cream Ware).	Probably Iraqi.
TGCW: Thick Grainy Cream Ware	Used for basins and medium-sized wide-mouthed water jars, the latter sometimes with rouletted surface-treatment.	Carter 2011: 34–35, fig. 4: 5–6, fig. 6 (Cream Ware).	Divided from (Fine) Cream Ware in an attempt to distinguish a slightly coarser version used for larger vessels. Can resemble A'ali Ware.

Figure 1. *Names of the wares used in this paper, with relevant descriptions and references.*

The initial study of the ceramics was undertaken by a joint team from Qatar Museums and UCL Qatar, who produced the macroscopic classification of wares[1] that is being used in this paper (ODRE classification).[2] Of all the studied ceramics, 148 samples of twelve different wares were selected and thin-sectioned at UCL Qatar facilities. The study of the samples was undertaken with polarizing microscopes LEICA DM750P and LEICA DM2500P in transmitted plain polarized (PPL) and cross-polarized light (XPL) at the UCL Qatar Archaeological Material Science Laboratories. Of the analysed samples, nine were refired at 1050°C to test the effects of firing atmospheres and temperatures in the petrographic groups related to these samples.[3] In addition, all glazed samples, Bahla and Manganese Underglaze Painted Turquoise Glazed Wares (MUPW), were initially analysed qualitatively using an Olympus Innov-X Delta Premium hand-held X-ray fluorescence (hhXRF) instrument with a 4W, 40kV Rh anode X-ray tube (using a 3 mm collimated beam). On the basis of these results and macroscopic features, sixteen samples of Bahla and MUPW (eight of each, all of them analysed with petrography, except for four MUPW, which were selected only for this study due to the good preservation of their glaze) were prepared at the UCL Qatar laboratories as polished sections and analysed using optical and stereo microscopy and a scanning electron microscope (SEM JEOL JSM-6610LV) with attached energy dispersive spectrometer (EDS Oxford Instruments X-Max^N 50).[4] The EDS analyses were undertaken using the Oxford instruments Aztec

[1] In this study, and following a long tradition of pottery studies, we use the term 'ware' to refer to the groups of pottery determined by macroscopic analysis of the ceramics and 'fabrics' to refer to the groups created by petrographic analysis. The option of denominating 'pastes' to classes of ceramics is used in chemical analysis, because in chemistry the composition of the pottery is considered as a homogeneous compound, unlike in petrography, where the texture of the ceramics composition is key to the analysis.

[2] This team included RC, FAN, FS, and AB from this paper's authors, as well as the work of Francesca Pisano (QM) and Huda Abu Amer and Tracey Cian (UCL Qatar students), whom we thank for their excellent contributions.

[3] MaG prepared the thin sections and refired the selected samples under the supervision of JCL and MyG. The petrographic analysis was done by JCL and MaG.

[4] The study of the glazes was undertaken by EA (UCL Qatar student) under the supervision of MyG, which resulted in a successful MSc dissertation — Adeyemo 2017, in which all the details of this study are presented.

software and calibrations and a cobalt metal standard was measured periodically to monitor and adjust the beam current (for further details on instrument set-up see Živković et al. 2019). Finally, forty-nine samples of the 148 were selected for chemical analysis with wavelength dispersive X-ray fluorescence (WDXRF), a work still in progress at the time this article was written. This paper, therefore, presents results based on the information obtained in all the processes described above, except for the chemical elemental analyses, which are still being processed.

Wares and fabrics

Of all the wares identified macroscopically in the ceramics study of the ODRE team, twelve were selected to be analysed in this study. These wares were selected in collaboration with the ODRE team for being the most abundant and the most relevant of the ceramics produced in the Gulf region and found in Doha in the period under study (nineteenth and twentieth centuries). These wares are listed in Figure 1, along with relevant references. Some of them are categories of wares well-known all over the Gulf. In Qatar, they were first identified in an initial classification made by Robert Carter with the ceramics of the Qatar National Museum (Carter 2011) and are now part of the ODRE classification.

The petrographic study was carried out following the method developed by Ian Whitbread (1995: 365–396; cf. Quinn 2013). A total of eleven fabrics were identified (Figs 2 and 3), and each fabric corresponds more or less

SN	Wares	Fabrics	SN	Wares	Fabrics	SN	Wares	Fabrics
OD/01	AW	Fabric 5	OD/52	RGGW	Fabric 2	OD/103	BW	Fabric 7
OD/02	AW	Fabric 8	OD/53	RGGW	Fabric 3	OD/104	BW	Fabric 7
OD/03	AW	Fabric 8	OD/54	RGGW	Fabric 4	OD/105	BW	Fabric 7
OD/04	AW	Fabric 8	OD/55	RGGW	Fabric 2	OD/106	BW	Fabric 7
OD/05	AW	Fabric 8	OD/56	RGGW	Fabric 4	OD/107	BW	Fabric 7
OD/06	AW	Fabric 8	OD/57	RGGW	Fabric 3	OD/108	BW	Fabric 7
OD/07	AW	Fabric 8	OD/58	JW	Fabric 1	OD/109	BW	Fabric 7
OD/08	AW	Fabric 6	OD/59	JW	Fabric 1	OD/110	BW	Fabric 7
OD/09	AW	Fabric 5	OD/60	JW	Fabric 1	OD/111	BW	Fabric 7
OD/10	AW	Fabric 8	OD/61	JW	Fabric 1	OD/112	BW	Fabric 7
OD/11	AW	Fabric 8	OD/62	JW	Fabric 1	OD/113	BW	Fabric 7
OD/12	AW	Fabric 8	OD/63	JW	Fabric 1	OD/114	BW	Fabric 7
OD/13	AW	Fabric 9	OD/64	JW	Fabric 1	OD/115	MUPW	Fabric 9
OD/14	AW	Fabric 8	OD/65	JW	Fabric 1	OD/116	MUPW	Fabric 9
OD/15	AW	Na	OD/66	JW	Fabric 1	OD/117	MUPW	Fabric 9
OD/16	AW	LONER	OD/67	JW	Fabric 1	OD/118	MUPW	Fabric 9
OD/17	AW	Fabric 8	OD/68	JW	Fabric 1	OD/119	MUPW	Fabric 9
OD/18	AW	Fabric 5	OD/69	JW	Fabric 1	OD/120	MUPW	Fabric 9
OD/19	PGW	Fabric 3	OD/70	PGGW	Fabric 4	OD/121	MUPW	Fabric 9
OD/20	PGW	Fabric 3	OD/71	PGGW	Fabric 4	OD/122	MUPW	Fabric 9
OD/21	PGW	Fabric 3	OD/72	PGGW	Fabric 1	OD/123	MUPW	Fabric 9
OD/22	PGW	Fabric 3	OD/73	PGGW	Fabric 4	OD/124	MUPW	Fabric 9
OD/23	PGW	Fabric 4	OD/74	PGGW	Fabric 4	OD/125	MUPW	LONER
OD/24	PGW	Fabric 3	OD/75	PGGW	Fabric 4	OD/126	MUPW	Fabric 9
OD/25	PGW	Na	OD/76	PGGW	Fabric 4	OD/127	MUPW	Fabric 9
OD/26	PGW	Fabric 2	OD/77	PGGW	Fabric 4	OD/128	MUPW	Fabric 9
OD/27	PGW	Fabric 2	OD/78	PGGW	Fabric 1	OD/129	FCW	Na
OD/28	PGW	Fabric 3	OD/79	PGGW	Fabric 4	OD/130	FCW	Na

SN	Wares	Fabrics	SN	Wares	Fabrics	SN	Wares	Fabrics
OD/29	PGW	Fabric 2	OD/80	PGGW	Fabric 4	OD/131	FCW	Na
OD/30	PGW	Fabric 2	OD/81	PGGW	Fabric 4	OD/132	FCW	Na
OD/31	PGW	Fabric 3	OD/82	PGGW	Fabric 4	OD/133	FCW	Na
OD/32	PGW	Fabric 2	OD/83	SW	Fabric 5	OD/134	FCW	Na
OD/33	PGW	Fabric 3	OD/84	SW	Fabric 5	OD/135	FCW	Na
OD/34	PGW	Fabric 2	OD/85	SW	Fabric 5	OD/136	FCW	Na
OD/35	PGW	Fabric 3	OD/86	SW	Fabric 5	OD/137	FCW	Na
OD/36	PGW	Fabric 3	OD/87	SW	Fabric 5	OD/138	FCW	Na
OD/37	FPW	Na	OD/88	SW	Fabric 5	OD/139	TGCW	Fabric 8
OD/38	FPW	Fabric 2	OD/89	SW	Fabric 5	OD/140	TGCW	Na
OD/39	PGW	Fabric 3	OD/90	SW	Fabric 5	OD/141	TGCW	Na
OD/40	PGW	Fabric 3	OD/91	SW	Fabric 5	OD/142	TGCW	Na
OD/41	PGW	Fabric 3	OD/92	SW	Fabric 5	OD/143	TGCW	Na
OD/42	PGW	Fabric 3	OD/93	FBW	Fabric 6	OD/144	TGCW	Na
OD/43	FBW	Fabric 6	OD/94	FBW	Fabric 6	OD/145	TGCW	Na
OD/44	FPW	Na	OD/95	FBW	Fabric 6	OD/146	TGCW	Na
OD/45	RGGW	Fabric 2	OD/96	FBW	Fabric 6	OD/147	TGCW	Na
OD/46	RGGW	Fabric 2	OD/97	FBW	Fabric 6	OD/148	TGCW	Fabric 8
OD/47	RGGW	Fabric 2	OD/98	FBW	LONER	OD/149	MUPW	Ns
OD/48	RGGW	Fabric 1	OD/99	FBW	Fabric 6	OD/150	MUPW	Ns
OD/49	RGGW	Fabric 4	OD/100	FBW	Fabric 6	OD/151	MUPW	Ns
OD/50	RGGW	Fabric 1	OD/101	FBW	Fabric 6	OD/152	MUPW	Ns
OD/51	RGGW	Fabric 2	OD/102	FBW	Fabric 6			

Figure 2. *Equivalence of samples, wares, and fabrics considered in this paper. See Figure 1 for acronyms of ware types. Na = Non-assigned (members of FCW or TGCW); Ns = Not studied (four members of MUPW that were considered only in the analysis of glazes).*

Fabric		Ware		Number of misses (TNSF-NM)	Number of errors (TNSW-NM)
Fabric identification	TNSF	Ware identification	NM of TNSW		
Fabric 1	16	JW	12 of 12	4	0
Fabric 2	13	RGGW	6 of 13	7	7
Fabric 3	16	PGW	14 of 22	2	8
Fabric 4	15	PGGW	11 of 13	4	2
Fabric 5	13	SW	10 of 10	3	0
Fabric 6	11	FBW	10 of 11	1	1
Fabric 7	12	BW	12 of 12	0	0
Fabric 8	13	AW	11 of 18	2	7
Fabric 9	14	MUPW*	13 of 14	1	1

Figure 3. *A list of fabrics and wares together with a comparison between the sample numbers of the identified fabrics and the sample numbers of the identified wares, with misses (macroscopic identifications that fail to recognize the fabric, e.g. two of the sherds identified as Fabric 3, which is typical of PGW, had been classified as other kinds of ware) and errors (macroscopic identifications that take other fabrics for the fabric in question, e.g. eight sherds which had been classified as PGW turned out to have fabrics other than Fabric 3, which was the fabric most typical of PGW). See Figure 1 for acronyms of ware types. * The MUPW group includes only the samples that have been thin-sectioned.*

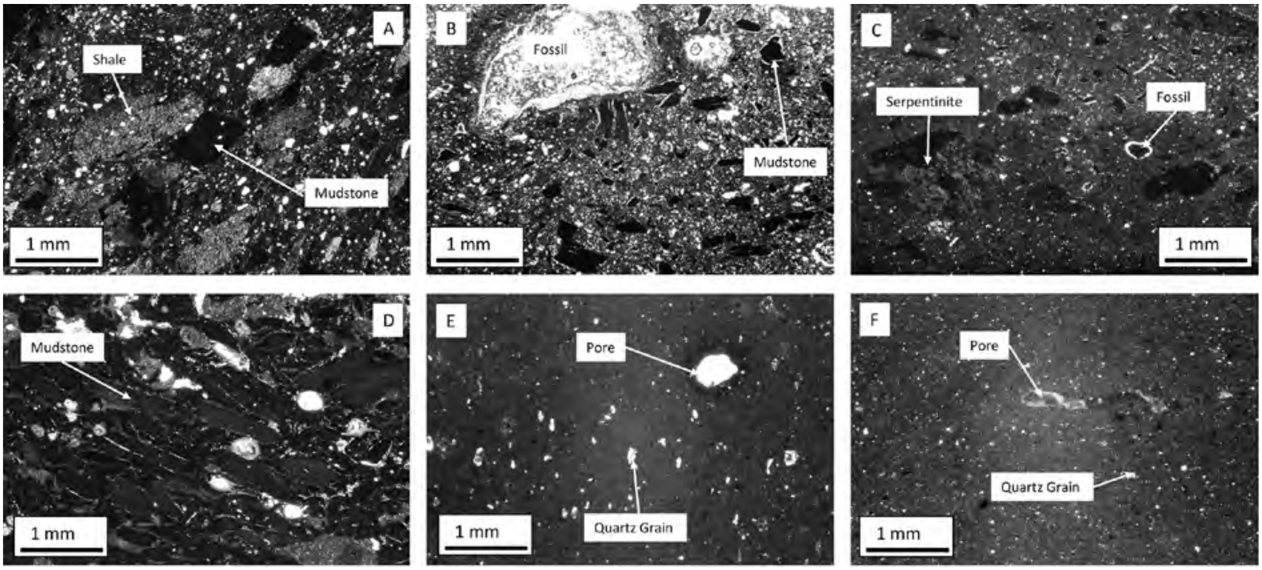

Figure 4. *Petrographic microphotographs:* **A.** *Fabric 1;* **B.** *Fabric 2;* **C.** *Fabric 3;* **D.** *Fabric 4.* **E.** *an example of the fabric of Thin Cream Ware;* **F.** *an example of the Thick Grainy Cream Ware;* **A and C–D.** *images taken in cross polarized light (XPL);* **B and E–F.** *images taken in plane polarized light (PPL).*

accurately to one of the wares (although not always exactly, as explained below). The only exception is Pale Fine Ware, which was spread in between different fabrics and consequently its constitution as a ware is not supported by petrographic analysis (see discussion of this point below). After the petrographic study, the fabrics (and their correspondent wares) can be divided into three groups that are defined texturally: the Gritty Group (see Fig. 4/A–D), which contains abundant inclusions of mudstones and shales (the grits); the Quartzitic Group (see Fig. 5), defined by the abundant presence of microcrystalline quartz; and the Fine Calcareous Group (see Fig. 4/E–F), which contains extremely fine fabrics. The last group is composed of Fine Cream Ware and the Thick Grainy Cream Ware and will not be discussed in this text because the petrographic analysis has not provided any useful information due to the extreme fine nature of the fabrics that compose it; support of the chemical elemental analysis will be required here. There are three outsiders that do not fit within the classification, samples with fabrics that do not match any of the groups formed by petrographic analyses and cannot be defined until further research is undertaken. Consequently, the rest of the paper will focus on the fabrics and wares contained in the Gritty Group and the Quartzitic Group.

In the Gritty Group, we can highlight the presence of Fabric 1 (corresponding to Julfar Ware), defined by a large number of inclusions (20–40%), which are dominated by shales and mudstone. The rest of the members of the group — Fabric 2 (Red/Grey Gritty Ware), Fabric 3 (Pale Gritty Ware), and Fabric 4 (Purplish Grey Gritty Ware) — are defined by other characteristics, such as the higher or lower presence of calcareous and/or serpentinitic rocks and calcite and quartz in the matrix. The Quartzitic Group includes on the one hand Fabrics 5 and 8 (Sandy and ʿĀlī Wares respectively), both with rounded quartzitic sand grains and on the other, three fabrics defined by different contents of angular and subangular monocrystalline quartz, ophiolitic rocks, and calcareous mudstones: Fabric 6 (Fine Brown Ware), Fabric 7 (Bahla Ware), and Fabric 9 (MUPW) (see Fig. 6).

Technology

Petrography and the techniques of glaze analysis contemplated in this paper offer useful insights to initiate reconstructions of segments of the *chaîne opératoire* of production of the different fabrics, although any statement is subject to experimental testing (something that this study cannot offer). With

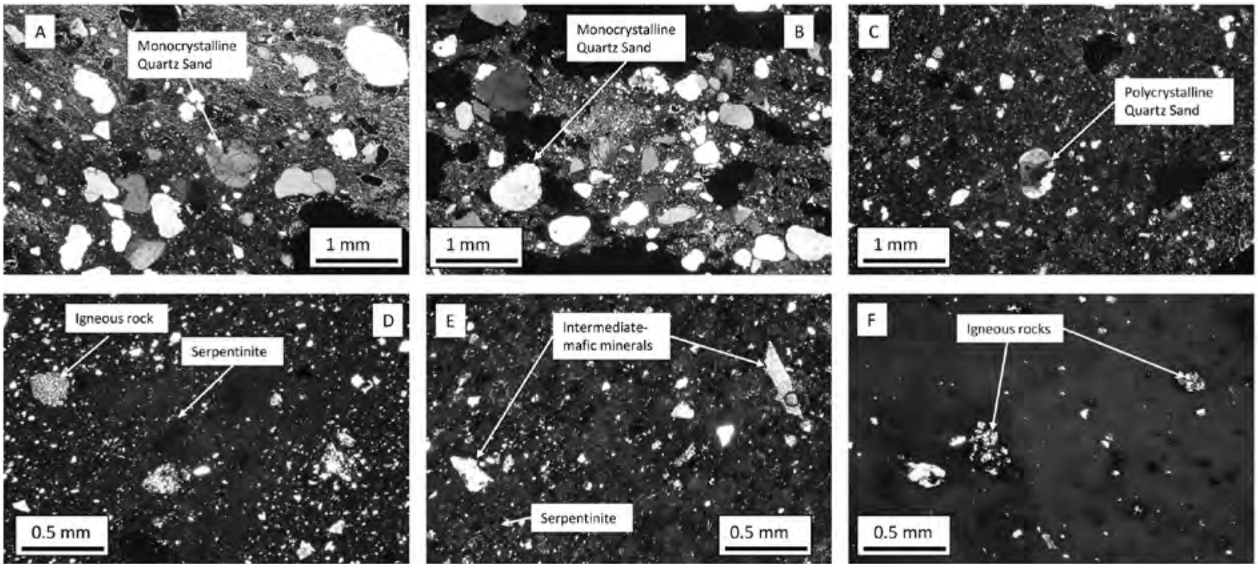

Figure 5. *Petrographic microphotographs:* **A–B.** *Fabric 5;* **C.** *Fabric 8;* **D.** *Fabric 6;* **E.** *Fabric 7;* **F.** *Fabric 9. All images were taken in XPL.*

Fabric number and name	**Textural characteristics**	**Main inclusions**	**Technological implications**
Fabric 1: Coarse fabric tempered with shale and mudstone	Few pores (1–15%), abundant inclusions (20–40%) with weak alignment and bimodal grain-size distribution. Few or no optical activity.	Shale (Predominant to Frequent, largest of 4.25 mm; mode = 1 mm); Mudstone (Predominant to Few, largest of 3.2 mm; mode = 1 mm). Others in coarse fraction include limestone, greywacke, serpentinite and igneous rocks.	Raw materials from sedimentary environment with incipient metamorphism and detritic minerals. Tempering is very likely, clay mixing and levigation are possible. High firing temperature, oxidizing atmosphere in kiln. Similar technology to Fabrics 2, 3 and 4.
Fabric 2: Coarse calcareous fabric tempered with mudstone and shale	Few pores (5–10%) and inclusions (5–15%) with weak to strong alignment and bimodal grain-size distribution. Calcareous matrix. Few or no optical activity.	Mudstone (Predominant to Few, largest of 4.25 mm, mode = 1.5 mm). Others in coarse fraction include shale, limestone, calci-mudstone, serpentinite and igneous rocks.	Raw materials from sedimentary environment with incipient metamorphism and detritic minerals. Tempering is very likely, clay mixing and levigation are possible. High firing temperature, oxidizing atmosphere in kiln. Similar technology to Fabrics 1, 3 and 4
Fabric 3: Calcareous fabric with serpentinite	Few pores (1–15%), moderate inclusions (5–20%) with weak to strong alignment, bimodal grain-size distribution. Calcareous matrix, no optical activity	Serpentinite (Dominant to Few, largest of 4 mm, mode = 1 mm); Limestone and fossiliferous limestone (Dominant to Few, largest of 3.25 mm, mode = 0.25 mm). Others in coarse fraction include mudstone, amorphous concentration features and igneous rocks.	Raw materials from sedimentary environment with notable presence of serpentinites. Tempering is very likely, clay mixing and levigation are possible. High firing temperature, oxidizing atmosphere in kiln. Similar technology to Fabrics 1, 2 and 4.
Fabric 4: Argillaceous mudstone fabric	Moderate pores (3–20%) and abundant inclusions (3–40%) with weak alignment, bimodal grain-size distribution. No optical activity	Amorphous concentration features (Predominant-Dominant; largest of 4.4 mm, mode = 1.5 mm). Others in coarse fraction include limestone, shale, serpentinite and igneous rocks.	Raw materials from sedimentary environment. Tempering and levigation are very likely, clay mixing is possible. High firing temperature, oxidizing atmosphere in kiln. Similar technology to Fabrics 1, 2 and 3.

Fabric number and name	Textural characteristics	Main inclusions	Technological implications
Fabric 5: Fabric with coarse rounded monocrystalline quartz	Few pores (3–10%), abundant inclusions (15–40%) without alignment and with unimodal grain-size distribution. Some optical activity.	Monocrystalline quartz (Predominant, largest of 1 mm, mode = 0.75 mm). Others in coarse fraction include crystalline and aplastic concentration features, micritic limestone, feldspar, polycrystalline quartz, serpentinite.	Sand tempering. Otherwise, the characteristics are very varied and could be a fabric composed of the output of different workshops.
Fabric 6: Fine ophiolitic fabric	Few pores (0–7%) and moderate inclusions (5–17%), aligned and unimodal grain-size distribution. Some optical activity.	Igneous rock (Dominant; largest of 1.1 mm, mode = 0.2 mm); Monocrystalline quartz (Dominant; largest of 0.3 mm, mode = 0.2 mm). Others in coarse fraction include polycrystalline quartz, feldspar, serpentinite, micritic limestone, crystalline and amorphous concentration features and detritic minerals	Raw materials from ophiolitic environment. Levigation is very likely. Moderate firing temperature in oxidizing atmosphere. Very similar to Fabric 7.
Fabric 7: Fine calcareous ophiolitic glazed fabric	Few pores (0–5%) and moderate inclusions (5–18%) with weak alignment and unimodal grain-size distribution. Calcareous matrix, no optical activity.	Crystalline concentration features (Dominant; largest of 1.1 mm, mode = 0.2 mm). Others in coarse fraction include detritic minerals, feldspar, micritic limestone, serpentinite and igneous rocks.	Raw materials from ophiolitic environment. Levigation and clay mixing are very likely. Moderate firing temperature in oxidizing atmosphere. Very similar to Fabric 6
Fabric 8: Fine fabric with rounded crystalline quartz	Moderate pores (1–20%) and inclusions (7–20%), aligned and with bimodal grain-size distribution. No optical activity.	Monocrystalline quartz (Predominant; largest of 1.5 mm, mode = 0.25 mm). Others in coarse fraction include crystalline concentration features, igneous rocks, feldspar, micritic limestone and serpentinite.	Raw materials from a sedimentary environment with presence of limestones and igneous rocks. Tempering is possible. High firing temperature and oxidizing atmosphere.
Fabric 9: Fine glazed fabric with rounded crystalline quartz	Few pores (1–5%) and moderate inclusions (7–20%), aligned and with unimodal grain-size distribution. No optical activity.	Monocrystalline quartz (Predominant; largest of 0.85 mm, mode = 0.25 mm). Others in coarse fraction include crystalline concentration features, igneous rocks (rhyolitic and basaltic), feldspar, micritic limestone, serpentinite and detritic minerals.	Raw materials from a sedimentary environment where ophiolites are present. High firing temperature and oxidizing atmosphere.

Figure 6. *Names and descriptions of the fabrics considered in this paper (see Whitbread 1995: 365–396 for a full description of the system used).*

petrography it is possible to assess the procedures and circumstances surrounding the preparation of clay recipes of each fabric, including the characterization of raw materials, the combinations of different clays (levigated or with their natural inclusions), and potential tempers used by the potters;[5] and the process

[5] In petrographic and chemical ceramic analysis, the term 'temper' is reserved for those inclusions that have been added deliberately by the potter, and it is therefore distinct from the inclusions that are found as natural components of the clays used.

of firing, including insights on the temperature and atmosphere of the kiln (Whitbread 2001). The study of glazes with optical microscopy and SEM-EDS techniques illuminates their composition, which can in turn be used to understand their recipes and application procedures (Molera et al. 2001).

The fabrics of the Gritty Group are characterized by the frequent appearance of shales and mudstones that could be the result of either clay mixing, with the shales and mudstones being a natural part of a primary clay containing those elements, or deliberate tempering, with the aim of controlling the plasticity of the recipe. The heterogeneous textures of the fabrics of this group, and particularly those of Fabric 2 (Red/Grey Gritty Ware) and Fabric 4 (Purplish Grey Gritty Ware), suggest that their recipes contained different amounts of distinct clays. Heterogeneous distributions of micrite (microcrystalline calcite) also suggest recipes that were obtained through the mixture of different clays (which can also be naturally heterogeneous). In the cases of Fabric 2 (Red/Grey Gritty Ware) and Fabric 3 (Pale Gritty Ware) at least one of these clays is calcareous, although these concentrations of calcite can be the result of secondary calcite in some cases (Cau Ontiveros, Day & Montana 2002). If clay mixing and tempering are considered, then some of the basic clays may have been levigated to form the base of the recipes. Once the clay recipe was completed, the vessels were modelled by hand or on a wheel, though not a very fast one, as the alignment of inclusions and voids to the margins is only rough. They would be fired at generally high temperatures (900–1000°C), enough to eliminate most of the optical activity of the matrix, but within variable ranges of specific temperatures and atmospheres.

Generalizations are a bit more difficult in the case of the Quartzitic Group. Fabric 5 (corresponding to Sandy Ware) is a possible case of tempering with sand and a modelling process on a slow-rotating wheel. Apart from those two characteristics, the clay matrix where the quartz is incrusted varies widely in the different samples of the fabric. One can suggest that rather than being the output of a single workshop, this fabric is composed of samples from different workshops. Fabric 8 (ʿĀlī Ware) is more homogeneous and characterized by the presence of quartzitic aeolian sand and calcareous mudstones which may be there as temper. The existing workshops in the village of ʿĀlī make use of levigation,[6] and it is certainly a possibility in the case of the archaeological samples of Doha, which have a fine texture if we leave aside the inclusions (although the samples taken from wasters of the present production are even finer; see Fig. 10). Fabric 8 was modelled on a wheel and fired to a high temperature with a relatively homogeneous oxidizing atmosphere. The three remaining wares of the Quartzitic Group — Fabric 6 (Fine Brown Ware), Fabric 7 (Bahla Ware), and Fabric 9 (MUPW) — share many characteristics: fine fabrics, probably the result of levigation; recipes obtained possibly by mixing of clays, in particular in Fabric 7; modelling on the wheel, with relatively high speed of rotation; and firing to high temperatures with diverse atmosphere ranges.

The glaze analysis performed by Elizabeth Adeyemo on Bahla Wares (Adeyemo 2017) showed that, in spite of their macroscopic homogeneity, there is a wide variability in their composition, although in general they can be identified as lead-barium silica types, to which iron oxide (FeO) could have been added as a colourant. This type of glaze is quite exceptional as it has only been documented before in China under the Eastern Han Dynasty, and yet the glazing technique used seems to be different as well. The Chinese wares were made by the application of a frit containing lead and barium. In the Bahla glazes, however, the wide variation in the correlation between barium and lead in the glaze composition of each sample suggests that the combination of the two elements was naturally found in the minerals used to add lead, rather than being the result of a deliberate recipe (in which the proportions of lead and barium in the glaze would probably have been stable) (see Fig. 7/A). The analysis therefore suggests that the glazing technique used with the Bahla glazes consisted of the application of a solution with lead-/barium-containing minerals and silica grains in suspension over the leather-hard vessels (see Fig. 7/B–D), rather than the use of a frit, as was the case with the Chinese glazes (cf. Živković et al. 2019).

The analysis of the glazes of the MUPW show different compositions and a different application technique. The turquoise glazes contain no lead and relatively high concentrations of potassium and sodium oxides (K_2O

[6] JCL and RC were able to see several levigation pools in action during a visit to ʿĀlī in 2016.

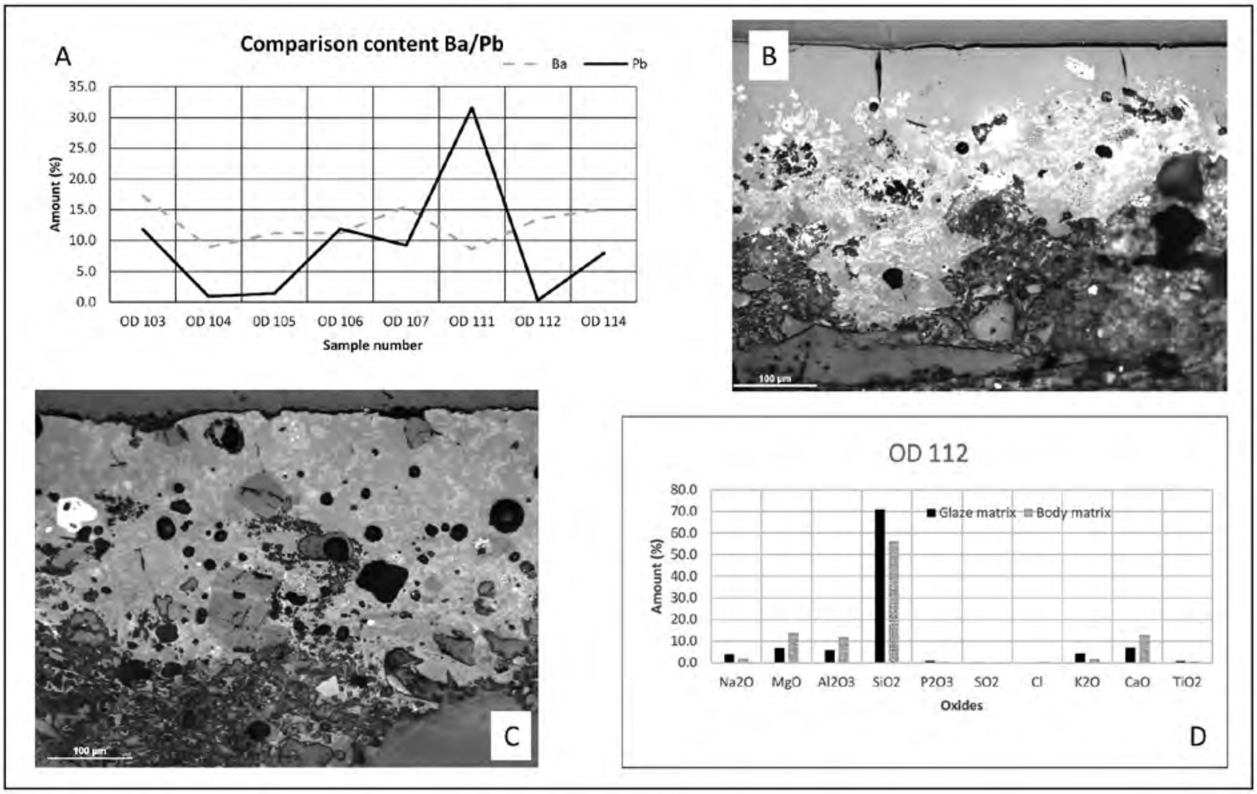

Figure 7. *Images produced during the analysis of Bahla glazes (see Adeyemo 2017):* **A.** *a comparison of the amounts of lead (Pb) and barium (Ba) in different samples;* **B.** *an image of sample 105; and* **C.** *an image of sample 106 showing high interface interaction (suggesting that the vessel was not fired before the application of the glaze) and high content in sand, bubbles, and other materials. The images were taken by reflected light optical microscopy (OM) in XPL, and their scales indicate 100 µm;* **D.** *a comparison of the normalized compositions (after removing iron, lead, and barium) of glaze and ceramic paste in sample 112, showing higher contents in silica (SiO2) in the glaze than in the matrix, suggesting that silica (sand) was added to the solution of lead/barium minerals applied for the glaze.*

and Na_2O respectively in Fig. 8/A), which means that they are alkali-based, made with plant ash, and applied as frits mixed in a suspension with silica grains over the leather-hard ceramics (Fig. 8/B). Their turquoise colour was most likely due to diffusion of iron in the glaze from the ceramic matrix and the manipulation of copper in the glaze recipe through the addition of either copper oxide or molten fragments of metal alloys (as the presence of tin oxides in some samples suggests). The decoration technique of this ware consists of the application of manganese oxide (Fig. 8/C) under the glaze, as correctly described in the name of the ware (Adeyemo 2017).

Provenance

A study of the provenance of the fabrics considered in this paper can be approached with a combination of the data obtained in this study along with available geological, archaeological, and ethnographic evidence. It must be remembered, however, that at present this approach can only be considered limited and very constrained: only one assemblage in a particular period of time is being considered and there are no parallel studies on petrography that can offer terms of comparison for Gulf ceramics in this period, with the exception of the study by Živković et al. (2019).[7] For this reason, this paper will

[7] The main petrographic work done in the Gulf by Blackman, Méry and

A **GLAZE CONTENT**

Sample	Na_2O	MgO	Al_2O_3	SiO_2	P_2O_3	SO_2	Cl	K_2O	CaO	TiO_2	MnO	FeO	CuO	BaO
115	8.2	2.1	3.2	70.0	0.1	0.1	0.5	6.7	5.3	0.2	0.3	1.1	0.6	
119	6.9	2.6	3.7	68.5	0.2	0.1	0.6	8.2	5.8	0.2	0.5	1.1	0.7	0.1
122	7.0	2.9	3.6	71.1	0.2	0.0	0.6	8.6	6.3	0.2		1.2		
125	5.7	1.8	3.3	68.5	0.2	0.1	0.6	9.2	5.8	0.2		0.9	0.4	
149	6.2	3.0	4.2	68.5	0.0	0.1	0.3	8.9	5.9	0.2	0.8	0.9	0.5	0.2
150	6.4	2.0	4.5	67.7	0.2	0.1	0.7	9.3	5.4	0.3	0.1	1.0	1.4	
151	7.4	2.3	3.9	67.5	0.3	0.1	0.3	5.6	5.9	0.3	0.8	1.4	0.2	
152	7.9	3.3	2.7	68.7	0.1	0.0	0.6	7.1	6.3	0.1	1.2	0.8	0.2	0.2
Total	7.0	2.5	3.6	68.8	0.2	0.1	0.5	8.0	5.8	0.2	0.6	1.1	0.6	0.2

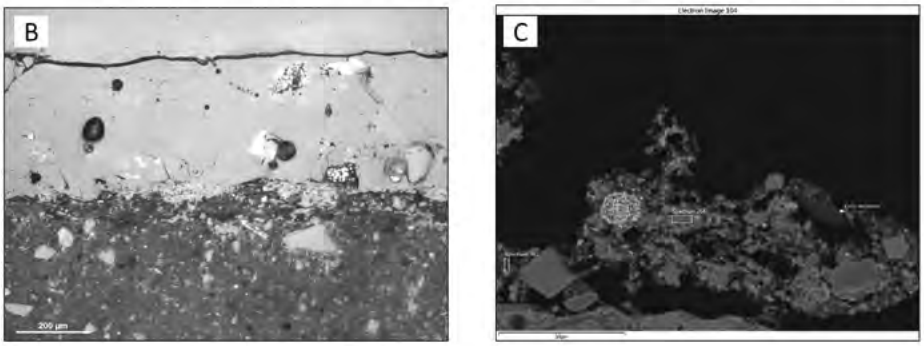

Figure 8. *Images produced during the analysis of MUPW glazes (see Adeyemo 2017):* **A.** *composition (wt%) of glazes of all samples analysed, showing a high content in sodium (Na_2O) and potassium oxide (K2O);* **B.** *OM (XPL) image of glaze in sample 119, showing sand inclusions and bubbles (scale = 200 µm);* **C.** *back-scattered electron (BSE) image of underglaze paint in sample 125, composed mainly of manganese oxide (scale = 50 µm).*

be limited to some views on the regional provenance of the wares discussed. A more extensive and nuanced knowledge of wares in the future will allow us to pinpoint more specific places of production.

Julfar ware (Fabric 1) is possibly the best studied ware of this assemblage in Gulf archaeology. Mitsuishi et al. (2013) established the precise location of the kilns where this ware was being produced in the period of Doha's expansion (nineteenth and twentieth centuries). William and Fidelity Lancaster (2010) described the process of manufacture of the pottery as explained by the Banū Shamāylī of Wādī Ḥaqīl, which is consistent, in principle, with observations about the technology based on petrography:

> 'Potters used *three or four different sorts of clay from different places*, mixed in varying proportions depending on what items they intended to make, with a major division between pots as containers and cooking pots. Muhammad bin Qaysi said that as a very rough division, hard clays were used for containers but not for cooking pots as they cracked when they came into contact with the heat of the fire. Soft clays were used for cooking pots. Rashid bin Haimur described *three clays, red, green and yellow*. Red clays were abundant, found on the surface or between rocks and sand and

Wright (1989) and S. Méry on Omani ceramics (1991; 1995; 2000), is focused on prehistoric material and on regions of the Oman peninsula dominated by a geology different than the one we need to consider here, but it offers interesting parallels for this research which have not been considered in this work due to time constraints. The authors were excited to hear Méry's presentation on the ceramics of Umm al-Quwain, presented at the Seminar for Arabian Studies in 2018, which introduced materials made in regions much closer to those of our interest, and are looking forward to that publication. Petrography was also one of the methods considered by Mynors (1983) and Stremtan et al. (2012), all focused on prehistoric material.

the most used. Green clay was scarce and mingled with earth and mountain rocks, and could be difficult to dig out. It was mixed, at the workplace, with red clays and a little yellow. The yellow clays tended to be very pale to almost white, and were found among rocks in the mountains. This clay was mixed with other clays to make it stronger and to harden and improve it, so it did not break so easily in the heat of the kiln. White clays from Iran were sometimes brought in, but these did not stand up to firing properly' (Lancaster & Lancaster 2010: 230; present authors' emphasis).

The main petrological types of inclusions observed in Fabric 1 are shales and mudstones, precisely the characteristic geological components of the Shargi (Sharqī) Member (easternmost) of the Fiqa Formation that can be found in the limit with the Hajar mountains of Oman (Alsharhan 1995) (see Fig. 9). Given that all the fabrics of the Gritty Group are similar in terms of technology and components, we can use the precise location of the kilns of Julfār, the technological knowledge documented by the Lancasters in different places of the Musandam peninsula, and the particular geology of this area to propose possible locations for the rest of the fabrics. The processes of pottery production described by the Lancasters are generic enough to correspond to any of the fabrics under discussion (2010: 208–255). However, the geological background of the regions where the pottery production areas as identified by the Lancasters are located is very different to that of Julfār, because the production areas are located not in the Fiqa Formation, but in the Ḥajar Group — richer in carbonate rocks — and in other formations (the Hawasim [Ḥawāsim] and Haybi [Ḥaybī] Units and the Semail [Samāʾil] Ophiolite), where a larger content of ophiolitic rocks would be expected. The particular mixture of

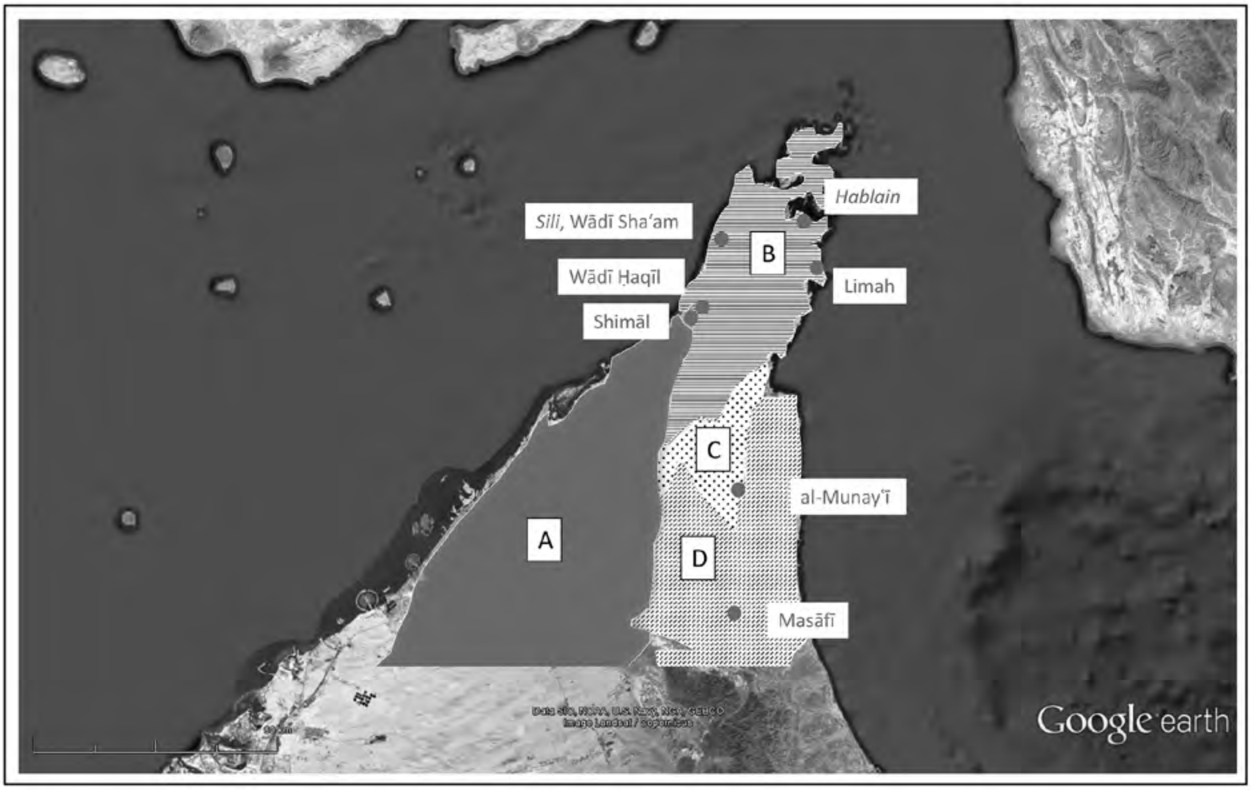

Figure 9. *A map of Musandam showing the pottery production sites (as indicated in Lancaster & Lancaster 2010: 208–255; base map from Google Earth, scale = 80 km; the geological areas are crudely marked following maps in Alsharhan 1995: 49; Alsharhan & Nairn 2003: 60):* **A.** *Fiqa Formation;* **B.** *Ḥajar Group;* **C.** *Hawasin (Ḥawāsin) and Haybi (Ḥaybī) Units;* **D.** *Semail (Samāʾil) Ophiolite.*

possible ophiolites with the shales and mudstones of Fabric 3 (consistent with Pale Gritty Ware) could, in principle, be compatible with the geological locations in the south and interior of the Musandam peninsula — for example Masāfī and al-Munayʿī — but the other two Gritty Wares are more compatible with environments related to the Fiqa Formation and to the Ḥajar Group, in other words, locations in the northern coastal areas of Musandam (Arsharhan & Nairn 2003: 59–62) (see Fig. 9).

The provenance of the fabrics of the Quartzitic Group is less straightforward. The most widespread and well-known of the fabrics of this group is Fabric 7 (Bahla Ware), for which there have been discussions to determine its provenance. The two hypotheses that have been considered most likely are the towns of Khunj in Iran and the town of Bahlāʾ in Oman (Kennet 2004: 54). Fabric 7, found in Doha, seems to be quite homogeneous in petrographic terms. The composition of the clay and the sands observed in the glaze shows abundant serpentine and mafic and ultramafic igneous rocks, all of it compatible with the geology of the area of Bahlāʾ in the Semail Ophiolite of Oman (Hunting Survey Ltd 1986a; 1986b), but not with that of Khunj in Iran (Spaargaren 1991; cf. Živković et al., in press); thus the location of Bahlāʾ is favoured as the provenance of the wares in this study. It is interesting to note that Fabric 6 (Fine Brown Ware) is so similar to Fabric 7 that in terms of petrography it could be considered an unglazed version of it. It is therefore reasonable to look for the provenance of this fabric in Bahlāʾ itself, or at least in any workshops in a similar geological area and with a similar technological manufacturing process. It has been shown above that the glaze composition and application of Fabric 9 (MUPW) is very different from that of Fabric 7 (Bahla Ware), but it should be noted that Fabric 9 shows a very similar process of production to that observed in Fabrics 6 and 7. The geological background of the raw materials observed in Fabric 9 is also similar to those of Fabrics 6 and 7, but a slightly higher presence of felsic (rhyolitic) rocks than of mafic (basaltic) in its fabric is documented. This is still compatible with the upper layers of the Semail Ophiolitic complex (Arsharhan & Nairn 2003: 59–62), but there are no outcrops of these layers in Bahlāʾ (Hunting Survey Ltd 1986a; 1986b). Instead, the origin of this ware should be looked for in areas near outcrops of the upper layers of the Semail formation in the Oman peninsula or in the outcrops of the Zagros Thrust or the volcanic deposits of Iran (Spaargaren 1991).

Fabric 8 (ʿĀlī Ware) can be linked to Bahrain by the active kilns and numerous deposits of wasters which can still be viewed at ʿĀlī, Bahrain. The petrographic analysis of the fabric has been compared to petrographic samples of ten wasters and three clay samples taken from the workshops in the locality of ʿĀlī recently.[8] The petrological composition of Fabric 8 and of the wasters and clay samples is very similar, and this supports the idea that Fabric 8 was indeed made there. It is notable that the texture of the wasters is finer than that of Fabric 8 samples; this could be the result of the introduction of a more refined levigation process or it could just be that potters today are using clays from a different quarry. In fact, potters nowadays claim to have their clay brought to them from another village in the centre of the island, al-Rifāʿ, which was not the case with the oldest potteries (Steffen Terp Laursen, personal communication) (see Fig. 10).

The most difficult fabric to provenance is Fabric 5 (Sandy Ware). Its most visible component is rounded sand, which is obviously very widely spread over the Gulf region. An interesting clue is that the characteristics of the sand inclusions are a high maturity (grains are rounded and well sorted), a relatively large size (some of them almost on the scale of gravel), and a plutonic or metamorphic origin, which are all characteristics easily found in lower Iraq (but not necessarily absent from south Iran or the eastern Arabian plate).

Comparison perceptions of wares and fabrics

It is important to discuss the combination of the macroscopic and microscopic (petrographic) points of view put forward in this paper. Discussion of the combination of scientific analyses with archaeology has been lengthy and is still going on. Many archaeologists tend to see in some scientific analyses a very expensive methodology that can be used to test certain

[8] These samples were taken during a trip to ʿĀlī by RC and JCL in 2016. Our thanks are due to Steffen Terp Laursen, director of the Moesgaard Museum expedition in Bahrain, for his support in guiding and helping us to contact potters. The wasters were thin-sectioned by MaG at UCL Qatar laboratories. The clay samples were used to make briquettes that were fired at 600°C, 900°C, and 1050°C and then thin-sectioned by MaG in the same facilities.

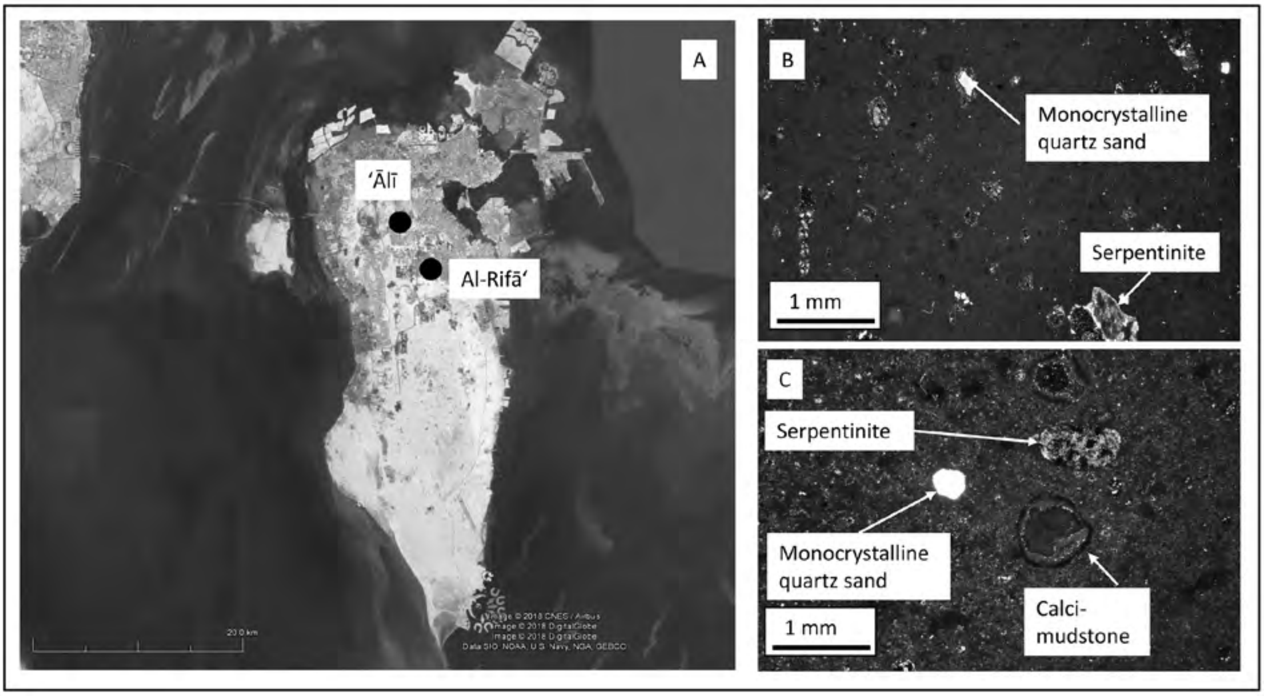

Figure 10. A. *A map of Bahrain showing the location of A'ali (ʿĀlī) and al-Rifāʿ (map from Google Earth, scale = 20 km);* **B.** *a petrographic microphotograph from a clay sample taken from a pottery workshop in A'ali, fired at 1050°C;* **C.** *a petrographic microphotograph of a sample taken from a waster from a workshop in A'ali.*

interpretations without regard to the many necessary caveats; and many non-archaeologist scientists fail to find ways in which their contribution to archaeological interpretation can be made relevant and adjusted to questions from the archaeologists themselves. This small project can contribute to the debate by providing a small discussion on how petrography and macroscopic ceramic analysis can work together in a way that is constructive from both points of view. Figure 3 offers a comparison of different perceptions of the ceramics under study from the points of view of macroscopic and microscopic analysis, considering the matches (when the macroscopic and the microscopic analysis coincide in their identification), misses (when the macroscopic analysis fails to identify wares with their correspondent fabric), and errors (when the macroscopic analysis identifies wares with a fabric that is not the correspondent one). The divergences are not very notable and can be explained relatively easily, showing that the two interpretations are consistent with the ideas developed in this paper.

The comparison numbers between macroscopic and petrographic interpretations are particularly good (high in matches, low in misses and errors) in the glazed groups and in the Quartzitic Group in general. In this group there are always fewer than three misses and fewer than two errors (except in the case of Fabric 8, ʿĀlī Ware, in which there are seven errors). The most problematic numbers (low on matches, high in misses and errors) are related to the Gritty Group, which has numbers as high as seven misses and eight errors, although overall the figures are better than that. This is caused by the similarity between the wares, which is particularly problematic at the macroscopic level, where core and surface colours, texture, and the appearance of inclusions are the key elements to establish differences between wares. As the wares of the Gritty Group have so closely similar compositional and technological techniques, the inherent variability between colour, texture, and the appearance of inclusions tends to overlap, making it very difficult to distinguish them. The same problems are also apparent in petrography, but the larger range of parameters available to make distinctions makes it easier to establish significant differences between fabrics.

Conclusions

Between its foundation at the beginning of the nineteenth century and the beginnings of the oil economy in the mid-twentieth century, Doha was one of the best-connected cities of the Gulf, as the excavations and macroscopic studies on ceramics undertaken under the ODRE project are showing. In this paper a programme to develop a science-based analysis of different wares identified in the assemblage of Doha has been initiated. The petrographic study of 148 samples has allowed the definition of nine fabric groups that can be correlated to nine wares identified in the macroscopic analysis. With the study of these fabrics it is possible to highlight some of the stages of the production processes used to make these fabrics. Besides this, an identification of the main petrological and mineralogical components of the vessels has been produced, which has led to some useful observations to establish the sources of the raw materials used in the vessels. The analysis of glazes with hhXRF, SEM-EDS, and optical microscopy has offered another set of results which can be used to identify segments of the *chaîne opératoire* of the application of glazes to the vessels, as well as complementary information on the identification and provenance of the raw materials used. This information will be expanded in the future with a more complete analysis of the petrographic fabrics and the inclusion of elemental chemical analyses with WDXRF.

In the last section of the paper, the relationship between the processes of identification of wares and fabrics by macroscopic and microscopic (petrographic) studies respectively has been addressed. This gives a useful perspective on the variable difficulty that there is in identifying any ware correctly by macroscopic means alone. In general, wares of the Quartzitic Group are quite easy to identify, while those of the Gritty Group are a bit more complicated, with the exception of Julfar Ware.

Acknowledgements

The analyses that made this paper possible were funded by UCL Qatar, by kind permission of Qatar Museums. The authors wish to thank Francesca Pisano for her efforts in the development of the ODRE classification, and Tracey Cian and Huda Abu Amer for their collaboration in sorting out many of the ceramics of the ODRE project. Additionally, thanks are due to Steffen Terp Laursen for his guidance and help in collecting samples from Bahrain.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 69–84

New excavations at the Umm an-Nar site Ras al-Hadd HD-1, Sultanate of Oman (seasons 2016–2018): insights on cultural interaction and long-distance trade

Maurizio Cattani, Jonathan Mark Kenoyer, Dennys Frenez, Randall W. Law & Sophie Méry

Summary

Renewed excavations in 2016–17 and 2017–18 at the Umm an-Nar coastal site HD-1 at Ras al-Hadd, in the Sultanate of Oman, provide new insights on regional and long-distance interactions during the Early Bronze Age. The Italian-American 'Joint Hadd project' is led by Maurizio Cattani from the University of Bologna, and Jonathan Mark Kenoyer from the University of Wisconsin–Madison, under the auspices of the Ministry of Heritage and Culture of Oman. New radiocarbon dates place the site firmly in the mid-third millennium BC. Plant and faunal remains are being examined to determine seasonal subsistence patterns and fishing strategies. The discovery of lithic, copper, and shell manufacturing debris provides new information on local technologies. Fibres and textiles preserved on copper tools and other artefacts reveal the nature of local fibre production and possible long-distance trade of other fibres. Finished stone beads of local as well as non-local materials indicate the importance of both regional and external trade. A wide variety of local as well as Indus-related ceramics reveal connections to regional Umm an-Nar communities and the more distant Indus source areas. Preliminary results of selected artefact analyses are presented here to highlight new directions for research.

Keywords: Oman peninsula, Umm an-Nar, Indus Civilization, trade, craft

The Umm an-Nar site HD-1 at Ras al-Hadd (22°31'51.93"N, 59°46'42.10"E), in Ash-Sharqiyah South Governorate of the Sultanate of Oman, is a relatively small and irregular-shaped mound located on the massive east–west sand bar between the al-Hajar lagoon and the open waters of the Sea of Oman. In the 1980s, a team from the British Museum excavated the site as part of the 'Joint Hadd Project' led by the late Serge Cleuziou and the late Maurizio Tosi. In addition to the discovery of Umm an-Nar pottery and evidence of local fishing activities as well as regional trade, the site provided some of the first evidence of Indus black slipped jars and other pottery in Oman (Méry 2000; 2007; Reade 1990; Reade & Méry 1988).

Prolonged excavations at RJ-2 in Ras al-Jinz (Cleuziou & Tosi 2000) eventually eclipsed the importance of HD-1, while further research in Oman and adjacent regions refocused the attention on larger coastal or inland communities (Cleuziou & Tosi 2007: 184–185, 235). In the Ras al-Hadd area, this trend led to the exploration of the late fourth-/early third-millennium BC settlement of HD-6 (Azzarà & Cattani 2018), where high levels of complexity do not show evidence of long-distance trade.

Nevertheless, smaller coastal sites like HD-1 still need to be fully investigated to address questions about coastal and inland interactions as well as external trade with the Indus Valley and other regions. Another urgent reason for comprehensive investigation and documentation is the increased pressures from tourism and the encroachment of the site by modern construction. This article will present an overview of the major discoveries from the first two seasons and preliminary results from specific artefact studies.

Indus trading in the Oman peninsula: a reassessment

The significance of exchange and interaction between the Indus Civilization and Umm an-Nar communities has often been discussed in the general context of local economic and sociotechnical developments in the Oman peninsula (Cleuziou & Méry 2002; Cleuziou & Tosi 2000;

2007; Possehl 1996; Thornton 2013; Vogt 1996). Most data documenting these reciprocal interactions comes from coastal sites (Cleuziou & Tosi 2000; Potts 1990; 2000), while the presence of Indus items at inland sites was mainly interpreted as the result of intertribal connections between the local communities (Cleuziou & Tosi 2007: 172–173). Interactions with Indus seafaring merchants were explained as being limited to a restricted number of coastal sites and these foreign traders did not venture into the interior regions (Cleuziou & Tosi 2007: 184–185, 235). The numerous fragments of Indus black slipped jars at interior sites were interpreted as local reuse, while the local production of Indus style pedestalled dishes was thought to have been stimulated by contact with Indus merchants along the coast (Méry 2000: 236–237).

However, recent discoveries of Indus and Indus-related materials at sites in the interior (Frenez et al. 2016; Méry et al. 2017; Thornton 2013; Thornton & Ghazal 2016), and a general reassessment of comparable materials throughout Oman (Frenez 2018; Kenoyer & Frenez 2018a; 2018b), suggest a more complex model of interaction. Instead of being simply the result of down-the-line trade managed by local communities, these artefacts probably reflect the presence of small groups of Indus merchants and craftspeople integrated into local communities and directly involved with important socioeconomic activities.

Ras al-Hadd site HD-1: trade and cultural interaction

In the context of long-distance trade, it is likely that Indus traders needed safe locations on the coast to offload goods and provide hubs to link with other trade networks. This would have been essential if they were involved in the extraction and primary processing of copper ore and other prized minerals in the interior. The nearest Umm an-Nar site to HD-1 is the small camp of HD-5, which is located some 3.5 km to the south along the beach facing the ocean (Borgi et al. 2012). A larger site with a variety of Indus-related goods is RJ-2 at Ras al-Jinz, some 15 km to the south along the Ja'alan coast. Although this site has evidence of long-term residence in mud-brick house structures, with a wide range of artefacts that reveal exchange with the Indus Valley as well as Mesopotamia, the beaches near the site are not favourable for anchoring large boats (Cleuziou & Tosi 2000; Reade & Méry 1988: 75). Safe anchorage for large boats is found only in the al-Hajar lagoon at Ras al-Hadd, which has a wide, open entrance, and in the larger al-Grama lagoon that has a longer, more restricted access (Massoubre 1988; Reade & Méry 1988: 75).

The Al-Hajar lagoon near HD-1 still serves as anchorage for medium-sized dhows of the *shu'i* type, which range from about 10 to 15 m in length, a size comparable to that proposed for the local Bronze Age seagoing vessels (Vosmer 2001; 2007). However, in case of emergency, even larger deep-sea vessels of the *baghlah* and *ghanjah* types can find shelter in the lagoon. In contrast, the sandy shores along the ocean side at both Ras al-Hadd and Ras al-Jinz can be used only to beach smaller fishing boats with much less draft.

Although there are numerous prehistoric sites around both lagoons, the only site discovered so far that has evidence of Umm an-Nar occupation and Indus pottery is HD-1, located along the northern edge of al-Hajar lagoon (Fig. 1). The current extent of the mounded area of HD-1 is approximately 160 m east–west and 190 m north–south. A separate small lower mound (HD-1 East) is located approximately 300 m to the east. The current shore of the lagoon at high tide is *c.*200 m south of the site and the beach that has access to the open ocean is *c.*500 m to the north. HD-1 is therefore strategically located for the offloading of fish and other commodities from large seagoing vessels that sail into the lagoon during high tide and dock safely on the beach just south of the site during low tide.

Excavations in the 1980s revealed that the ancient occupants of HD-1 were involved in fishing as well as other local terrestrial subsistence activities (Reade 1990; Reade & Méry 1988). They may also have been engaged in the trade of copper due to the discovery of a large ingot made from copper, probably derived from further inland (Giardino 2017: 101–103). The limited excavations also provided a large and diversified amount of Umm an-Nar as well as diagnostic Indus ceramic types, including the characteristic black slipped jars, pedestalled dishes, perforated jars, and ledged cooking pots (Méry 2000: 237, fig. 144). After her initial analyses, Méry stated that, 'the proportion of such (black slipped) jars in the pottery assemblage is actually much higher at Ras al-Hadd HD-1 than at Ras al-Jinz RJ-2 [...]. This is probably due to the fact that Ras al-Hadd was a natural harbour and favourable anchorage' (2007: 199).

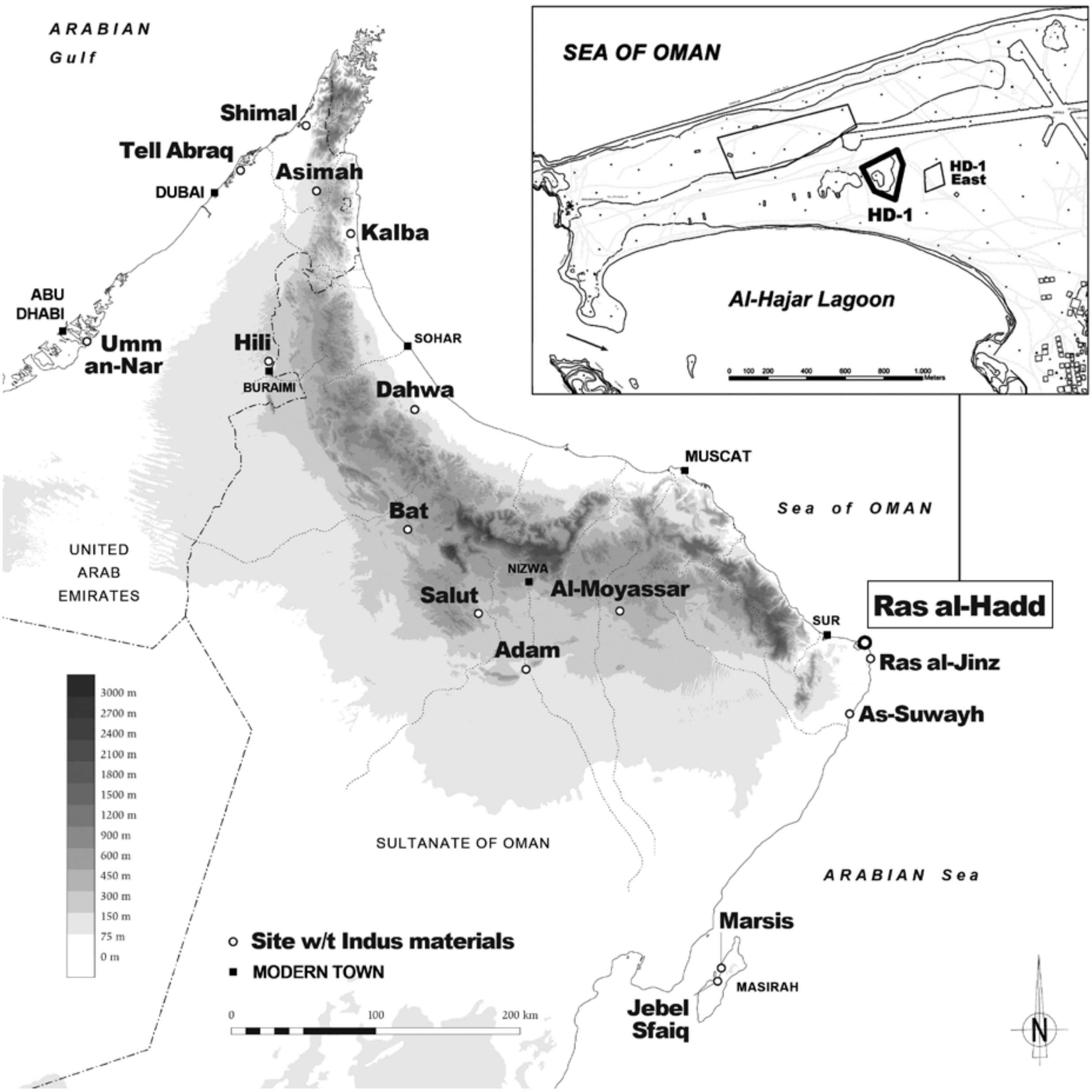

FIGURE 1. *Map of the main sites with Indus and Indus-related materials in the Oman peninsula and detail of the north-western area of Ras al-Hadd (base map by H. David-Cuny modified after various sources; map of Ras al-Hadd by M. Cattani ©Italian-American Joint Hadd Project).*

The presence of the diagnostic Indus cooking pots was not emphasized in earlier studies (with the exception of Méry 2000: 236). However, based on their importance in defining Indus cuisine and cultural styles (Dales & Kenoyer 1986: 132–144), the presence of these vessels suggests that people from the Indus Valley were present at the site. This pattern is also seen at some sites in the interior of Oman where it is suggested that, 'The presence of characteristic Indus cooking pots most likely indicates that there were Indus individuals or communities who wanted to cook food in Indus-style vessels to follow their traditional culinary habits' (Frenez et al. 2016: 112). The current excavations have revealed many more examples of Indus style pottery and other artefacts that provide a new perspective on the possible cultural interaction between Indus and Umm an-Nar individuals and communities.

The Italian-American 'Joint Hadd Project' at Ras al-Hadd

A new Italian-American research collaboration was established within the so-called 'Joint Hadd Project' for an in-depth exploration of HD-1, under the co-directorship of Maurizio Cattani and Jonathan Mark Kenoyer and with the scientific coordination of Dennys Frenez. The research plan included the excavation of small trenches to determine the extent of the occupation, the extension and deepening of some of the old test trenches to correlate the stratigraphy with the new excavations, and the collection of samples for dating the occupation. Another aim was to locate possible architectural features, which had not been discovered in the previous explorations. In addition, the goal was to recover a wide range of artefacts that could be studied in greater detail to understand technological traditions and raw material sourcing.

During the course of the first two seasons, four different excavation areas were opened on the mound (Fig. 2). Two of the trenches were laid out along the western edge of the mound adjacent to or overlapping the trenches excavated by the British Museum team in order to correlate the stratigraphic features of the site and obtain charcoal for radiocarbon dating. In addition,

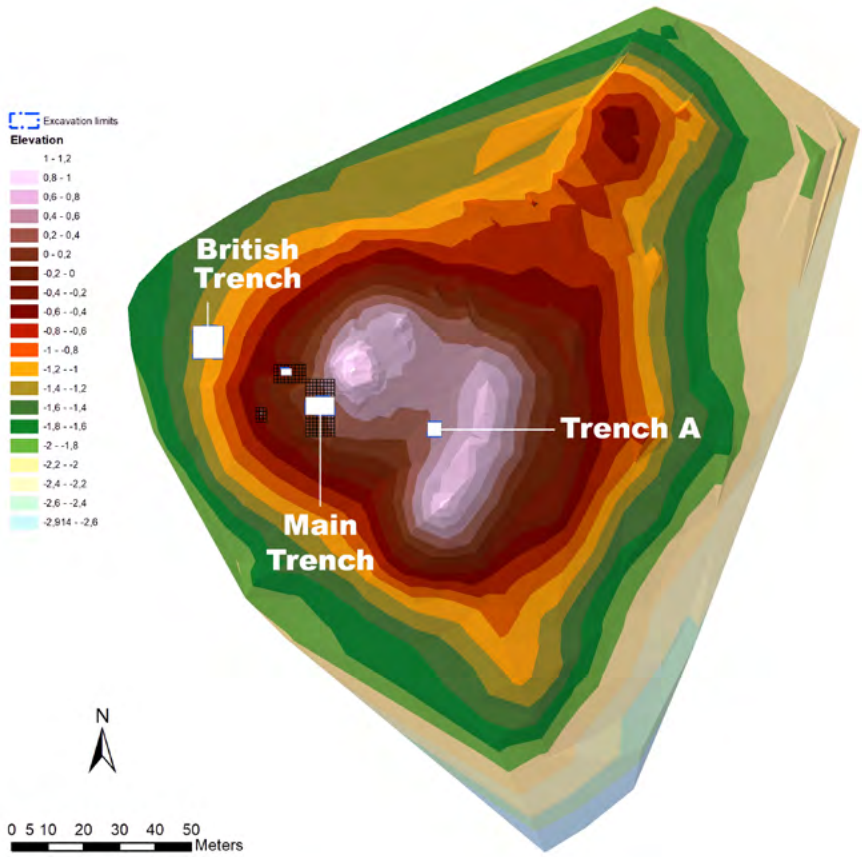

FIGURE 2. *Ras al-Hadd HD-1. Plan with contour lines of the surface and investigated areas (image by M. Cattani ©Italian-American Joint Hadd Project).*

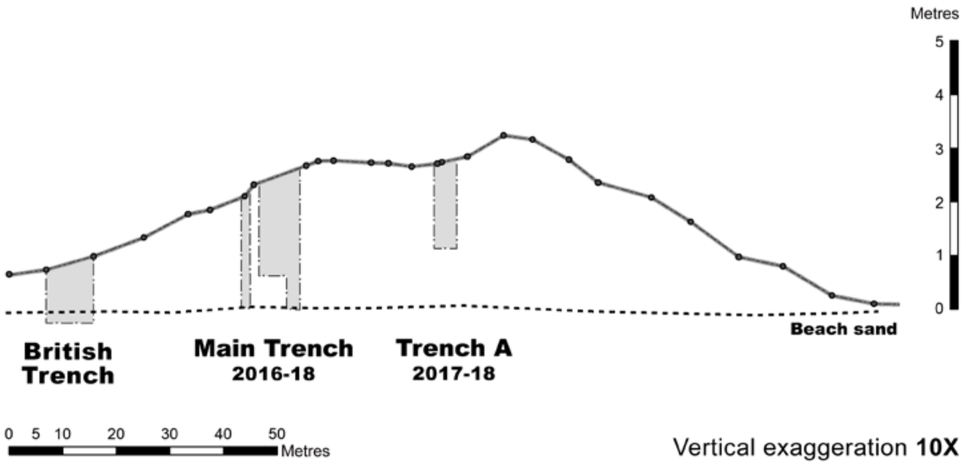

Figure 3. *Ras al-Hadd HD-1. West–east profile with the location and depth of the excavation trenches (images by M. Cattani ©Italian-American Joint Hadd Project).*

the so-called Main Trench was opened up in an area measuring 10 x 8 m near the top of the mound to expose a larger horizontal area of occupation activities and to reach the lowest levels at the centre of the mound in a smaller sounding. A fourth 4 x 4 m sounding labelled Trench A was laid out in a depression to the east of the Main Trench and at the top of the mound.

Combining observations made in all four trenches, it appears that the overall height of the mound is approximately 3 m above the natural soil (Fig. 3). The prehistoric occupation layers (*c.*2.4 m) are made up of alternating layers of dark ashy sand and discontinuous layers of light yellow-brown sand or fine gravelly limestone pebbles and shell. The excavations did not reveal any prehistoric architectural features and no distinct patterns of post-holes could be identified. It is possible to define at least three main levels with higher concentrations of hearths and occupation debris, which can be roughly correlated stratigraphically between the four trenches. Pottery, lithics, beads, and corroded copper/bronze objects were collected in all layers, although there appears to be more pottery in the lower levels of the Main Trench and a higher presence of copper in the upper layers.

A significant variety of botanical and faunal remains has been recovered, including a few charred date stones, some terrestrial fauna (mainly dogs and sheep/goats, but also gazelle), large quantities of marine fauna (mainly bony fish but also some requiem sharks and eagle rays), and a wide variety of marine shells. A comprehensive programme of bioarchaeological studies is ongoing in collaboration with William Belcher (archaeo-ichthyologist, University of Hawaii, West Oʻahu), Alfredo Carannante (archaeo-malacologist), and Elena Maini (archaeo-zoologist, University of Bologna), to define the subsistence strategies of the local community and to document specific aspects of food processing, specifically with regards to the fishing industry, as well as seasonality patterns.

One of the most important results of the first season was the recovery of charred wood and charred date stones, four samples of which have been radiocarbon dated in the framework of the 'NéoArabia' ANR Project directed by J.-F. Berger (Fig. 4). Apart from one possibly aberrant date (HD1_AB_1607), the origin of which needs to be investigated, the site is firmly dated to around the middle of the third millennium BC and was occupied over a period of at least 200 years. These preliminary dates need to be confirmed by additional samples, but they are consistent with the well-established chronology of the archaeological finds associated with the Indus Valley region.

By defining the cultural affiliation and actual provenance of different types of artefacts and raw materials, we hope to be able to differentiate between local production and imports, and determine whether the production was undertaken using local knowledge or was based on shared technological traditions from some other regions. While the Indus Valley is one of the major regions that had the potential for impacting this site, other areas include the Makran coast, Baluchistan, and Iran or regions further to the south along the coast of Oman and Yemen. In the following sections, a selection of artefact categories will be discussed to illustrate the research approaches and preliminary interpretations of the cultural interactions that occurred at HD-1.

Sample	SU	Square	Date	+/-	cal BC 2sigma
HD1_No_8, charred indet. [(a)]	100	-	3935	± 30	2493–2336
HD1_AB_1603, charcoal [(b)]	100	AE97	3995	+/-30	2576–2467
HD1_AB_1607, charcoal [(b)]	111	AG98	4240	+/-45	2924–2670
HD1_AB_1627, date stone [(b)]	115	AF97	4000	+/- 30	2577–2468

Figure 4. *Radiocarbon dates from the 2016–17 excavations calibrated by J.-F. Berger (CNRS, UMR 5600 EVS/IRG-University of Lyon) using Calib 7.1 without applying reservoir effect:* **a.** *dated by the 'Centre de datation par le Radiocarbone' of University Lyon 1 Artemis;* **b.** *dated by the Laboratory for Sciences of Climate and Environment (LSCE) in Gif-sur-Yvette (©Italian-American Joint Hadd Project & Project NéoArabia).*

Pottery analysis and sourcing

The pottery from the site has been recorded using a combination of approaches that will be presented in a future publication. All diagnostic Indus sherds and selected local pottery were sampled for instrumental neutron activation analysis (INAA) that is being undertaken at the University of Missouri Research Reactor (MURR), Columbia, USA. A large comparative sample from sites in the Indus Valley as well as sites in Oman has already been analysed at this lab, allowing detailed comparative studies of the specimens from HD-1. In addition, selected sherds have been sampled for petrographic analysis that is being carried out by Sophie Méry at the Archaeoscience Laboratory, University of Rennes 1, France. Méry (2000: 231) had already carried out petrographic study of nine samples from the 1990 excavation, the results of which all showed that they were produced in the southern Indus basin. Now, by combining both INAA and petrography, it will be possible to provide more reliable interpretations regarding the source areas for the pottery found at the site.

New types of Indus pottery that were not documented in earlier excavations at HD-1 include two perforated jar fragments (Fig. 5/a) that may have been used as a reverse strainer for preparing some form of distinctive Indus beverage (Kenoyer 1998: 155). The lack of cattle bones at the site would indicate that any dairy product like cheese or yoghurt must have derived from sheep or goat milk, while fermented beverages might have used grain

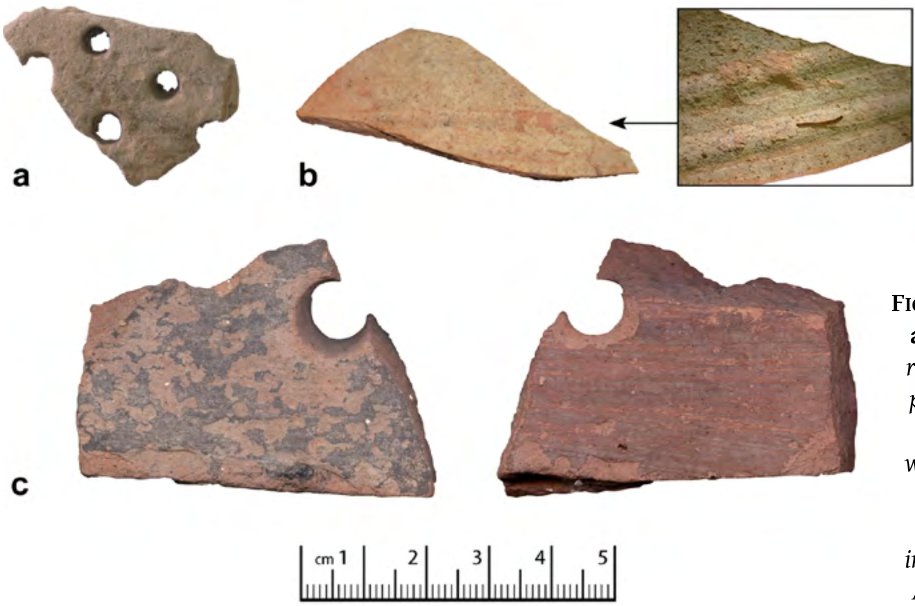

Figure 5. *Ras al-Hadd HD-1, pottery:* **a.** *perforated jar (HD1_16_001);* **b.** *ridged sherd from a possible Indus pointed base goblet (HD1_17_255);* **c.** *Indus black slipped jar sherd with drilling (HD1_17_177) (images of pottery from HD-1 ©Italian-American Joint Hadd Project; images of Indus pottery ©Harappa Archaeological Research Project).*

and/or dates. Another important discovery is a ridged sherd (HD1_17_255) from what may be an Indus pointed base goblet (Fig. 5/b). Such disposable drinking vessels are usually found only at large urban centres in the greater Indus Valley (Kenoyer 1998: 155) and if confirmed as being from the Indus, it would suggest links to the largest Indus sites, such as Mohenjo-Daro or Dholavira. In addition, three sherds of large globular jars, one of which is a black slipped jar (Fig. 5/c), have evidence of drilling that may have been used to join two broken sherds together. This type of repair is not a common feature at sites in the Indus Valley and it may reflect a local tradition of repairing broken storage vessels.

Residue analysis will be undertaken on samples of Indus pottery, including black slipped jars, cooking pots, the perforated jar, and the possible goblet, as well as on some local wares. Smaller vessels such as cooking pots, perforated jars, and goblets may have been used for multiple purposes, but generally speaking they were used for food processing or consumption. The black slipped jars, however, appear to have been containers for shipping specific types of commodities, the determination of which has been a major question ever since they were discovered (Kenoyer 1998: 97). HD-1 provides an optimal location for trying to figure out the contents of the large black slipped jars because it was the first place where jars were offloaded after being shipped overseas. It is therefore highly likely that the residue signatures of these jars may reflect their original contents. At Indus sites, black slipped jars were usually reused as sump pots at the end of drains or as commodes in household latrines (Kenoyer 1998: 60). The analysis of such vessels would thus not provide evidence of their original contents. Black slipped jars shipped to interior sites in Oman might possibly represent their original contents, but there is also a possibility that these vessels were reused for shipping local commodities.

Bead and ornament analysis and sourcing

An overview of the total number of beads collected from both 2016 and 2017 shows that out of eighty-six beads of stone, shell, and bone, forty-eight (56%) were made from unfired grey black chlorite. These beads represent the local bead-making technology that is well documented from the Neolithic throughout the Umm an-Nar and later periods. Other types of beads include nine heavily worn beads made from local marine shell and two from bone (13%). There are twenty-one steatite beads (46%), some of which are unfired and some fired to over 900°C.

Preliminary results of the analysis of steatite beads provide some intriguing patterns, which could indicate the trade of beads from the Indus region as well as the local processing of non-local steatite. X-ray diffraction (XRD) analysis of five steatite beads revealed that one bead (HD1_17_016) was made from a dolomitic steatite that is not found in the Oman peninsula (Law, 2018) (Fig. 6/a). The others were instead made from ultramafic steatite that might be from Oman even if no source has been located so far. The analysis of four additional beads using INAA determined that three of them were specifically made from a low-fired ultramafic steatite similar to that found at the earlier Hafit site of HD-6 (Fig. 6/b1–3), while one of the beads appears to be made of a high-fired dolomitic steatite identical to that found in the Indus (Law 2011: 191) (Fig. 6/b4). So far, there is no indication that steatite beads were being made at HD-1, therefore the production location must be at another regional site. The types of beads found at HD-1 reflect a local ornament tradition that is broadly similar to what is seen at other Umm an-Nar sites, including both settlements and burials (Cleuziou & Tosi 2007: 126; Böhme & Al-Sabri 2011; Mortimer 2016; Schmidt & Döpper 2014). At HD-1, beads were probably used as ornaments in necklaces and to decorate clothing and were lost in the course of daily activities.

The one carnelian bead (HD1_16_014) found in 2016 is a short bicone that has conical drill holes from each side made by pecking and then drilling (Fig. 7/a). This perforation technique is distinct from the simple pecking that was commonly used for short biconical beads. The carnelian is pale red-orange in colour and slightly opaque. The chemical composition of the carnelian was analysed to determine the source area using laser ablation inductively coupled mass spectrometry (LA-ICP-MS), which was undertaken at the Field Museum, Chicago under the direction of Dr Laure Dussubieux. When compared with agate source areas in the current database, it appears to source with carnelian from south-eastern Iran. If this bead can be confirmed as sourcing to Iran, it would indicate that finished carnelian beads from this region were entering into the trade networks that connected to HD-1. Two additional

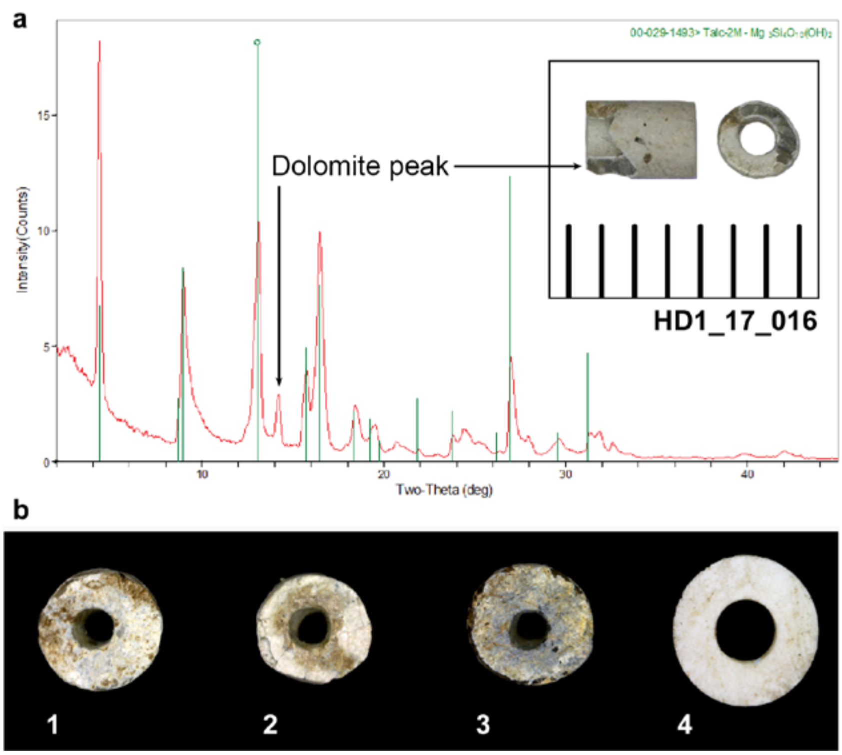

Figure 6. *Ras al-Hadd HD-1:* **a.** *steatite bead with XRD showing dolomitic peak (HD1_17_016);* **b.** *steatite beads from ultramafic (1–3) and dolomitic sources (4) (images by R.W. Law ©Italian-American Joint Hadd Project).*

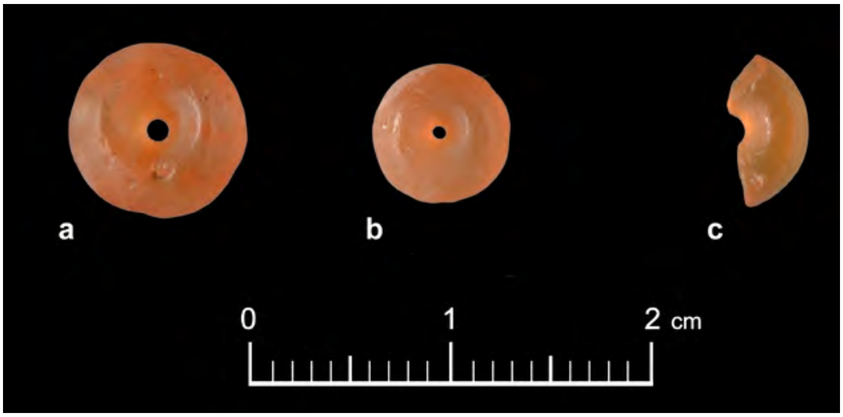

Figure 7. *Ras al-Hadd HD-1, pecked carnelian beads:* **a.** *HD1_16_014;* **b.** *HD1_17_021;* **c.** *HD1_17_036 (images by J.M. Kenoyer ©Italian-American Joint Hadd*

carnelian beads were recovered in the 2017 excavations and their analysis is ongoing (Fig. 7/b-c).

A possible ornament or decorated round handle in ivory (HD_17_718) was discovered in Trench A. Further analysis will determine if it was carved from Asian elephant or dugong ivory, both of which were not locally available in this region of Oman (Charpentier & Méry 2018). Ivory trade networks may have overlapped with the long-distance trade circuits of carnelian and ceramics.

Lithic analysis and experimental replication

The lithics are being studied by Jonathan Mark Kenoyer and Gregg Jamison, but a preliminary analysis of the total sample collected from Trench A provides a preview of the nature of the site assemblage. The chipped stone lithics are dominated by nummulitic flint tools and debitage (594) that can be associated with the third-millennium Umm an-Nar occupation. The primary source of the flint appears to be the nummulitic flint deposits located in the Jabal es-Saffran, some 2 km from the site of RJ-2 at Ras al- Jinz (Charpentier 1986: 48). In addition, one jasper flake with cortex and one limestone flake with possible retouch were recovered *c*.40 cm below the surface in an area that does not seem to be disturbed.

The majority of lithic finds comes from the prehistoric occupation layers associated with hearths, concentrations of fire-cracked rock, burned bone, and shell as well as sandy layers with less ash and fine charcoal. Two flint hammer stones were recovered and seven additional hammer stones, made from oval or discoid pebbles, were found in layers with flint tools and debitage. The association of hammer stones and debitage indicates that lithic tool preparation and maintenance was taking place at the site.

Most of the shaped tools were made from naturally elongated nodules, blades, or flakes that were retouched to form a point at one end and usually a flat edge on the opposite end. These retouched tools are highly varied and have been found at sites from other periods as well. At the third-millennium Umm an-Nar site of RJ-2 they are referred to as *bec* borers or borers (Cleuziou & Tosi 1988: figs 23:1,2,4 and 24:1), while at the second-millennium site of RJ-1 they were referred to as fabricators or polyhedral tools, or thick instruments with traces of percussion (Biagi 1988: 4, fig. 5). Borers from RJ-2 and HD-60 are thought to have been used in the manufacture of *Conus* sp. shell rings (Charpentier 1994). At other sites they are called *retouchoir* or *macro-perçoir* (Charpentier 2001). In this report, 'borer' is used as a catch-all term, and each tool will be reclassified after detailed use-wear analysis. Preliminary examination shows that there are several different types of borers, some used to perforate by rotary movement, while others appear to have been used as punches or picks. Experimental replications are ongoing to determine what types of activity result in specific tip damage. The discovery of one unworked flint nodule and one unfinished borer indicates that the raw materials were brought to the site and tools were made as needed.

In addition, there are smaller pointed flakes that can be classified as *perçoirs* and one micro drill. The *perçoirs* are made on flakes of various sizes and appear to have been expedient tools used in a variety of activities. Generally, the tips show evidence of scraping and/or rotary movement as if they had been used to scrape grooves or perforate hard materials, such as wood or shell. The micro drill (HD1_A17_579) is extremely small and has a long narrow distal point (1.75 mm) about the size of the perforations found in the ancient chlorite and steatite beads. The proximal end is retouched to make it easier to haft it in a reed or wooden rod. So far, no bead manufacturing debris has been found at the site, but experimental micro drills of the same size and shape were made by Kenoyer using nummulitic flint obtained from eroding deposits at Ras al-Jinz. The experimental flint drills worked well on soft steatite but broke down very quickly when used to perforate replicas of chlorite or marine shell beads, which are much harder.

Copper tools and technology

A preliminary study of copper or copper alloy artefacts from the first two seasons has been completed (Valsecchi Gillmeister 2017). Using a typology developed by C. Giardino (2017), from a total of 1140 artefacts, 750 (66%) were sorted into identifiable categories such as fish hooks, awls/pins, chisels, needles, sheets, small blocks, rings or beads, and other miscellaneous objects. The remaining 389 (34%) were tiny indeterminable fragments. Complete fish hooks, which are currently being compared with types from other regions, are very rare but when preserved they range in size from 1 to 5 cm in total length (Valsecchi Gillmeister 2017: 49–50) (Fig. 8/a). An awl fragment with a bone handle and two examples of possible netting needles consisting of a copper rod with a bifurcated point have also been identified (Valsecchi Gillmeister 2017: 62).

In addition, three types of artefacts found at the site suggest that some degree of metalworking was taking place at HD-1. A copper crucible fragment with corroded copper and slag on the interior was found in Trench A. Two tiny fragments of copper ore, one of chalcopyrite (0.5 g) the other of malachite (1.6 g), were found in the same trench. Some of the hammer stones have circular depressions on both faces similar to those found at ore processing sites (Giardino 2017: 89 and fig. 8.8). Although the total number of artefacts associated with copper-working is not very great, they do indicate at least small-scale metal recycling or smelting, and the possibility that ores were being traded or transhipped at the site. Selected copper artefacts will be studied to

Figure 8. *Ras al-Hadd HD-1:* **a.** *copper hook (HD1_16_125);* **b–g.** *copper hook fragments with fibre (HD1_17_078, 17_079, A17_360, A17_515, M_1068, M_1124);* **h.** *copper sheet with fibre (HD1_17_098);* **i.** *steatite bead with fibre (HD1_17_106) (images by J.M. Kenoyer ©Italian-American Joint Hadd Project).*

determine the composition and possible use of alloys, and lead isotope analysis will be carried out to source the copper.

Fibre analysis

A total of twenty-two copper objects, including fourteen fish hooks, were found with traces of fibre or fabric preserved on the corroded surface (Valsecchi Gillmeister 2017: 60) (Fig. 8/b–h). The use of shell fish-hooks during the Neolithic period (Bavutti et al. 2015) confirms that there is a long history of hook and line fishing in this region and a variety of local plant fibres must have been tested and used in the preparation of cordage. However, no traces of fibre were found on the Neolithic shell fish-hooks and although fibre on copper fish-hooks was reported from the earlier excavations at HD-1 (Reade 1990: 35), no analysis was undertaken.

Preliminary analysis of the hooks shows that different techniques of twisting and knotting were used. One copper rod/hook (HD1_17_078) (Fig. 8/b) has a cord that has been wrapped around the shaft four times with some form of knotting over the end, but the knotted section has been damaged and cannot be completely reconstructed (Fig. 9/a:1). SEM analysis shows the use of three or four strands combined to create a Z-twist thread that is approximately 537 to 608 μm or 0.6 mm wide (Fig. 9/a:2), which is then plied to make a single S-plied cord that is approximately 0.8 to 1.0 mm wide. Each of the fibre strands are around 8 to 13 μm wide and have a hollow core that is clearly visible under high magnification (500X) (Fig. 9/a:3). This hollow shape of fibres is sometimes seen in palm fibre (Agoudjil et al. 2011: fig. 3; Tahiri et al. 2016: fig. Y), but the overall fibre surface does not show other characteristics of palm fibre structure. It is possible that this fibre represents some other local plant used in Oman and further research is necessary to determine the species being used to make fishing line.

Fibres preserved on sample HD1_17_M1124 (Fig. 8/g) are also loosely twisted around a copper hook shaft and consist of a cord made from two Z-twist strands to form a loose S-plied cord (Fig. 9/b:1). The width of individual fibres is between 25 to 42 μm and the cord is around 50 μm or 0.5 mm wide (Fig. 9/b:2). It is possible that two of these S-plied cords are then plied to form a larger Z-plied cord of 1 mm width, but it is not possible to determine this based on the preserved fragments. The repeated twisting of fine fibres to build strong cords indicates a well-developed fibre technology that would have been needed for line-fishing technology. The fibre is not identified but it appears to be similar to palm

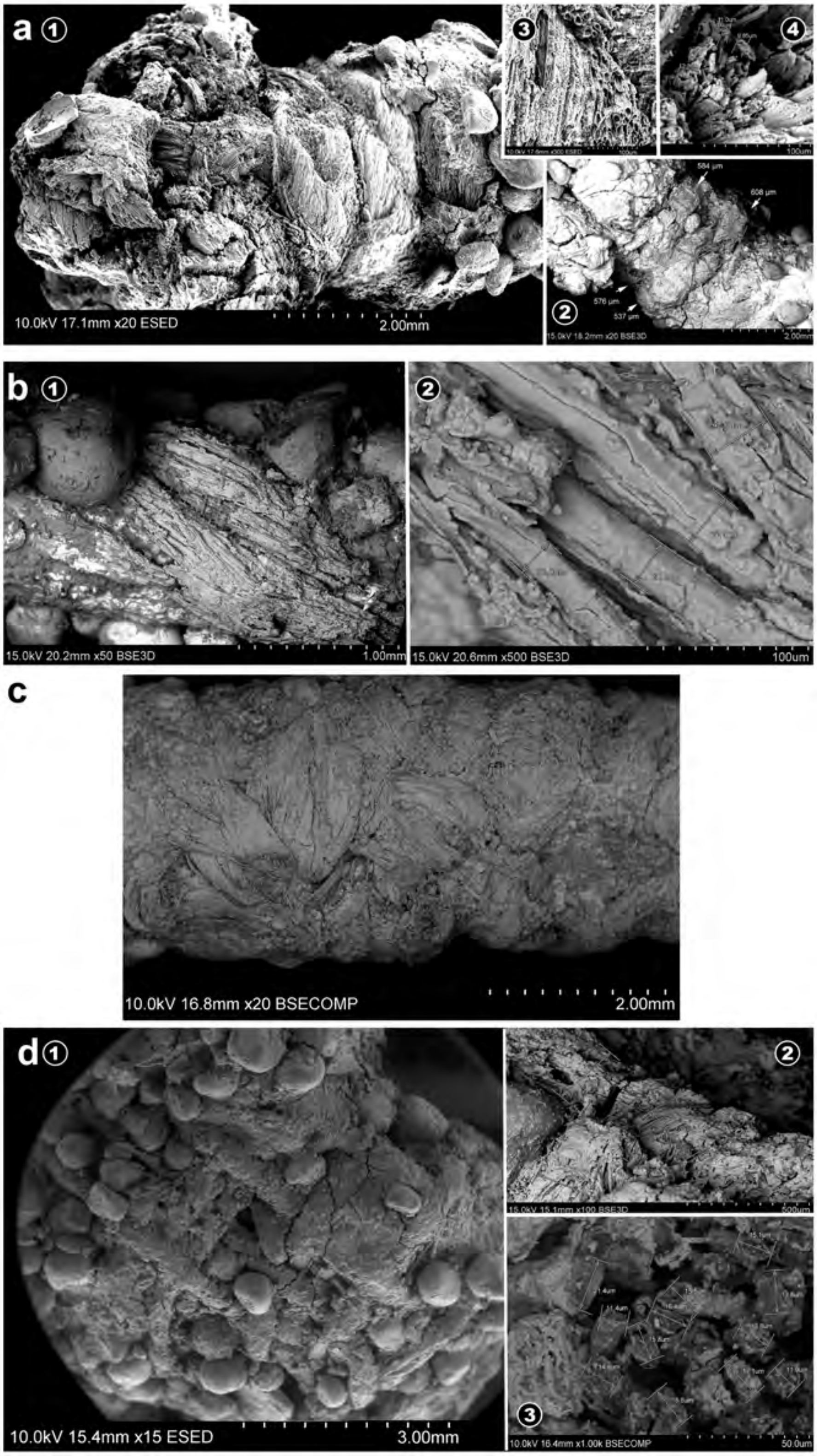

FIGURE 9. *Ras al-Hadd HD-1, SEM images of fibres on copper:* **a.** *rod/hook (HD1_17_078);* **b.** *hook shaft (HD1_17_M1124);* **c.** *hook shaft with knotted fibre (HD1_A_17_360);* **d.** *sheet with woven fibre (HD1_17_098) (images by J.M. Kenoyer ©Italian-American Joint Hadd Project).*

fibre in overall structure although some diagnostic cell features are obscured due to the state of preservation.

HD1_A_17_360 provides clear evidence of one pattern of knotting used to attach fishing line cordage onto a shaft (Fig. 8/d). The cord is approximately 1.0 to 1.2 mm wide and is made up of two Z-twist strands that are combined to make a single S-plied cord (Fig. 9/c). The cordage is attached to the shaft using repeated half hitch knots along the length that is preserved. The individual fibres are between 11 to 21 μm wide and are made up of an external casing with internal microfibres. The external surface is similar to that seen in HD1_17_M1124 and is possibly some form of palm fibre, but the diagnostic cell structure was not preserved.

One preserved fragment of woven fabric (HD1_17_098) was recovered on a piece of corroded copper sheet (Fig. 8/h). The simple weave fabric is made up of S-twist threads that are around 0.27 to 0.4 mm thick (Fig. 9/d:1–2) and have 1.0 mm space between each thread in one direction and 1.0 mm space between each thread in the other direction. It is not possible to determine which direction is the warp. Examination of the fibres under SEM reveals a distinctive profile and hollow shape (Fig. 9/d:3), with small cell divisions similar to that seen on jute (*Chorcorus* sp.) but also occasionally on palm fibre. One fibre visible on the object has a damaged surface and hollow structure that is seen in palm fibres degraded by alkaline conditions (Oushabi et al. 2017: fig. 2). The use of jute is documented in the Indus region at the site of Harappa (Kenoyer 2016; Wright et al. 2012), but so far there is no evidence of jute used in Oman. Further analysis is required to confirm the plant fibre used in this fabric.

A steatite bead (HD1_17_106) has traces of what appears to be cotton fibre preserved on the interior of the bead drill hole (Figs 8/i & 10/a). The individual fibres have the diagnostic shape of cotton and range in width from 10 to 35 μm wide (Goodway 1987: fig. 1; Kenoyer 2016: fig. 2.10) (Fig. 10/b). They are all bunched up and tangled without any indication of twist direction, so it is possible that they resulted from some abrasion of the original cordage that was used to string the bead. The bead drill hole was perforated by drilling from two directions that do not meet precisely in the centre of the bead and this has resulted in a slight ledge that may have contributed to the accumulation of the fibre inside the bead drill hole.

These preliminary observations of the fibres found at HD-1 indicate that multiple types of fibre were used in Oman during the third millennium BC. Fibres from the local date palm and other local plants may have been the dominant fibre used in fishing, but the possible presence of cotton and jute would indicate links to the Indus Valley. The discovery of linen fabric at the

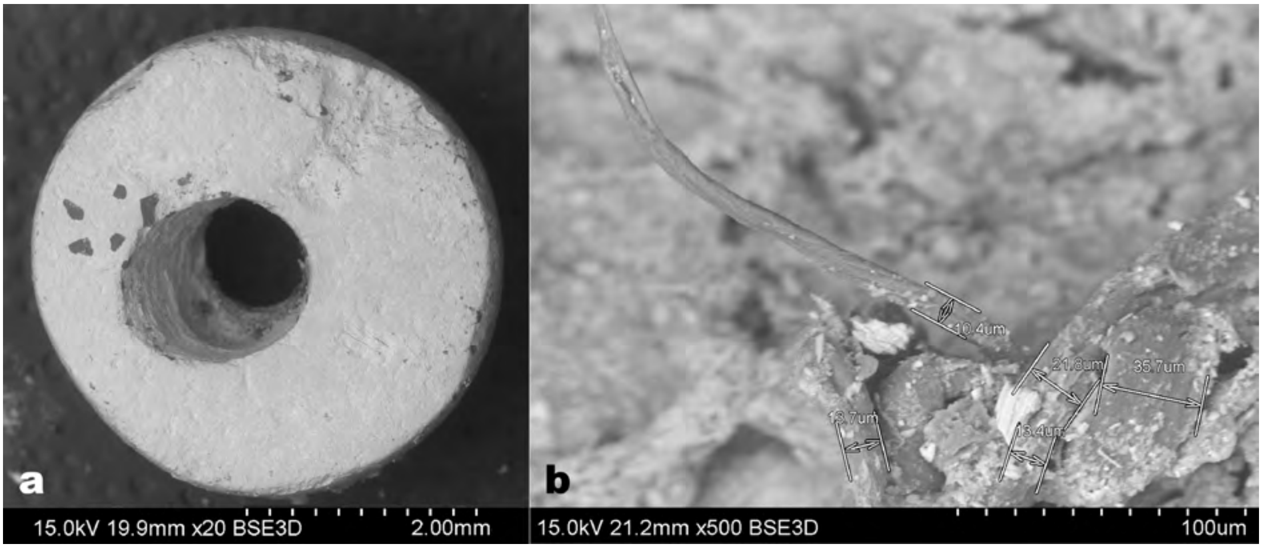

Figure 10. *Ras al-Hadd HD-1, SEM image of:* **a.** *steatite bead (HD1_17_106);* **b.** *cotton fibre inside the perforation (images by J.M. Kenoyer ©Italian-American Joint Hadd Project).*

contemporaneous site of Tell Abraq (Potts 2000: 97–99; Reade & Potts 1993) suggests that further analyses might reveal the presence of this fibre as well.

Conclusions

The new excavations demonstrate that the site of HD-1 at Ras al-Hadd is the result of repeated occupation over a period of around 200 years during the mid-third millennium BC. The lack of any permanent mud-brick structures would suggest that the occupations were seasonal followed by partial or complete abandonment. Analysis of the marine and terrestrial animal remains will possibly provide concrete data on seasonality. However, since there are other nearby locations along the coast where fishing can be undertaken from small boats, it is possible that HD-1 was not a major fishing settlement and that the fish being processed at the site were only for occasional consumption by people associated with the offloading and provisioning of larger seagoing vessels during short periods of time.

The presence of Indus pottery, especially the large black slipped jars associated with long distance exchange, could indicate that the site was occupied primarily when large boats were arriving from or departing towards the Indus coasts. Sailing seasons and routes in the Early Bronze Age cannot be precisely determined because of a complex combination of changing wind patterns and ocean currents (Vosmer 2007). However, since most traditional sailing vessels avoid crossing the Arabian Sea during the summer monsoon (June to September), the most likely seasons for intense activity at the site would have been before or after the summer monsoon.

When the site was occupied, there is evidence of considerable activity in terms of stone tool preparation and use, possible metal recycling, or even smelting as well as the maintenance of fishing lines and equipment such as nets. The variety of beads found at the site indicates that the occupants were probably wearing local ornament styles, but that there are some stone beads from more distant regions such as Iran or the Indus Valley. Preliminary identification of the fibres also shows predominantly local palm-like fibres, but the possible use of cotton and jute provide a link to the Indus. The pottery also shows the dominant use of local ceramics, with Indus pottery resulting primarily from long-distance trading, but also used at the site for specialized cooking and food-processing activities.

Although the site is relatively small, its strategic location, repeated occupation for several centuries, and the variety of Indus-derived artefacts and raw materials, indicate that it played an important role in the socio-economic system that connected the local Umm an-Nar communities with external regions. In the upcoming season and with the completion of more in-depth analyses of the artefacts, we expect to be able to provide more detailed interpretations of these cultural interactions.

Acknowledgements

The Italian-American ‘Joint Hadd Project’ at Ras al-Hadd wishes to thank the Ministry of Heritage and Culture of the Sultanate of Oman for granting permission for fieldwork at Ras al-Hadd, with specific reference to H.H. Sayyid Haitham bin Tariq Al-Said, Minister for Heritage and Culture; H.E. Salim Mohammed Almahruqi, Undersecretary for Heritage; Mr Sultan Said Al-Bakri, Director General for Archaeology; Mr Khamis Al-Asmi, Director of the Department of Excavations and Archaeological Studies. We wish to thank also Mr Khamis Al-Amri, Representative of the Ministry at Ras al-Hadd, and Mr Salem Al-Ghazali for the support on logistics. In addition, we thank Dr Jean-François Berger from CNRS, UMR 5600 EVS/IRG-University of Lyon and Director of ‘Project NéoArabia’ (ANR16 CE03 141356), the Centre de datation par le Radiocarbone of Université Lyon 1, and the Laboratoire de Mesure du Carbone 14 (UMS 2572), ARTEMIS in Saclay for the radiocarbon measurements by SMA within the framework of the National Service to CEA, CNRS, IRD, IRSN, and the Ministère de la Culture et de la Communication, as well as the ‘Laboratory for Sciences of Climate and Environment’ (LSCE) in Gif-sur-Yvette. A special thanks to Florencia Debandi from the University of Bologna who served as field director and to all the students — Francesca Barchiesi, Marco Benatti, Paola Iacono, Dario Fanin, Serafino Rosso, Valeria Tiezzi, and Andrea Margherita Valsecchi Gillmeister — who took part in the two field campaigns. Special thanks also to Laure Dussubieux and Randall Law for the preliminary results of the LA-ICP-MS on the carnelian bead, to Bil Schneider for help with the SEM analysis of the fibre samples in the Department of Geology, UW–Madison, and to Brad Chase from Albion College for support on INAA of fired steatite beads. Funding for the analysis of the samples at the UW–Madison has been provided by a grant to Kenoyer from the College of Letters and Sciences, Wisconsin Alumni Research Foundation Named Professorship Award in 2017.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 85–96

Al-Khutm Project 2017/2018: a Bronze Age monumental tower (Bat, Oman)

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Summary
The extensive investigation carried out between November 2017 and the end of January 2018 at the UNESCO site of Al-Khutm (Bat) has allowed us completely to expose an important tower dated back to the end of the third millennium BC. The excavation revealed the good state of preservation and monumentality of the complex, unique among the towers so far investigated in Oman. The tower was covered by a deposit of collapsed stones several metres deep, which had hidden the tower until recent times. Among the significant results of this season is the exposure of the tower wall reaching a height of *c.*4 m and a perimeter wall 2.3 m in height, surrounding the western side of the tower. The excavation has also revealed the presence of several structures located inside the tower, including a deep well found in the central corridor. The sloping profile of the substratum and the monumental architecture of both these structures testify to the monumentality of the tower. Preliminary analysis of stratigraphic data and associated pottery suggests dating the construction of the tower to the late Umm an-Nar period and to a second, Wadi Suq, period featured by constant rebuilding. The present article outlines the preliminary results of the two excavations seasons.

Keywords: Oman, UNESCO, Bronze Age, tower, Bat

Introduction

This article discusses the preliminary results of the fieldwork conducted in 2017–2018 at the tower of Al-Khutm (Bat, Oman). The authors are still working on the study of the materials, stratigraphic units, and scientific analysis to provide an accurate description of the phases and periods. The final interpretation of the chronological sequence will therefore be presented in the final monograph publication.

The extensive investigation carried out between November 2017 and the end of January 2018 at the site of Al-Khutm has enabled us to uncover an important archaeological complex dated back to the end of the third millennium BC, whose state of preservation and monumentality is unique among the towers so far investigated in Oman. The tower was covered by a deposit of collapsed stones several metres deep and was only partially visible in 2015.

The main achievement of the excavation is the exposure of the tower wall that reaches the height of *c.*4 m and of an imposing perimeter wall more than 2 m high. Furthermore, the excavation has brought to light several structures located inside the tower, including a deep well found in the central corridor. The sloping profile of the substratum and the monumental architecture of both the tower wall and the perimeter wall have revealed the monumentality of the tower.

The existing literature describes the existence of about seventy-three Bronze Age towers in the south-eastern Arabian Peninsula, dating from the early third millennium to the first centuries of the second millennium BC (Cattani & Azzarà, in press; Thornton, Cable & Possehl 2016). Of these, seventeen were only partly excavated and none of them has been completely documented or excavated. The towers are mainly clustered along a north-west strip which roughly corresponds to the slopes of the Al-Hajar mountains, with a concentration around the villages of Hili, Bat, and Bysia (Fig. 1). Some towers lie on alluvial floodplains, while others are located on the rocky substratum of hilly areas, generally consisting of limestone bedrocks. A small group is located on coastal high hills. In terms of architectural characteristics, the diameters of the towers usually range from 20 to 25 m, with some relevant exceptions such as the towers of Abraq, in the UAE,

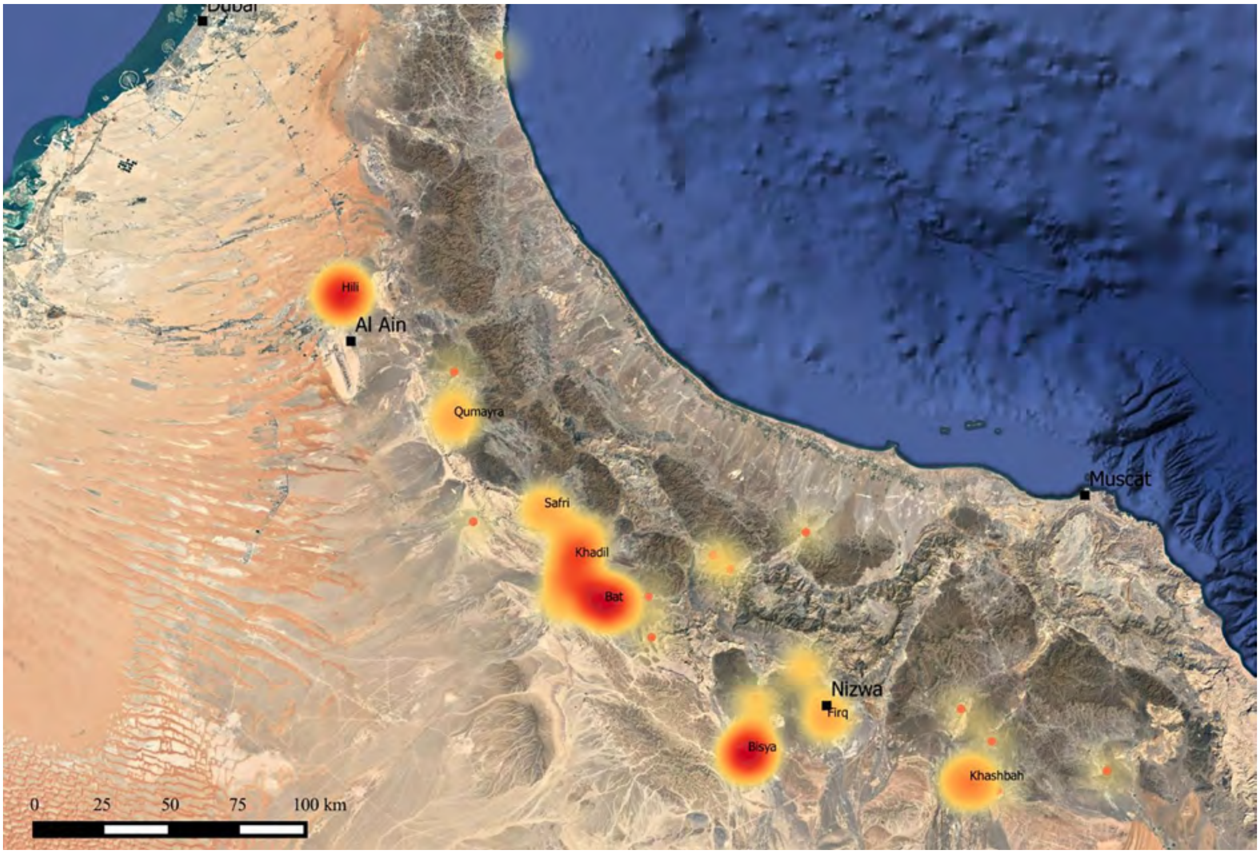

FIGURE 1. *A map showing the location of some of the Bronze Age towers in the Arabian Peninsula.*

and Bysia, which are significantly larger in diameter — between 35 and 45 m.

Together with the area of Bat and the tombs of Al Ayn, the tower of Al-Khutm has been registered on the UNESCO list of Omani monuments since 1988, as the most unique ensemble of 4000–5000 year-old burial monuments, towers, and remains of settlements in the Arabian Peninsula. The third-millennium BC archaeological landscape around Bat is exceptionally well preserved and fully integrated in the modern town. The hilltops in the area present Bronze Age cairn tombs and towers recently investigated by an American team (Thornton & Schmidt 2015; Possehl, Thornton & Cable 2009; 2010; 2011; 2013).

The tower

Discovered by Beatrice de Cardi in the 1970s (de Cardi, Collier & Doe 1976), the tower was covered by more than 3 m of collapsed stones and was only partially visible in 2015 (Fig. 2). After preliminary investigations carried out by an Omani team in 2009 (Possehl, Thornton & Cable 2009), a new project was started with the aim of exposing the tower and making it accessible for local visitors and tourists (Cocca et al. 2016; Cattani et al. 2017). The project is funded by the Ministry of Heritage and Culture of Oman and has been carried out by an Italian team of freelance archaeologists supervised by Prof. Maurizio Cattani of Bologna University. Although excavation in the northern sector of the complex needs to be completed, the main area has already been exposed. It is therefore possible to provide a general overview of the preserved structures and the building techniques. A topographic and architectural survey was carried out using 3D photogrammetry managed on a GIS open-source platform (Mandolesi & Cocca 2013).

The tower sits on top of a limestone bedrock mound, slightly elevated above the surrounding alluvial plain,

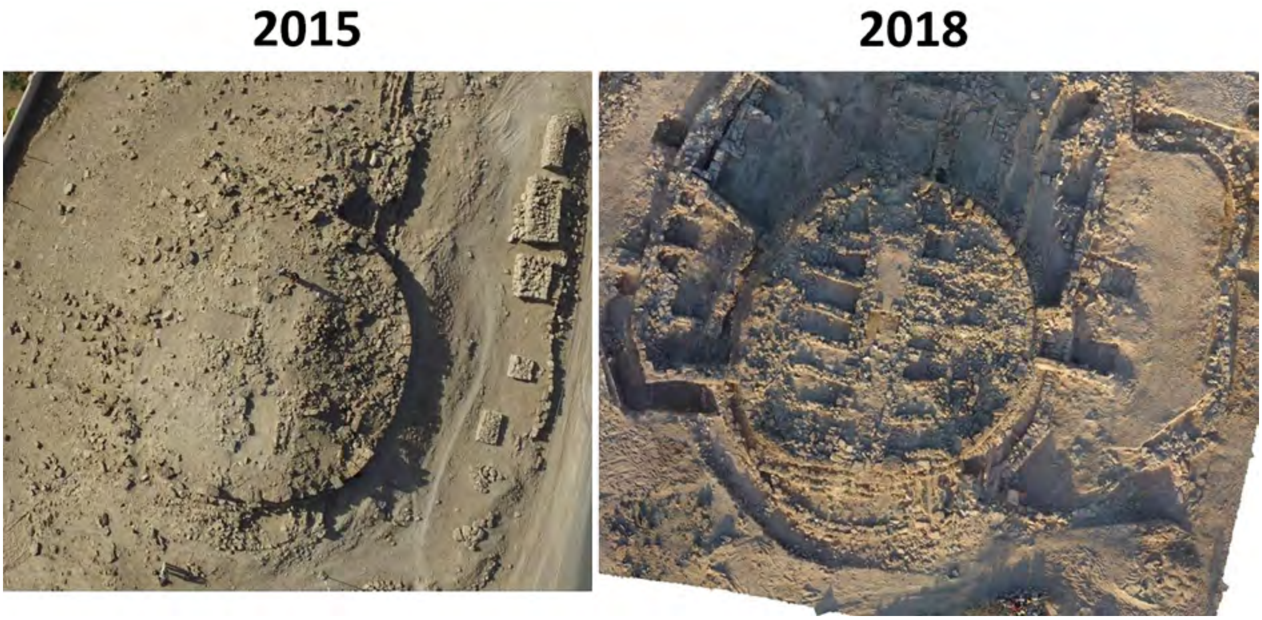

Figure 2. *The tower in 2015 and 2018.*

Figure 3. *Rocky outcrops oriented east–west used as a solid base for the construction of the tower.*

at an average altitude of 464 m a.s.l. Such limestone outcrops are widespread in the area; they are naturally broken into blocks and boulders which were extensively used for the construction of the tower and all the other surrounding structures. This substratum has several rocky outcrops, oriented east–west, and was used as a solid base for the construction of the tower (Fig. 3).

The tower is 20 m in diameter and circular in shape, with both the east and west sides slightly rounded, probably to adapt to the shape of the hill. Inside the tower, a central corridor provides access to several narrow perpendicular rooms. On the northern side, two rows of rooms on two terraced layers, with the lowest built over a bedrock outcrop, were uncovered (Fig. 4). The tower is surrounded by perimeter walls on its north-eastern and western sides; the latter is very well preserved and has been extensively investigated, while the northern one needs further investigation. The tower wall is preserved to a maximum height of 3.5 m and consists of nine rows of squared blocks and

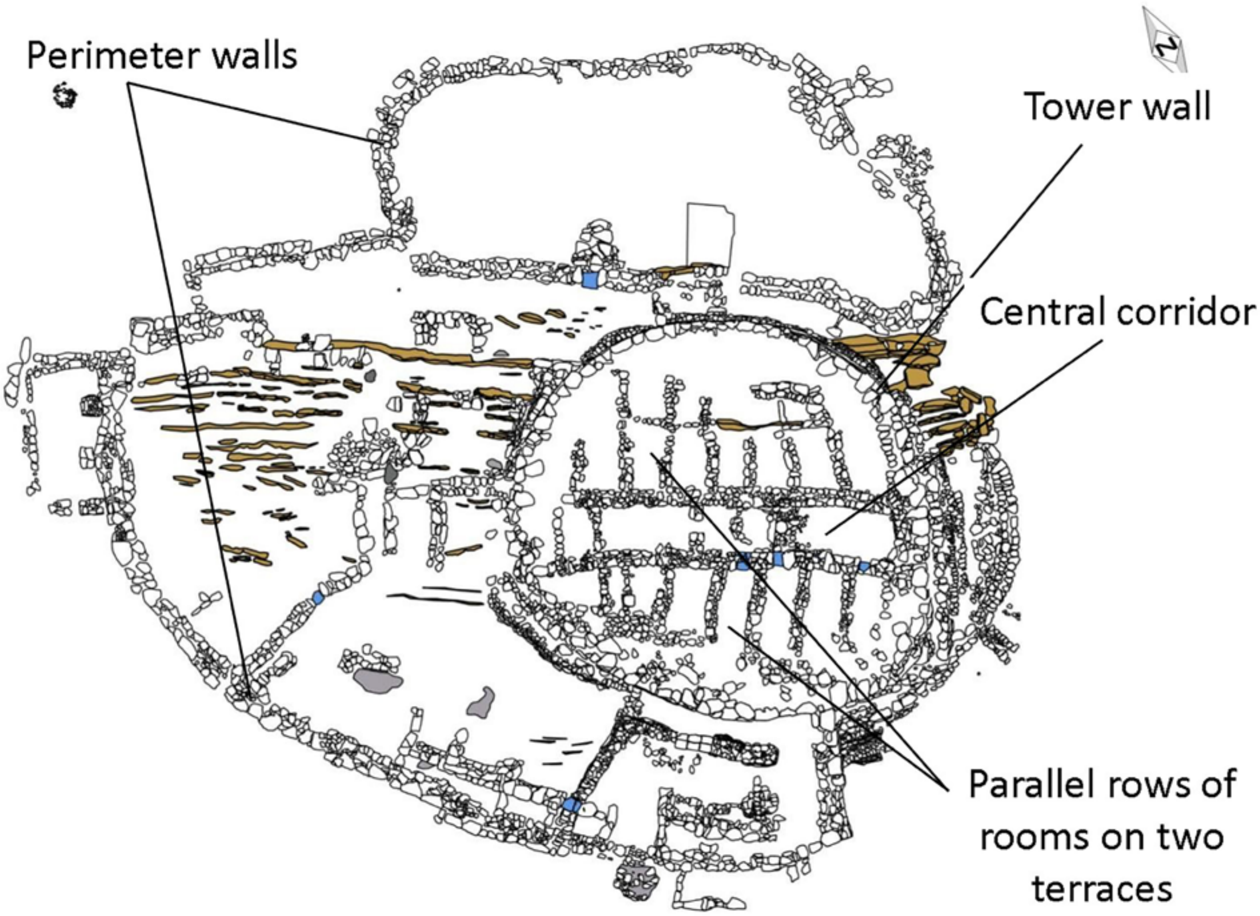

FIGURE 4. *A final plan of the Al-Khutm tower (drawing Enzo Cocca).*

slabs about 120 cm in length, 90 cm in width, and 25 cm in thickness. These characteristics and dimensions are similar to those of many excavated towers of the third millennium BC.

The tower complex includes an inner space and an outer space partitioned by several walls and surrounded by a long and curved perimeter wall (Fig. 5). This wall extends for 45 m, becoming irregular in shape on the western part of the tower due to three offsets. This occurrence may reflect the need to adapt the wall to the morphology of the bedrock. In order to investigate the state of preservation of the external wall, the stratigraphic sequence of the outer deposits, and the morphology of the limestone bedrock (including a possible artificial shaping), test trenches measuring *c.*4.5 x 2 m were opened in Sectors 5, 6, and 7.

This wall is preserved on 8–10 vertical rows and reaches a maximum height of *c.*2.3 m. One of the test trenches opened on its southern side revealed a complex series of superimposed layers and the presence of a compact silty clay flooring associated with the perimeter wall, which lies on the bedrock and is sealed by a thick alluvial deposit. The building of this wall required constant interventions involving cutting and reshaping the rocky substratum, as can be observed in some portions of its perimeter.

Two major phases of construction of the tower and related wall structures were identified. From the preliminary analysis of stratigraphy and associated pottery, these correspond to the late Umm an-Nar and Wadi Suq periods. Despite the lack of precise absolute chronological markers so far, it is very likely that the

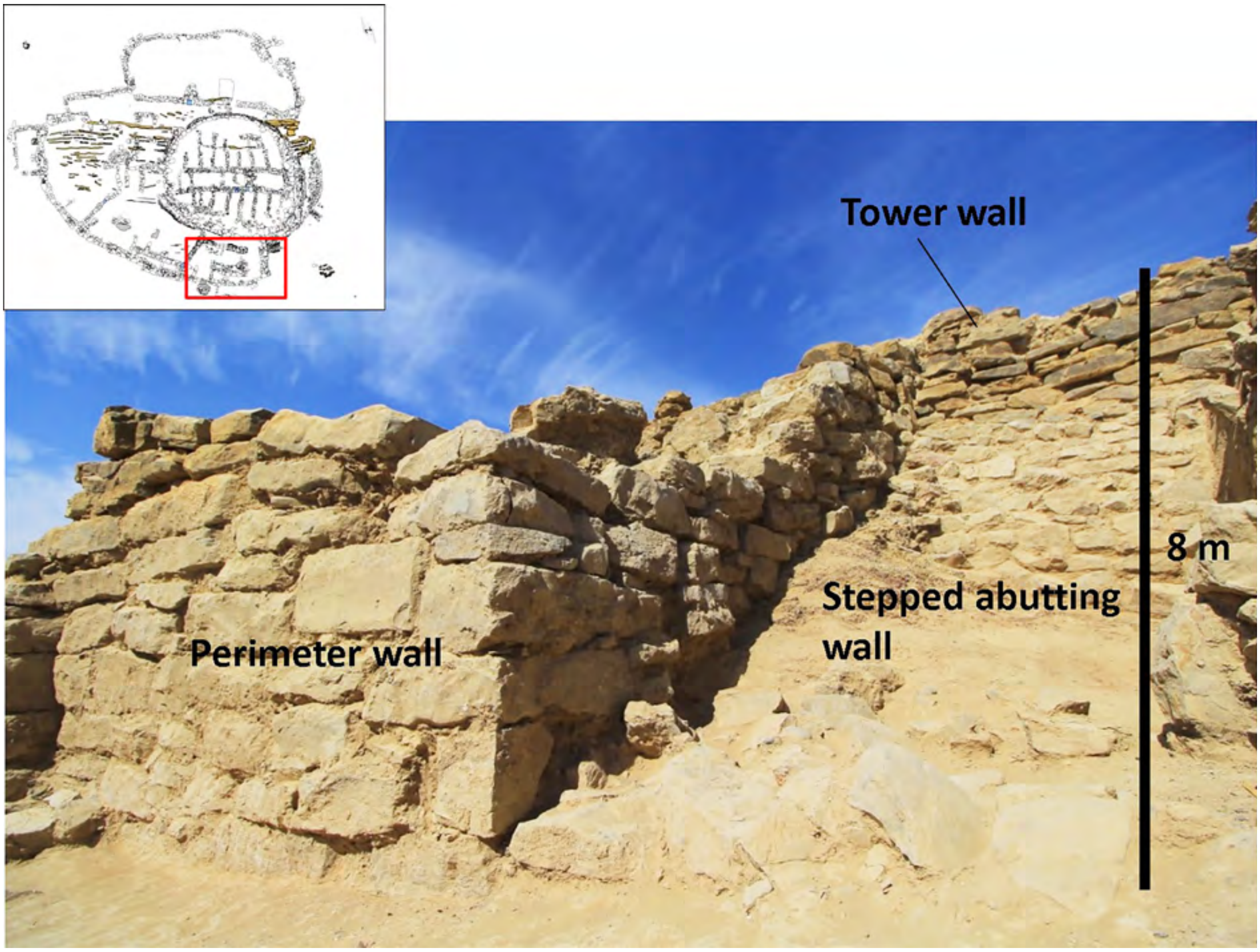

Figure 5. *The tower is surrounded by perimeter walls on its north-eastern and western sides, the latter very well preserved and extensively investigated.*

tower was in use for a long period between the late third and the first century of the second millennium BC.

The test trench in Sector 7 revealed a fairly well-preserved flooring layer characterized by silty clay sediments compacted on the top and including Umm an-Nar fine ware pottery fragments 5–15 cm in size (SU 559). These findings and other stratigraphic considerations suggest an attribution of the construction of the tower to this period. An area of fire-altered reddish clay, a few centimetres wide, was also found on top of the layer of flooring. The charcoal was sampled for ^{14}C analysis.

After the initial layout of the area, with several small rooms arranged between the tower and the perimeter wall, the whole external area was sealed by a vast landfill that reshaped the outer space on the western side of the tower into a wide terrace. Several additional walls were built with different orientations from those of the previous phases. Pottery found in these layers suggests that these constant alterations can be placed in the Wadi Suq period, probably in the first half of the second millennium BC. Significantly, this stratigraphic sequence is largely comparable with that revealed inside the tower, where two major phases of construction/restoration were also identified. This is best demonstrated by the superimposition of the south-western wall delimiting the central corridor over an earlier one (see Fig. 8).

Among the most interesting architectural features is the presence of several entrances. Next to the tower wall and to the north of three ascending ramps, the team found two pivots in primary position, consisting of a hole within a flat limestone block which may have contained a wooden pole. Moreover, an opening on the westernmost part of the perimeter wall, associated with poorly preserved stairs, suggests the presence of an entrance. Other well-preserved stairs ending with a large stone threshold were detected in the northern part of the tower. In the second period of the tower, these features were used to enter an elongated room located next to the tower wall (Fig. 6). The door was later blocked off by boulders arranged haphazardly. All these findings suggest a reconstruction of the access path and allow us to propose a model for mobility within the tower. The main access was in the western part, running along a monumental ramp system consisting of three rising stone terraces connecting the outside of the tower with the central corridor (Fig. 7). Circulation within the tower was enabled by stairs and stone thresholds which provided access to the single rooms.

In the very last days of the final field season, a circular well located in the central corridor of the tower was found. It has a diameter of *c.*60 cm, comparable to wells found in other excavated towers. Further investigations are necessary but taking into consideration the average height of the water table below the floodplain ground level, it is likely that the well reaches a maximum depth of *c.*8 m (Fig. 8).

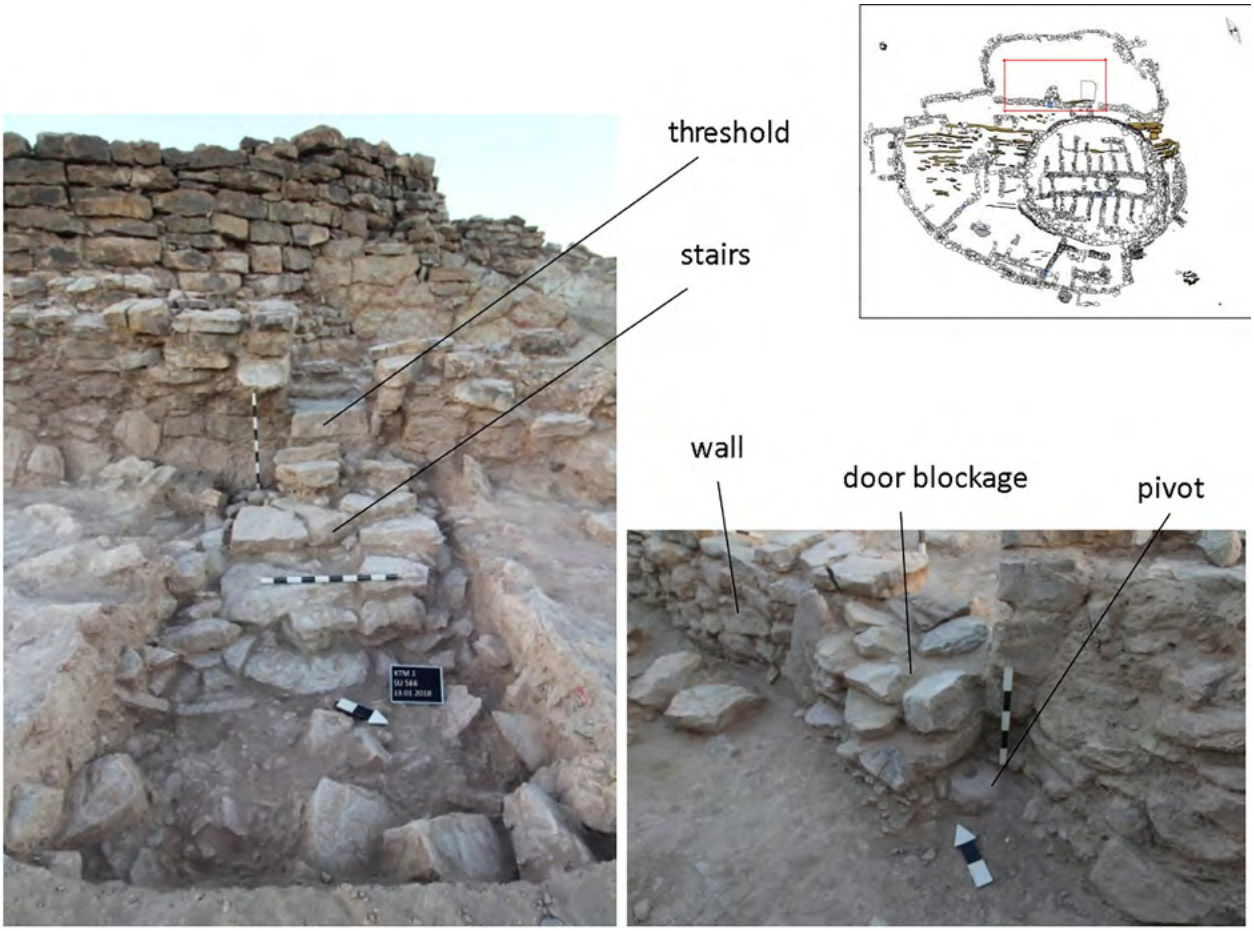

Figure 6. *Well-preserved stairs ending with a large stone threshold were uncovered in the northern part of the tower.*

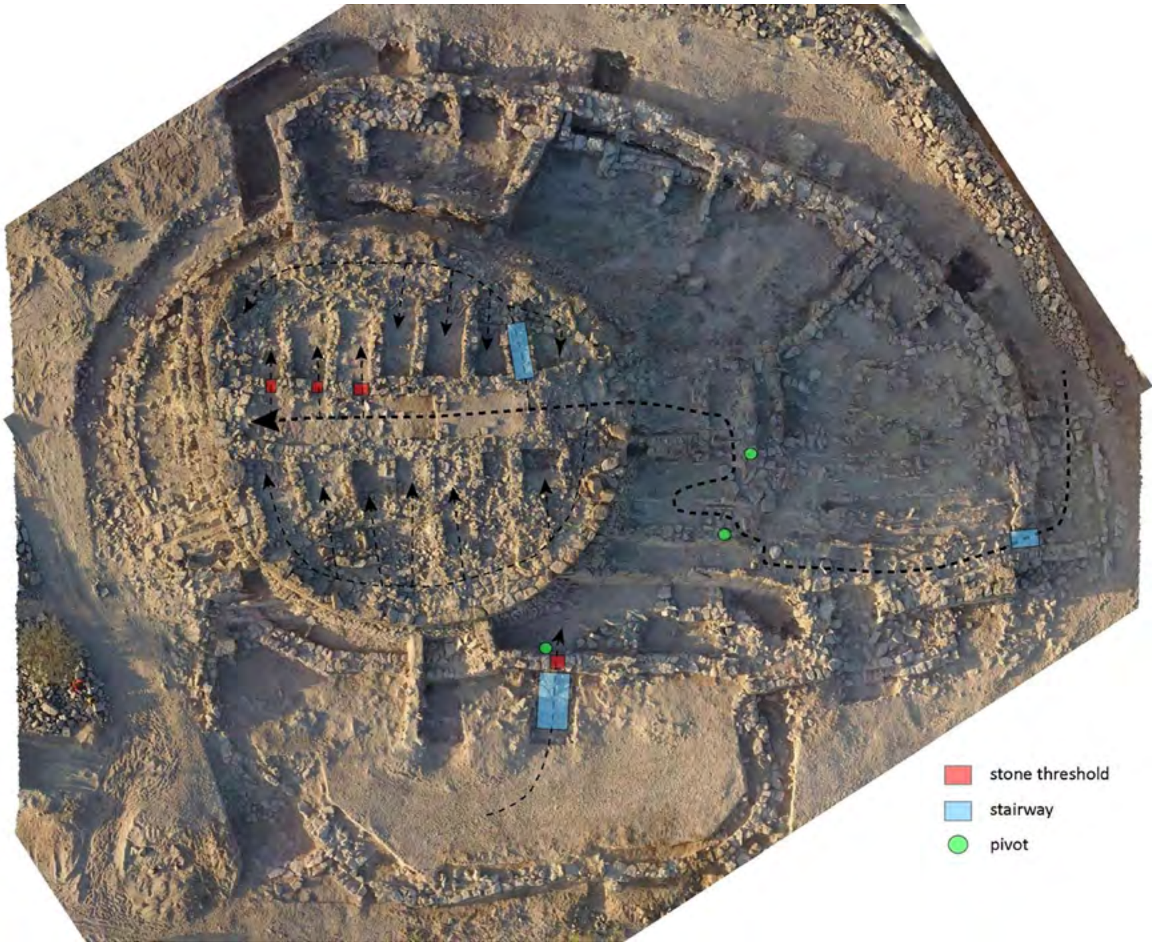

Figure 7. *The main access route into the tower.*

Archaeological finds

Although the archaeological finds do not reflect a wide range of different artefacts, some play a very important role in the reconstruction of the chronology and activities carried out at the site. Fireplaces with charcoal and ashes containing the seeds of different plants, including palm dates, will provide crucial information on the palaeo-environment and on food consumption at the site. Another interesting find is a carved stone with the representation of an animal, possibly an oryx or a camel, found within the collapse of the structure on the western side of the tower.

The team has recovered more than 35,000 pottery sherds, of which 1157 are diagnostic. However, despite the significant ratio between the non-diagnostic and diagnostic pottery, the ceramic assemblage is very significant because it attests to the existence of two main cultural facies, corresponding to the Umm an-Nar and Wadi Suq periods (Fig. 9). The pottery from the Umm an-Nar layers shows the main features characteristic of the period: fine ware, very depurated paste, and black painted decoration under the rim or on the shoulder of the vessel. The pottery from the Wadi Suq period is more abundant and shows a more variegated typology. There are many types of jars, painted and unpainted — the most common are jars with a short neck and everted, rounded, or pointed rims (Cleuziou 1989; Eddisford & Phillips 2009; Righetti & Cleuziou 2010; Thornton, Cable & Possehl 2016). Analysis of the stone materials from the 2017/2018 archaeological season revealed ground-stone tools, such as hammerstones and querns, and a seal.

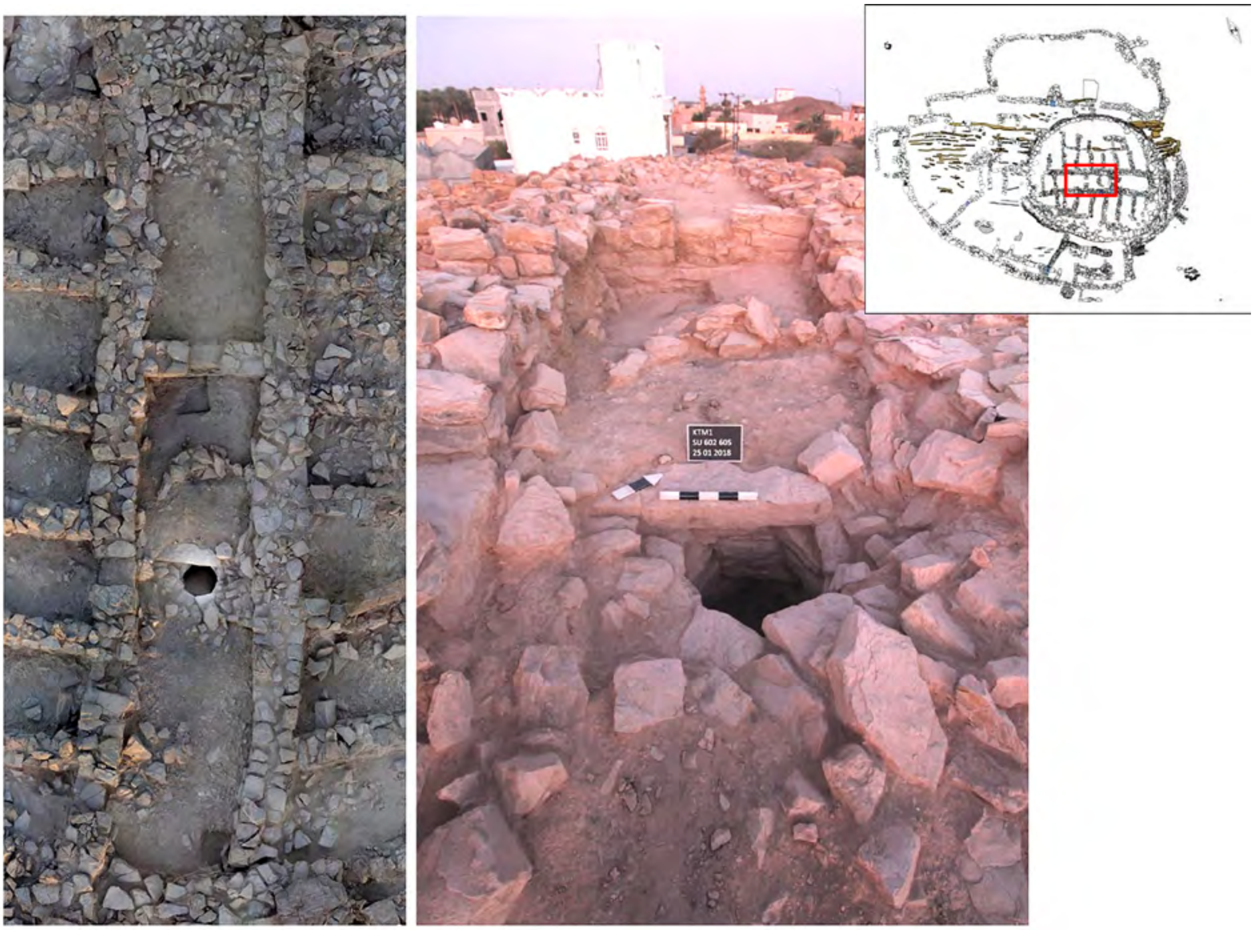

Figure 8. *The circular well located in the central corridor of the tower.*

The seal (Fig. 10) is made of a fine soapstone (steatite or chlorite). It is composed of an irregular disc with a slightly convex base (the obverse where the design is incised), surmounted by a flat dome of smaller diameter, which creates a flat ring-shaped horizontal surface around the boss (collar). A transversal perforation has been drilled from both sides across the base of the boss. The seal found at Al-Khutm is unique; it can be related to the Dilmun seals but has some details which do not belong to the typical style of this production known in Bahrain and Kuwait during the early centuries of the second millennium BC. In general, Dilmun seals are quite rare in the Oman peninsula; a few examples have been found in Oman at Shokur, Bid Bid and Nizwa, and in the UAE at Mazyad, Tell Abraq, Jebel Buhais, Sir Bani Yas, al-Ashoush, and Saruq- al-Hadid (Al-Sindi 1999).

Figure 9 (page 93). *Selected pottery sherds.* **1–8.** *glasses and cups, Wadi Suq classic types. The ware is reddish in colour, with a sandy texture and small- or medium-sized inclusions, and shows the typical wavy and strip decoration;* **9–10.** *Wadi Suq types, with a sandy texture, medium-sized inclusions, and showing the typical strip decoration;* **11–13.** *storage jars; sherds 11 and 12 are not decorated and have a sandy texture with medium and large inclusions; sherd 13 shows the same type of ware and is from a decorated jar. These sherds cannot be considered as representative of a specific period but they are very common throughout the whole Wadi Suq period;* **14–15.** *Umm an-Nar period with a very fine ware, sandy-yellowish in colour, thin walls, and a decoration with straight and curved black strips. The shapes of these two vessels are not typical (drawing Ilenia Gennuso).*

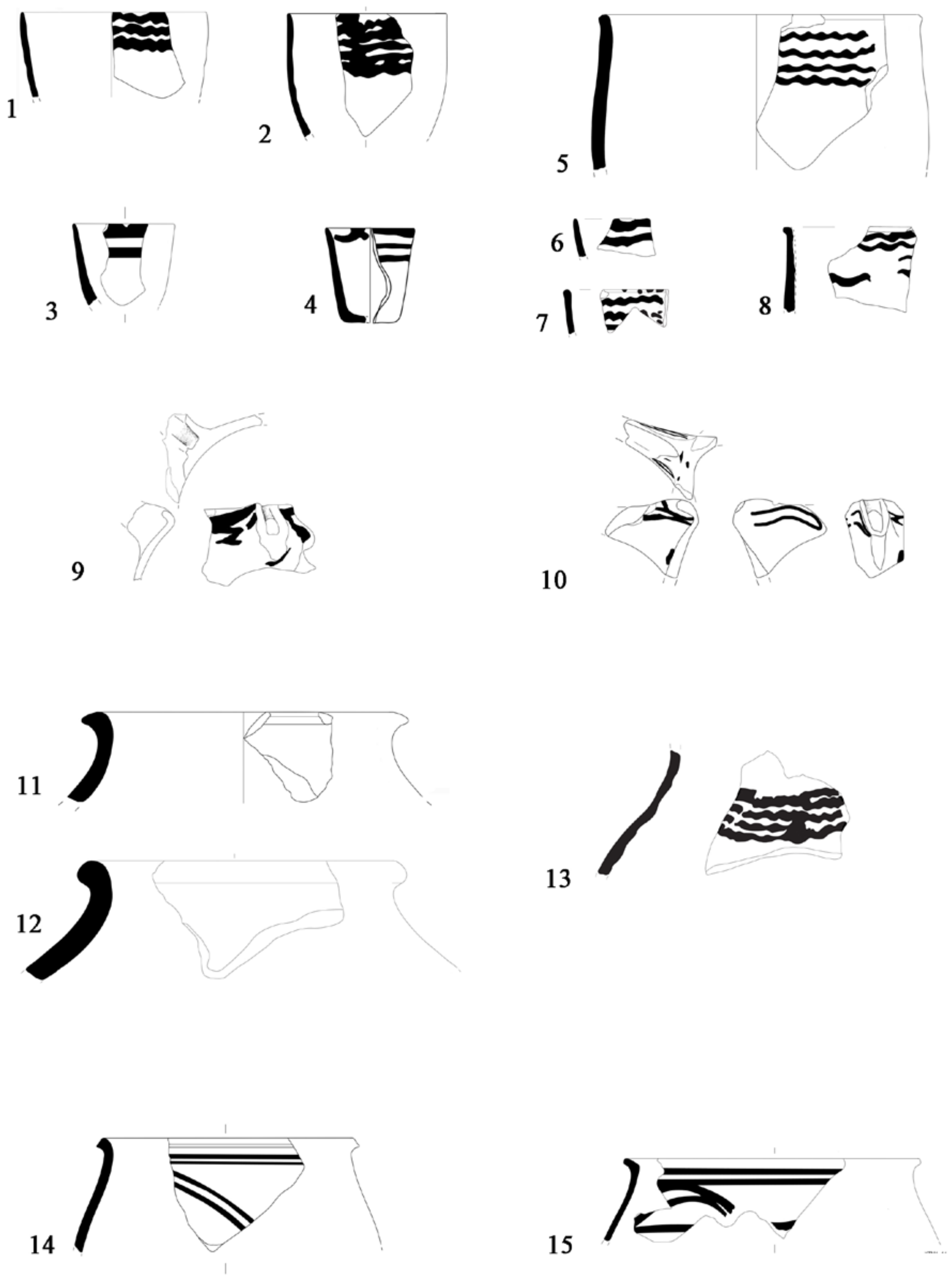
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Figure 10. *The unique seal found at al-Khutm (drawing Hélène David-Cuny).*

Conclusion

With a total height of more than 8 m (from the ancient ground level to the highest point of the tower), Al-Khutm is the most impressive monument in the Bat area and a magnificent expression of the architectural originality of the third millennium BC in Oman. Thanks to the good state of preservation of the stratigraphy, architectural features, and abundance of finds, it is now possible to update and clarify some issues about the construction of these monuments. Preliminary analysis of stratigraphic data and associated materials (especially pottery) suggests that the construction of the tower can be dated to the Umm an-Nar period (likely in the last centuries of the third millennium BC) and to a second — Wadi Suq — period characterized by constant rebuilding and restorations (likely in the first half of the second millennium BC). The radiocarbon dating on collected charcoal samples will, it is hoped, narrow this range.

At present it is difficult to determine specific functions for the Bronze Age towers of Oman as they exhibit fairly wide variability in features, settings, and periods of occupation and, most importantly, only a few of them have been excavated so far; the same can be said for Al-Khutm. Despite this, on the basis of stratigraphic data and preliminary study of collected materials, particularly the pottery assemblage, it is not considered that the tower was used for main residential purposes, but it is likely that some production and storage activities, especially in the space outside the tower, were carried out for a long period of time.

However, it is clear that, similarly to other structures spread across the Arabian Peninsula, the erection of the Al-Khutm tower was certainly connected to the creation of the surrounding oasis. In this perspective, the monumentality of the tower was aimed at expressing the prestige of the community who proudly 'tame the desert', as eloquently expressed by Serge Cleuziou and Maurizio Tosi (2007).

Acknowledgements

We would like thank H.E. Hassan b. Mohammed Al-Lawati, Special Adviser for World Heritage Sites; Sultan b. Saif Al-Bakri, Director General for Archaeology; Sultan b. Ali Al-Maqbali, Director World Heritage Sites Department; and Khamis Al-Asmi, Director Department of Excavations and Archaeological Studies for giving us the opportunity to work at such an important archaeological site in the Sultanate of Oman. Special thanks to Sulaiman Hamood Aljabri, supervisor of Bat, Al-Khutm, and Al-Ayn, for his help and collaboration throughout the season. We are very grateful to Dennys Frenez and Hélène David-Cuny for their precious contribution to the study of the decorated seal.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 97–113

The Late Iron Age of central Oman (*c.*300 BC–AD 300) — new insights from Salūt

Michele Degli Esposti, Enrica Tagliamonte, Marzia Sasso & Philip Ramorino

Summary

Ongoing investigations by the Italian Mission to Oman at the Iron Age site of Salūt are revealing the extension and complex articulation of the settlement (Qaryat Salūt), which surrounded the fortified place (Ḥiṣn Salūt) previously excavated by the same team. Although the heyday of the site can be dated to the local Early Iron Age (1300–300 BC), several pieces of evidence, which have similarities with the Late Iron Age Samad pottery, point to a continuation of its occupation beyond this period. In late 2017, the discovery of a few sherds of Fine Painted Ware, similar to those known from the Late Iron Age Pré-Islamique Récente (LIA-PIR) sites in the northern Oman peninsula, such as Mleiha and Ed-Dur, provided significant evidence for an even longer extension of the site's occupation, whose chronology will be discussed again in this paper. This is the first time such pottery has been found in residential contexts in central Oman and is also quite a distance away from where such pottery is most commonly found. This discovery therefore offers the possibility to ask new questions regarding the chronology of the transition from the Early to the Late Iron Age in the central Oman peninsula, where continuous stratigraphic sequences bridging the two periods have so far been unknown.

Keywords: Late Iron Age Oman, south-east Arabia chronology, painted ware; Pré-Islamique Récente, Samad

Previous work and open questions

In the area of the ancient oasis of Salūt, in central northern Oman,[1] Early Iron Age (EIA) remains have been the main focus of the work carried out since 2004 by the Italian Mission to Oman (IMTO). These excavations have also targeted settlement and funerary sites dated to different periods (Fig. 1) (Phillips, Condoluci & Degli Esposti 2015; Condoluci & Degli Esposti 2015; Degli Esposti 2016; Degli Esposti et al., in press). The excavations have been conducted alongside various surveys, which have highlighted the widespread human occupation of the oasis in ancient times. Specifically, these surveys have located a number of smaller EIA sites that are better considered as part of an integrated network, most likely gravitating around the main site of Salūt itself (Condoluci, Degli Esposti & Phillips 2014; Degli Esposti 2015).

On the basis of the available data, Salūt can now be described as a major site comprising a smaller, completely fortified area — a sort of acropolis — surrounded by a much more extended settlement, which occupies both the rest of the hill housing the 'acropolis' and the adjacent plain (Figs 1–2/a). To ease their recording and to be able to make a connection between them, these two intimately related components of the site have been named Ḥiṣn Salūt and Qaryat Salūt respectively (Tagliamonte & Avanzini 2018).

Excavations at Ḥiṣn Salūt were conducted between 2005 and 2014. The collected data not only revealed the site's material culture but also enabled the study of its architectural characters and the definition of its three main constructional phases (Degli Esposti & Condoluci 2018). From a historical point of view, the identification of the specific chrono-cultural development of the site has been the main result of the Ḥiṣn Salūt excavations. These results will, it is hoped, serve as a reference for central Oman, an area for which the partially diverging chronology proposed on the basis of results from sites located in the northern Oman peninsula (modern-day UAE territory; Magee 1996), does not seem to fit. At the same time, there is no reason to argue against the chronological scheme currently adopted for the UAE

[1] Salūt lies near the modern town of Bisya, Wilayah Bahla, in the Al-Dakhiliyah governorate of the Sultanate of Oman. Coordinates for Ḥiṣn Salūt: 22° 44' 50.65" N 57° 13' 58.05" E.

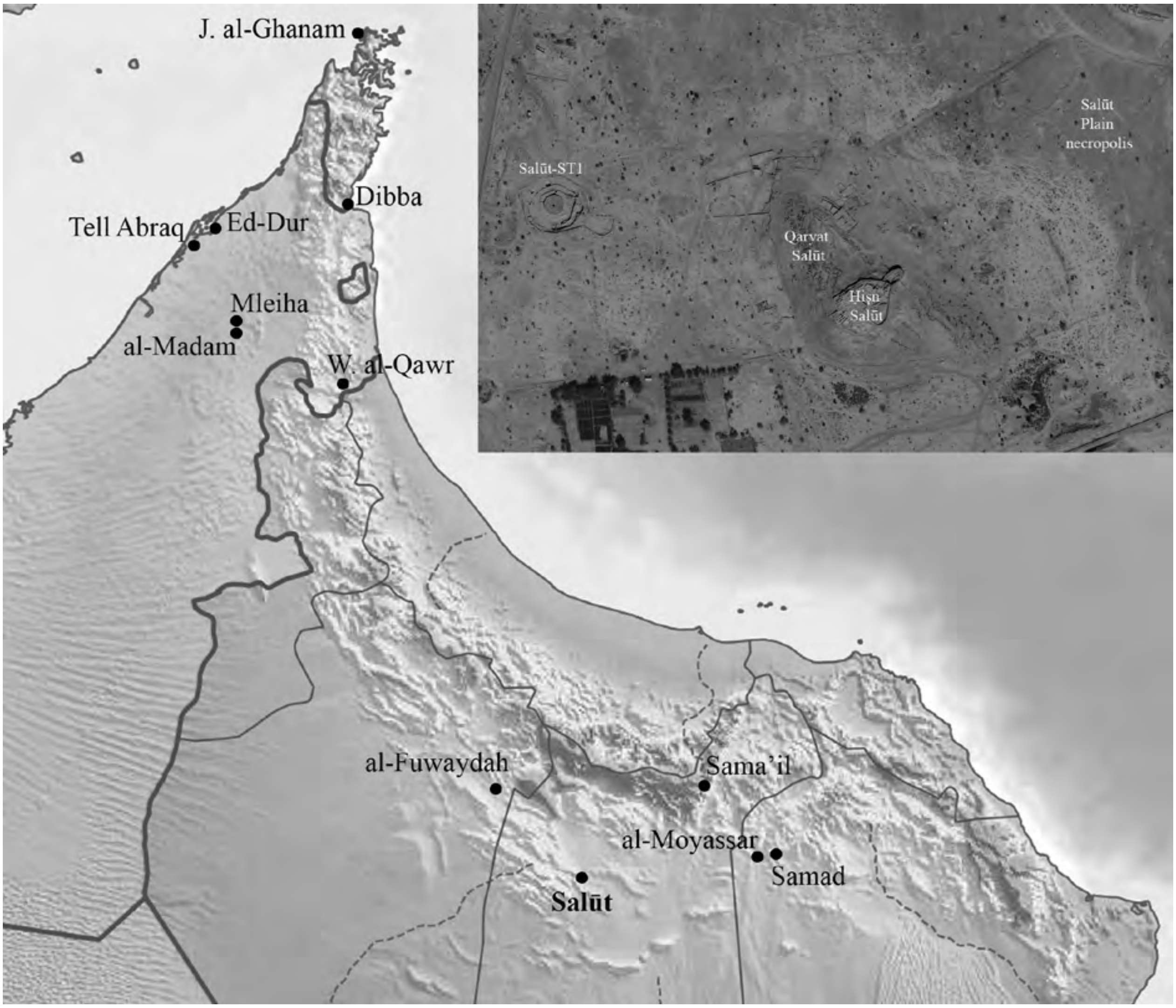

Figure 1. *The location of Salūt and other main sites mentioned in the text.* **Top right:** *a rectified aerial view of the core area of IMTO activities, showing the location of the EBA tower (ST1), the Iron Age settlement (Ḥiṣn & Qaryat Salūt), and the LIA necropolis.*

territory per se, but this cannot be extended a priori to the whole peninsula (Degli Esposti et al. 2018).

One of the most important pieces of evidence is a robust dataset of twenty-five radiocarbon dates, many of which originate from two connected stratigraphic sequences. These dates were modelled applying Bayesian constraints derived both from the stratigraphic relationships of the contexts and from the elaboration of the Matrix diagram for the site (Condoluci, Degli Esposti & Phillips 2018: fig. 40). This allowed us to define the date for the three main constructional phases mentioned above: Ḥiṣn Salūt I (1300–1050 BC), Ḥiṣn Salūt II (1050–650/600 BC), and Ḥiṣn Salūt III (650/600–300 BC) (Degli Esposti et al. 2018: 373–377). The first two phases are characterized by an identical material culture: the collected material is homogeneously comparable with the material commonly associated with the EIA II period of south-east Arabia. However, this interpretation relies on data from a limited territory and might rather express regional traits (Magee 1996;

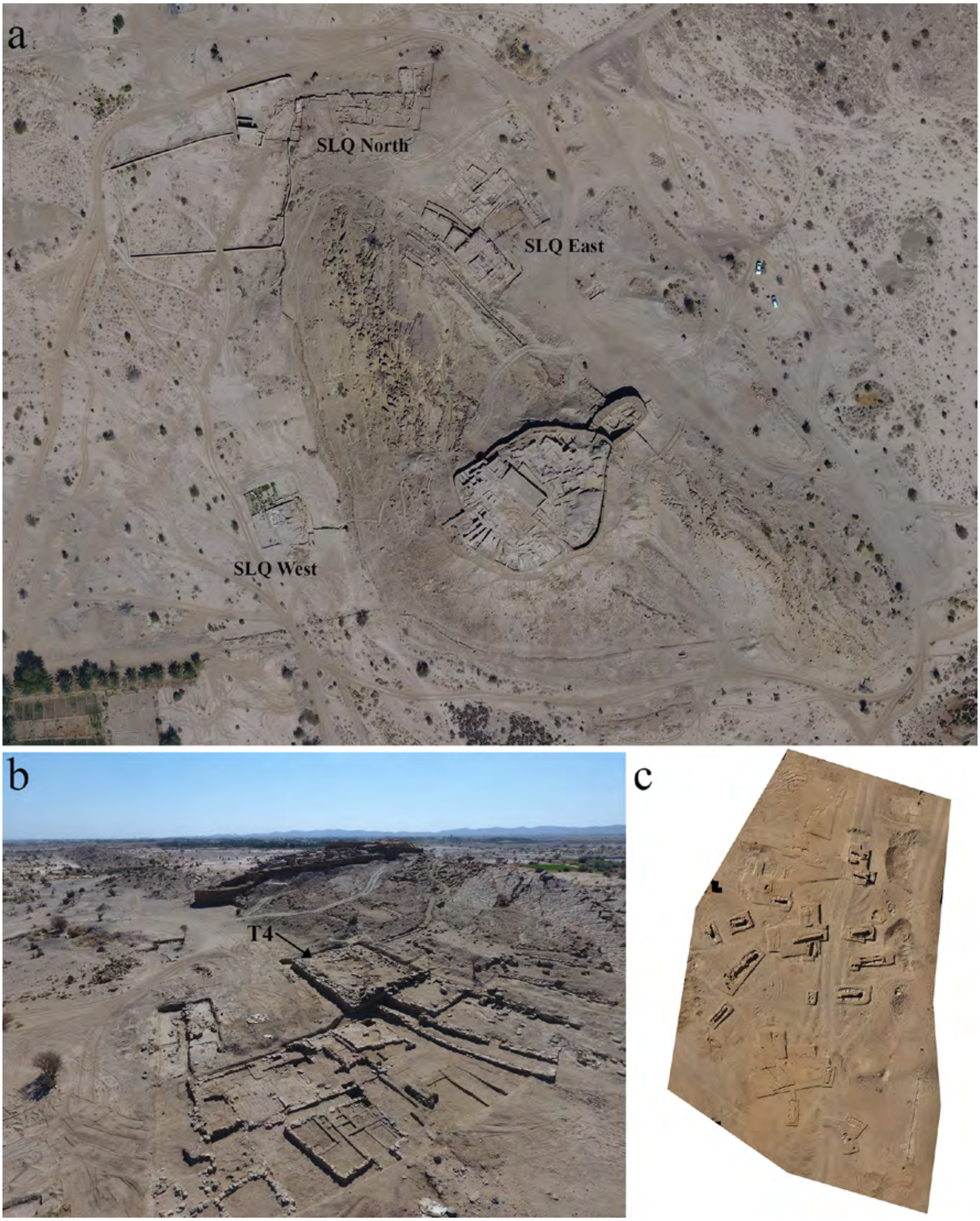

FIGURE 2. a. *A rectified aerial view of Ḥiṣn and Qaryat Salūt, showing the three main excavation areas of Qaryat Salūt;* **b.** *an aerial view of Qaryat Salūt East, showing the monumental terrace T4;* **c.** *a rectified aerial view of the Salūt Plain necropolis, March 2017.*

see discussion in Degli Esposti et al. 2018). A different type of pottery appears during the Ḥiṣn Salūt III phase, namely abundant sherds of Burnished Maroon Slip Ware (BMSW), which constitutes the main 'leit-fossil' for the EIA III period (Magee 1996; 2005). In the absence of fully reliable radiocarbon dates which could be connected with the HS III phase, the presence of BMSW sherds can help to establish the beginning of HS III to *c.*650–600 BC, but offers little support in determining its end. It therefore remains uncertain when the site was abandoned before its reoccupation during the early Islamic period, possibly around the ninth century AD.

A re-evaluation of older finds from Ḥiṣn Salūt first suggested that occupation at the site continued beyond 300 BC, a date conventionally considered as the end of the EIA III period. Additional evidence supporting this conclusion (discussed below) has already been found during excavation of the large settlement of Qaryat Salūt, begun in late 2015 (see Tagliamonte & Avanzini 2018 for the preliminary results). The aim of this paper is to provide the first discussion of the later Iron Age occupation at Salūt, in the hope of reviving interest in the archaeology and history of south-east Arabia between *c.*300 BC and AD 300. This period will be referred to here as 'Late Iron Age' (LIA), during which two different main archaeological facies can be distinguished in south-east Arabia: the Pré-Islamique Récente assemblage (LIA PIR) in the north of the Oman peninsula, and the Samad assemblage (LIA Samad) in its central and southern part (see Yule 2016: 32, fig. 1). The chronological range indicated in the title of this paper includes both facies, although the initial evidence for the LIA Samad has most recently been dated to the final part of the first millennium BC, roughly the mid-third century BC (see Yule 2016: 34, table 1), while the LIA PIR has been divided into four main phases (A–D) that date from the mid- to late third century BC to the mid-third century AD (Mouton 2014: 55) (see Fig. 10).[2] Elements with links to both facies are present at Salūt, although the chronological data they can provide do not, so far, cover this whole time span (see below).

[2] It should be stressed that these chronologies rely almost exclusively on artefact comparisons, and only on two TL dates regarding LIA Samad contexts (see Yule 2016: 35).

First hints on the LIA period at Salūt: a re-evaluation of Ḥiṣn Salūt's finds

A few potsherds discovered at Ḥiṣn Salūt first suggested that the site's occupation probably continued beyond 300 BC (see Degli Esposti et al. 2018: 380–382). Due to the apparent strong conservatism in pottery production throughout the stratigraphic sequence of the site,[3] a fabric-led distinction between LIA Samad and earlier sherds has always been extremely difficult at Salūt. The presence of deeply incised chevron decorations, comprising isolated, deeply punched hatches instead of more continuous motifs, could be a tentative indicator of a LIA date when the shape is not recognizable (Fig. 3/1–6).

When the shapes are identifiable, the presence of several sherds belonging to jars with nozzles near the base ('nozzle jar') could also support the LIA occupation hypothesis, given that parallels are known to the authors only from LIA contexts (see Degli Esposti & Condoluci 2018: 55 and pl. 8).[4] More complete examples were also found in late contexts of Qaryat Salūt (see below). Both types of evidence suggest a direct derivation from the EIA pottery tradition if the continuity of fabrics and most of the shapes are considered. Although late contexts at Ḥiṣn Salūt were not safely sealed, it must also be kept in mind that these materials were always found in association with EIA (II or III) materials, further suggesting continuity.

More significant are two unique finds from Ḥiṣn Salūt: the small handled jar in Figure 3/7 and the small jar/bottle in Figure 3/8, which fit the LIA Samad repertoire in terms of fabric, decoration (Fig. 3/7), and shape, the latter significantly absent from EIA assemblages. Good comparisons can be found in the Samad cemeteries Fig. 3/7 has a perfect parallel in one balsamarium from grave S101102 (Yule 2001: pl. 183/7), although other specimens included in the same G07.04 class have different shapes (notably Yule 2001: 66, fig. 5.4.3). Figure 3/8 resembles shape G07.08 (2001: 73; 66,

[3] Moreover, the sherds from Salūt appear to have a similar but grittier fabric than typical Samad wares (P. Yule, personal communication, 18 July 2018), looking therefore less distinguishable from the EIA sherds from the site.

[4] However, C. Phillips (personal communication, 4 August 2018) reported to the authors the presence of nozzle jars from EIA contexts in south-east Arabia. The filling of one such jar discovered in SLQ West (see below) was sampled for radiocarbon dating, results still pending.

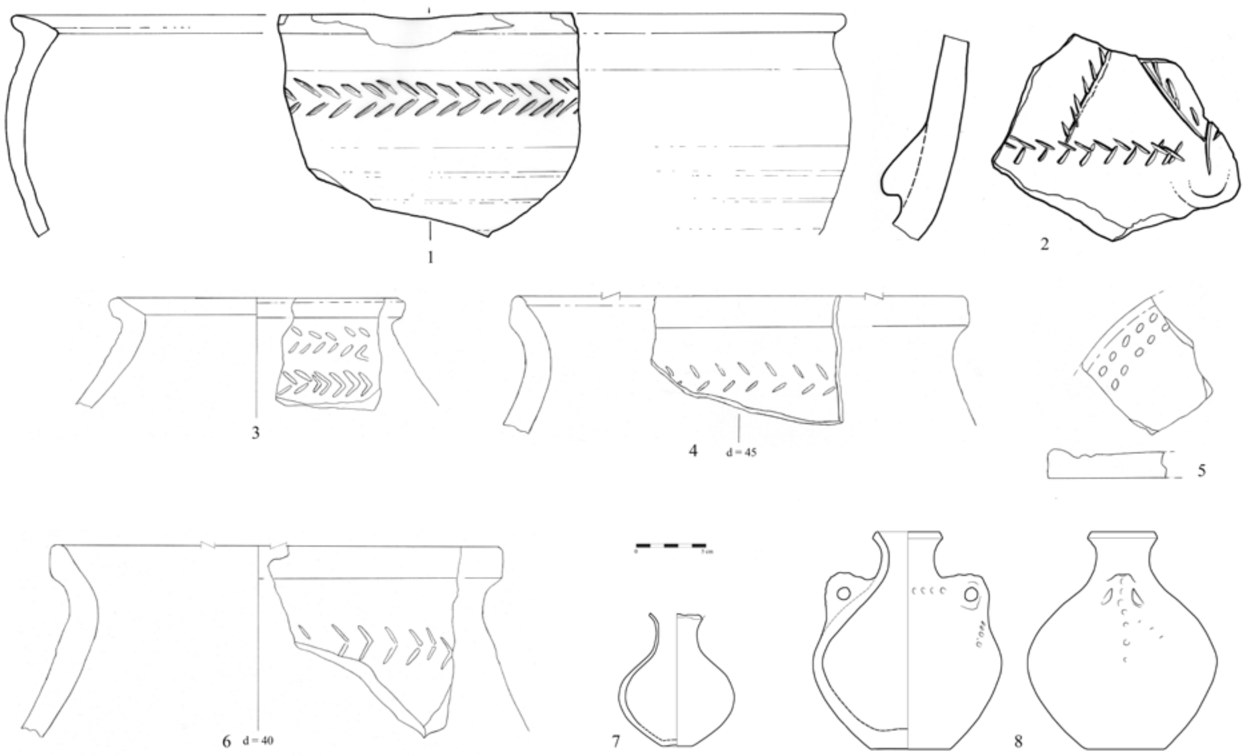

FIGURE 3. *Possible LIA Samad-type pottery from Ḥiṣn Salūt (no. 1 after Degli Esposti et al. 2018: fig. 110).*

fig. 5.4.3), although in a coarser ware that does not fit the balsamaria class. Its impressed dot decoration near the handle also resembles the one on a small bottle with vertical handles from grave S10116, also in Samad (2001: pl. 196/2).

The discovery of several lathe-turned stone vessels at Ḥiṣn Salūt was even more indicative of a late occupation of the site (Tagliamonte 2018: pls 80/57–61, 81/62–70). The use of this technique is commonly thought to have been introduced during the Late Iron Age (Mouton 1999: 22; see also Yule 2016: 39–42). Regarding the open carinated bowls 'with constricted rim' (Yule 2016: 40, 66) parallels from stratified excavations are known from PIR A levels at Mleiha (Mouton 1992 [2008]: fig. 25.8) and, significantly, from a grave at al-Fuwaydah (Yule 1999: 181, fig. 38/FU13.1), a cemetery that shares all the main characteristics with the one recently excavated in the Salūt Plain (see below). Conversely, the remaining shapes have more parallels in the LIA Samad sites of central Oman than in the north (see Yule 2016: figs 3–4) where they date back to a significantly later period, the PIR C period (first–second century AD; see Mouton 1992 [2008]: figs 93, 94/1–3). The evidence from Ḥiṣn Salūt where pottery, potentially contemporaneous with the stone vessels, was until recently deemed to be extremely scarce, initially induced more caution, and the working hypothesis of a possible earlier introduction of the wheel in stone-working was put forward (see Tagliamonte 2018: 286–287). The growing evidence of a LIA occupation at the site, discussed below, suggests that this hypothesis should be rejected.

Excavations at Qaryat Salūt: bridging the Early and Late Iron Age?

In late 2015, an extensive excavation of what has been identified as the settlement surrounding Ḥiṣn Salūt, hence named Qaryat Salūt, was begun (Tagliamonte & Avanzini 2018).

The settlement occupies the entire hill, with an extensive stone-built terrace system developing over the whole eastern, northern, and western slopes (Fig. 2/a). To the south of Ḥiṣn Salūt, the situation is less clear due to the impact of reoccupation during middle Islamic times (around the twelfth to thirteenth century, but possibly even later), which probably obliterated earlier structures. Numerous Iron Age buildings, separated by narrow streets, occupy the plain surrounding the hill (Fig. 2).

No traces of buildings were revealed on the investigated terraces. However, a test trench dug through the deposits covering the largest of these terraces revealed the presence of manured soil at the bottom of the sequence. This is not surprising when one considers the numerous examples of modern-day houses located on the lower slopes of wadi valleys, with one or more small terrace-gardens where palm trees and/or other cultivars are grown. Despite its limited extension, the cultivation of these ancient terraces would nonetheless provide temporary support for the population during the possible floods of the surrounding plain, where more extensive cultivations were likely located.

The residential part of the settlement lay at the foot of the hill, built on the flat ground. So far, two main sectors of the settlement have been unearthed, one to the east of the hill and one to the north. To the west, a large trench has revealed a complex stratigraphic sequence with several rebuilding phases. In both main sectors, narrow streets and at least one open area (a square?) were revealed. It is also clear that the settlement underwent several phases of restructuring, which is the reason their actual layout remains difficult to define. A key feature of the site is a complex drainage system aimed at preventing the damage caused by run-off after heavy rain, an issue that is problematic for the restored parts of Ḥiṣn Salūt today. This channel network serves both the slope terraces and the lower settlement, and comprises both simple dug-out runnels and stone-built drains.

The excavation of Qaryat Salūt is providing evidence on the basis of which the chronology of the site's abandonment can be further discussed. As mentioned, ceramic and soft-stone artefacts are being collected in growing numbers, for which good parallels can be found in the ceramic assemblage that characterizes the LIA Samad culture. More significantly, such LIA ceramic and stone vessels appear to be associated with some of the later building phases identified in different areas of the site, and do not appear in lower levels. While such a trend was dimly perceivable at Ḥiṣn Salūt, at Qaryat Salūt the related contexts are much more safely delimited. This is thus promising from the perspective of achieving a stratified sequence including both EIA and the LIA levels.

The area where evidence of LIA materials has so far been more abundant is the western sector of the site (SLQ West). Here, the remains of what was thought to be a small, completely ruined country mosque, or a simpler platform for occasional prayer (B13), are being investigated.

Excavations in SLQ West: additional data on LIA occupation

Excavations in SLQ West revealed a sequence of built structures that spans the EIA up to the late Islamic period, with the main building B13 built over the ancient remains in the central part of the trench. The removal of B13 and the coeval features was recently completed, allowing a deeper stratigraphic investigation. Among the collected materials, several appear to be datable to the LIA, either Samad or PIR.

The clearest indications of a late occupation come from several lathe-turned soft-stone vessels whose shapes, colours, and decorations mirror those discovered at Ḥiṣn Salūt mentioned above, particularly regarding carinated (Fig. 4/1–2) and open bowls (Fig. 4/5–7). Similar bowls to those discovered at SLQ West are also known from Ed-dur (Zutterman 2003: 83, fig. 2/6,11), Mleiha (e.g. Mouton 1992 [2008]: figs 44/2, 93/5,7), Dibba al-Hisn (Jasim & Yousif 2014: fig. 40/1–10), and various Samad LIA contexts (e.g. Yule 2016: 41, fig. 4). One small cylindrical beaker (or box) with a pointed rim (F205) is also attested (Fig. 4/4); the stone colour is lighter than the colour of the other stone vessels considered here, and it shows a marked lathe-turned decoration of parallel grooves and ribs.

This shape corresponds to type Sg36 in P. Yule's classification (2001: 130, fig. 5.19.2; 135), and is known from grave S3004 at Samad al-Shan, while another specimen supposedly comes from the site of al-Juba (Yule & Pariselle 2016: 156, 159 fig. 4/4). Grave S3004 is reputed to date early in the Samad LIA sequence (Yule 2016: 66). F205 from SLQ West was discovered in connection with a badly preserved surface (SU731) that was possibly the boundary between the Islamic levels and the earlier levels in the stratigraphy of the area.

Figure 4. 1–7. *LIA Samad/PIR soft-stone vessels from Qaryat Salūt West;* **a.** *a deeply punched decoration jar;* **b.** *the base of a nozzle jar with detail of the nozzle's punched decoration.*

Two small perforated soft-stone lids were found in association with the aforementioned cylindrical beakers from Samad al-Shan and al-Juba (Yule 2001: pl. 426/5; Yule & Pariselle 2016: 156, 159 fig. 4/4). They provide perfect comparisons for two lids found at SLQ West (Fig. 4/3). Apart from the overall shape, varying slightly one from the other, both are pierced by a circular hole. On the bottom side, the hole is enclosed in a squared socket. Four other lathe-turned stone vessel fragments, all belonging to open shapes, were discovered in the northern sector of Qaryat Salūt. Contexts here are nearly always mixed, but Iron Age material widely outnumbers later items. Simple linear decoration and stone quality agree with the general characteristics of stone vessel production during the LIA (both Samad and PIR), with a specific mention of the fragment of a carinated bowl, similar to the most complete examples discussed above.

Pottery which is similar to LIA material, albeit not abundant, was also attested in the mixed contexts of SLQ West. Yellow-goldish or whitish glazed pottery with light grey fabric — comparable with vessels found in the Salūt Plain cemetery (see below) — are present but unfortunately only in small fragments. What was more relevant was the discovery, still *in situ*, of the base of a fragmentary 'nozzle jar' and of a complete storage jar characterized by deeply punched decoration ridges (Fig. 4/a–b). Charcoal samples were collected from the contents of the 'nozzle jar' and will help to clarify its date. So far, a comparable vat with nozzle was discovered from the ruins of house M4304 at al-Moyassar (Maysar) (Yule 2016: 66, and fig. 31), a site dated to the early LIA Samad period (2016: 53–55). Other examples are known from Mleiha, Samad al-Shan, and Izki, also dated to the LIA (see Degli Esposti & Condoluci 2018: 55, with references).

'Namord' ware at Salūt?

A detailed description of Qaryat Salūt and its complex stratigraphy is beyond the scope of this paper. However, a specific context deserves a brief mention, as relevant evidence was collected there that provides information on Salūt's latest occupation. The foot of the eastern slope is dominated by the monumental terrace T4, which extends onto the plain (Fig. 2/b). The terrace was erected reusing and partly obliterating the remains of an earlier curved wall, which still needs further investigation. A noticeable feature of T4 is the presence of a stone-built drain that runs through the southern perimeter wall, exiting through a large passage and then flowing into the plain in a west–east direction. This drain most probably belongs to the same constructional phase as the terrace perimeter wall through which it flows.

The earlier contexts excavated inside T4 are connected to the collapse of the curved wall and a subsequent levelling with additional loam deposits. From these deposits, only potsherds which fit the EIA assemblage (including the EIA III period[5]) of the site were collected. Very few, though extremely relevant, sherds were collected from the deposits that cover the drain. These sherds are related to the last phases of occupation of T4 but differ significantly from the rest of the assemblage (Fig. 5).

Similar rare fragments were also discovered in the eastern part of the site, there also from late contexts. The best parallel for these sherds is found in the Fine Painted Ware initially reported from the early LIA PIR phases at Mleiha, specifically from the levels dated to the PIR B and C periods, dated to between the second half of the second century BC and the mid-second century AD (Mouton 1992 [2008]: fig. 35/13–14, 16–18; 64/5–16). Consistently, the aforementioned Mleiha parallels cannot be compared to the Fine Orange Painted Ware, which appears at the same site in PIR D contexts, as especially made clear by the absence of the burnished surface that characterizes the latter. Although sherds of Fine Orange Painted Ware had already been reported, for example from Jazirat al-Ghanam (de Cardi 1972), these two wares were subsumed by M. Sajjadi under the broadly inclusive denomination of Namord ware, proposed on the basis of his south-eastern Iran survey results (Sajjadi 1989). However, significant inconsistence between the distinct characters of the earlier, Fine Orange Ware and such a broad type including the Fine Orange Painted Ware, were underlined by M. Mouton in his discussion of Mleiha excavations (1992 [2008]: 128).

The different characteristics of the two wares appear, nevertheless, to be mirrored in the more recently proposed distinction between an early (= Fine Painted) and a late (= Fine Orange Painted) Namord ware outlined

[5] To determine whether LIA Samad sherds are also represented in these early layers, further analysis of the material is needed.

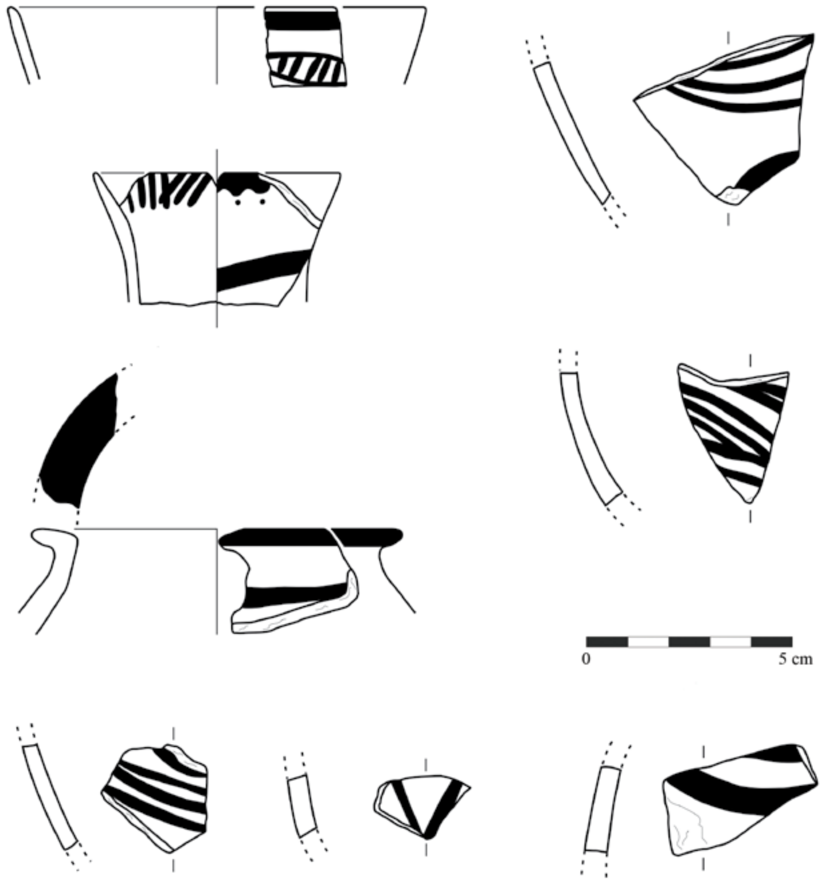

Figure 5. *Sherds of early Namord ware discovered at Qaryat Salūt.*

by D.T. Potts (1998) on the basis of their stratigraphic occurrence at a few south-east Arabian sites, namely Tell Abraq, Ed-Dur, and Mleiha itself. The use of one and the same label underlines the fact that the late version of this ware was derived from an earlier version, together with the fact that the production centres are reputed to be located in Iran (e.g. Mouton 1992 [2008]: 128; Williamson 1972: 99).[6] Early Namord ware was also recovered in substantial quantity from the excavation of a settlement site at Dibba al- Ḥiṣn (Jasim & Yousif 2014: 60–62 and figs 30–32).

Regardless of the adopted terminology, Mleiha Fine Painted Ware (or early Namord) can be dated between the second half of the second century BC and the first–second century AD (Mouton 1999: 19; Potts 1998: 211). The presence of this pottery at Salut therefore provides a significant piece of evidence in favour of a much longer duration of the site than previously reported. This is consistent with the possible PIR C chronology of some of the soft-stone vessels discussed above, and with the possible presence of LIA Samad-type pottery.

It should be stressed here that the sherds of Fine Painted Ware collected inside T4 came from sealed contexts, buried under strongly compacted layers of decayed mud-brick clay. Nevertheless, their paucity could possibly be dismissed as an outcome of a later and ephemeral occupation of the site, not necessarily related to a significant continuation of its life.

LIA grave-goods from the north: the discovery of the Salūt Plain necropolis

The recent discovery of a new necropolis located on the plain to the east of Qaryat Salūt (referred to as Salūt Plain) supports a different reconstruction,

[6] Additional evidence of this origin is the suggested derivation of Namord ware from the earlier Londo ware (Sajjadi 1989: 36; Mouton 1992 [2008]: 128).

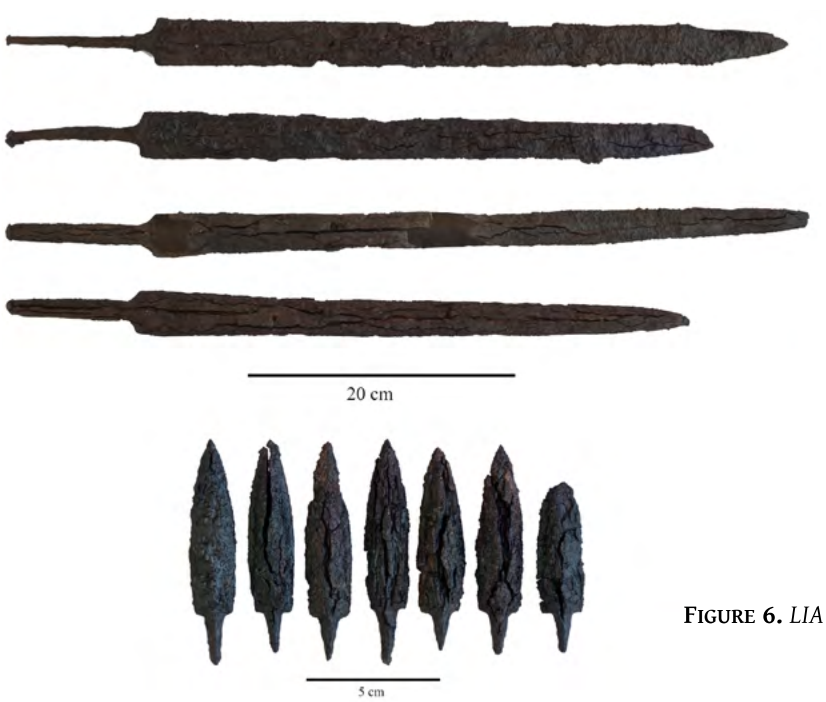

Figure 6. *LIA Iron swords and arrowheads from the Salūt Plain necropolis.*

involving a substantial and longer continuity in the site's occupation. Exotic artefacts from the investigated tombs also attest to the renewed inclusion of the oasis of Salūt into an intra-regional trade network, the evidence for which was lacking during the EIA period. Although heavily plundered, the grave-goods collected from this cemetery show a remarkable similarity with material known from the main LIA PIR sites of Mleiha in the Sharjah Emirate and Ed-Dur on the coast of Umm al-Quwain. At the same time, some of the collected grave-goods are more similar to the LIA Samad materials from central Oman. As the discovery of this cemetery occurred very recently, the full documentation of the finds its still at an extremely preliminary stage. Therefore only the most decisive parallels, useful to pinpoint the graves' chronology, will be mentioned here.[7]

So far, twenty-three graves have been excavated out of the twenty-nine identified (see Fig. 2/c), including a severely disturbed camel burial. The full extent of the cemetery still needs to be understood and it is evident that at least one part of the cemetery was established on top of older buried structures associated with EIA pottery. The most abundant class of materials represented in the tombs are weapons such as iron arrowheads and swords (Fig. 6), a common occurrence at Mleiha, Ed-Dur, and Samad al-Shan (e.g. Mouton 1992 [2008]; Haerinck 2001; Yule 2001). Arrowheads usually occur in large groups, which suggests they were deposited (as complete arrows) inside quivers that have now disappeared.

Pottery comprises glazed vessels that can be linked with Parthian productions, including jars and pilgrim flasks (Fig. 7/a) (e.g. Haerinck 1983: fig. 4/4; Hannestad 1983: pl. 31). Specimens of the latter were also found with a shape and fabric that find parallels in the LIA Samad assemblage (e.g. Yule 2001: pls 10, 77/1) (Fig. 7/b–d).

The coexistence of items belonging to one or other of the two LIA cultural assemblages becomes even more evident with the discovery of a complete flask made in a characteristic Samad-type fabric and bearing an incised mark near the neck (Fig. 7/d). This flask was discovered in the same tomb as a set of copper-based items, which are usually interpreted as being linked with a ceremonial banquet (e.g. Haerinck 1994), together with a simple bowl (six have been recovered from the cemetery so far), a decorated ladle with a zoomorphic handle, and a deep bowl with a strainer below the rim. A horse protome-shaped spout was attached to the strainer (Fig. 8).

[7] Drawings of the grave-goods also need to be completed.

FIGURE 7. a. *Glazed and* **b.** *unglazed pilgrim flasks from the Salūt Plain necropolis;* **c–d.** *flattened globular jars without handles;* **d.** *a globular jar bearing a graffito on the shoulder.*

FIGURE 8. *View of grave SLP – GP19 with the surviving grave-goods, which include two iron swords, a bronze drinking set (a deep bowl with strainer, a horse-protome spout, and a ladle are shown on the right, after restoration), and a Samad-type flask (as shown in Fig. 7/d).*

This kind of artefact, in its complete form, has only one parallel so far at Ed-Dur (Haerinck 1994: fig. 4). From the same site, a detached horse-shaped spout was found in a tomb dated to the PIR C period (Mouton 1992 [2008]: fig. 91/4), while another one from Mleiha came from a context dated to the PIR B period (1992 [2008]: fig. 43/5). Detached spouts, including specimens in the shape of a bull's head, are known from other sites and are all dated to the LIA period, but remain limited in number.[8] The discovery of two other similar spouts from two other graves at Salūt Plain is therefore even more exceptional: while one represents — although in a much more skilfully executed variant — the horse motif (Fig. 9/a), the other is a *unicum*, and bears a hybrid human/animal representation similar to a sphinx[9] (Fig. 9/b). Finally, the large number of mosaic glass ribbed bowls deserves a mention (Fig. 9/c–d). The bowls bear witness to the arrival of peripheral Roman production (probably Levantine) to inland Oman, and at the same time offer a strong chronologic benchmark, as they can be dated to the end of the first century BC and the mid-first century AD (Whitehouse 1998: 64; 2000: 96).

It should be mentioned here that no sherd of Fine Painted (or early Namord) ware has so far been recovered from the tombs of the Salūt Plain cemetery. This is consistent with the suggestion that at Ed-Dur such ware was more common in domestic than in burial contexts (Potts 1998: 212).

The presence of LIA Samad objects in these tombs, together with LIA PIR imports, strongly suggests this cemetery was the place where people living at Qaryat Salūt (and Ḥiṣn) were burying their dead well after 300 BC, which thus far has been thought to be the final date for the Iron Age occupation at Salūt. However, it is now clear that the site survived at least 300 to 400 years longer and that this survival was not just the residual occupation of decaying older structures. Conversely, remarkable restructuring probably took place during this period and production activities (i.e. copper working) continued, while at least one part of the population was capable of attracting foreign, luxury goods, which they could use to display their wealth (and rank?)[10] in their eternal resting places.

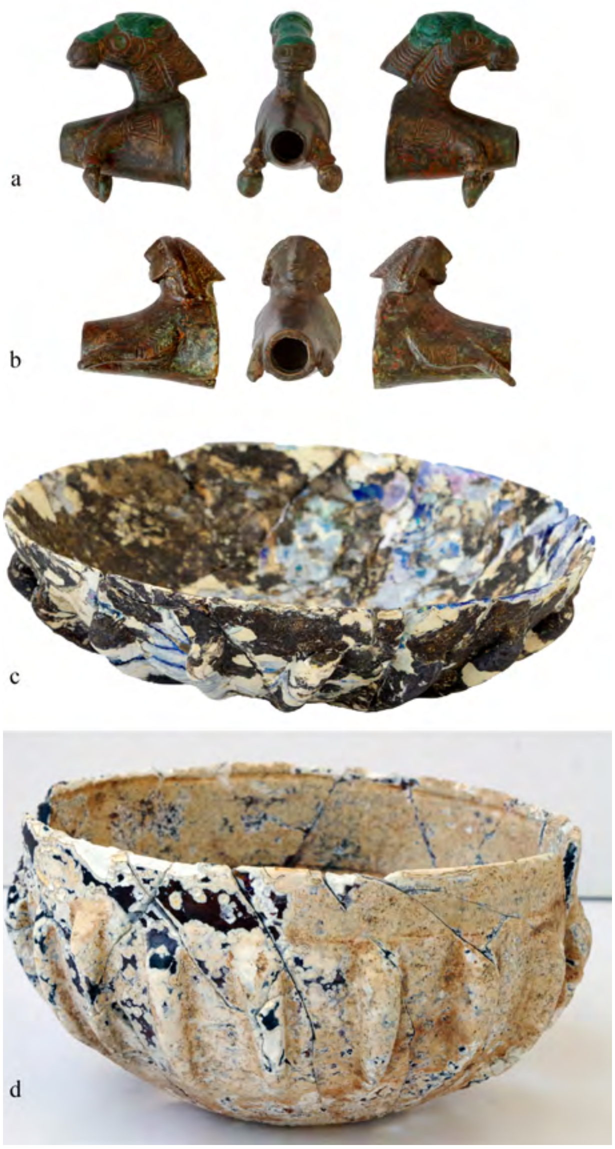

FIGURE 9. a. *Horse-protome and* **b.** *possible sphinx spouts;* **c–d.** *two examples of mosaic glass ribbed bowls from the Salūt Plain necropolis.*

[8] Horse-shaped spouts were discovered at Sumhuram (Pavan 2008: 395, pl. 31/6); in a grave at al-Fuwaydah and in another one at Sama'il (Yule 2001: pls 240/7, 534/2); at Jabal Kanzan (Potts 1989: 74–75, figs 188–119); at Qasr-i Nabu in south-east Iran (Whitcomb 1985: 173, fig. 73/k). New specimens have recently been found at Mleiha (B. Overlaet, personal communication, 4 August 2018).

[9] A comparison with centaurs engraved on the bronze bowls from Mleiha has been suggested (B. Overlaet, personal communication, 4 August 2018), but the peculiar headdress of the specimen from the Salūt Plain necropolis, and the fact that hooves are not so carefully depicted as they are on horse protomes, seem to exclude it.

[10] This issue will only be tackled when all the excavated grave-goods are restored and documented, offering the chance to test their

Salūt from the EIA to the LIA: some preliminary remarks

The chronological clues provided by the artefact comparisons mentioned above can be combined in order to obtain a first rough picture illustrating the development of Salūt occupation after *c*.300 BC. To sum up, the items discovered in the settlement (Ḥiṣn and Qaryat Salūt) speak of a possible continuity in occupation, especially the fact that, possibly, LIA artefacts bear a close resemblance to EIA materials, such as the punched-decoration jars and 'nozzle jars'. Carinated soft-stone bowls and other lathe-turned soft-stone vessels, occurring both in early LIA PIR and LIA Samad contexts, so far provide the strongest support to this interpretation.

The very preliminary study of the Salūt Plain necropolis's grave-goods has also provided elements of continuity in occupation from the EIA onwards. However, those datable to the second–first century BC and later are more abundant, which would thus, in theory, imply a gap of more than a century after the conventionally accepted end date of the EIA III period at around 300 BC (Fig. 10/b).

Overall, Salūt's occupation appears to have lasted remarkably longer after 300 BC than previously supposed. The most reliable indicators, that is, materials which have stratified parallels from sites in the UAE, found both in the settlement and in the Salūt Plain necropolis, suggest that it might have lasted as long as until the mid-second century AD, although an even longer duration cannot be excluded.

Indeed, the scarce LIA Samad-style pottery (i.e. shapes that are completely absent during the EIA) is the element that provides the least secure chronological indications. Absolute dates for contexts belonging to these facies are limited to one single TL determination of 130±150 BC, obtained from an *in situ* jar discovered at the hill fort of al-Moyassar M34 (most recently, Wagner & Yule 2015: table 5). At the same time, only one date of 280±170 BC, from al-Moyassar M42, can be referred to the very final phases of the EIA (2015). Absolute dating could therefore suggest a hiatus between the two periods, although with an extremely limited dataset of dates which, moreover, have a remarkable standard deviation. This situation clearly blurs the indication of continuity provided by this type of pottery when found in occupational contexts at Salūt.

The possible presence of a hiatus between the final part of the EIA and the beginning of the LIA remains a matter of debate, particularly due to the absence of continuous stratigraphic sequences bridging the two periods. So far, the only known large settlement dated to the centuries immediately following the end of the EIA was Mleiha. Here at the bottom of the stratigraphic sequence, scattered potsherds were found. These may tentatively be dated to the EIA but they also have parallels in the later assemblage. However, their context is separated from the initial establishment of the site (PIR A period) by a relevant accumulation of wind-blown sand (Mouton 2014: 52), for which an estimated deposition time is lacking.

The typological parallels for the PIR A assemblage determine its starting date around the mid- to late third century BC (most recently, Mouton 2014: 52, 55), which is significantly earlier than the available TL date for the LIA Samad facies. Continuity from the EIA to the LIA was suggested for the EIA III site of Rafaq 2 in Wādī al-Qawr on the basis of a few features typical of the PIR A assemblage observed in the pottery (2014: 45–46), as well as for other EIA III sites, including al-Madam in the Emirate of Sharjah (Benoist, Cordoba & Mouton 1997: 70). However, agreement on this issue has not been reached (e.g. Yule 2016: 64–68).

On the other hand, the stratigraphy revealed at Qaryat Salūt shows no evidence at all for a gap. Although the precise phasing of different building activities still needs to be elaborated, the events appear to be recorded within closely packed, relatively thin deposits, with no intervening layer of abandonment-related, wind-blown sand or relevant debris accumulation. Salūt might thus represent the first site in south-east Arabia offering the possibility of studying a continuous stratigraphic sequence that bridges the EIA and LIA periods. A series of samples have been submitted for radiocarbon dating, which will hopefully contribute further elements supporting or confuting this hypothetical reconstruction (see n. 4).

At present, at Salūt a stratigraphy indicating continuous occupation must be associated with a

correlation with the models proposed by P. Yule and M. Kunter (see Yule 2018 for a most recent summary) even in the absence of skeletal remains.

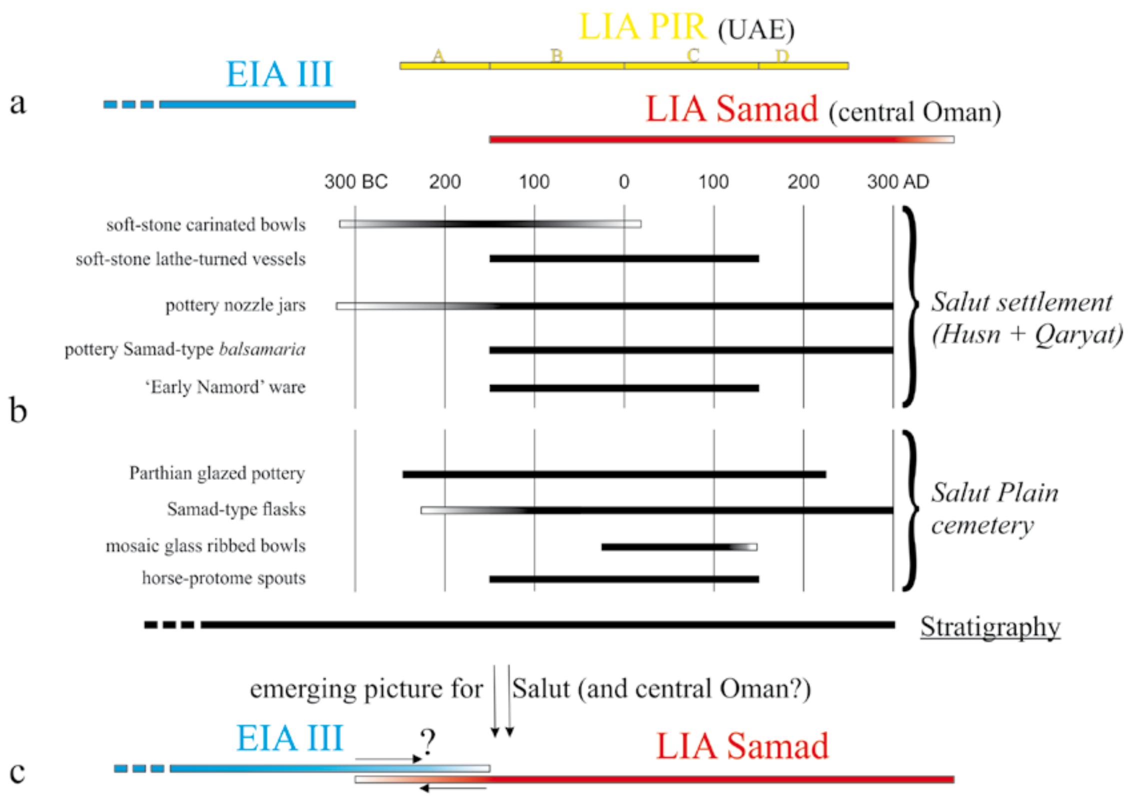

Figure 10. *A schematic diagram illustrating the current understanding of Salūt's late chronology:* **a.** *the more usually reported dates for the EIA III period (starting beyond the graph's limit) and for the two LIA facies discussed in the text;* **b.** *the chronological indications provided by artefact comparisons, from both the Salūt settlement and the Salūt Plain necropolis, and from the settlement's stratigraphy; later boundaries for Samad-type pottery have not been safely established;* **c.** *the resulting picture and the two opposing solutions for filling the apparent gap between EIA III and LIA facies in central Oman, which is not mirrored in the stratigraphic record at Salūt.*

material culture that could suggest the existence of a short break in the sequence, an uncertainty mainly due to the debated chronology for the beginning of the LIA Samad period (see Yule 2016: 34–35, table 1). Overall, this indicates that a gradual transition from the EIA to the LIA period is conceivable. The issue then is: how does one fill the chronological gap possibly indicated at the material culture level, and hinted at by the few absolute dates available for the LIA Samad facies, but apparently not reflected by Salūt's stratigraphy? One faces two options (Fig. 10/c): envisaging a longer duration of EIA (III) characters, or an introduction of characteristic LIA Samad traits already around 300 BC, the latter being implicit in current use (see Yule 2016: 35).

Among other issues connected to the settlement layout, crafts, and subsistence strategies, the continuation of the work at Qaryat Salūt will hopefully provide better stratigraphic evidence to illuminate this point, making Salūt a key site for the Iron Age chronology of the region from the very beginning of its early period to the first centuries of the Christian era.

Acknowledgements

The authors warmly thank Prof. A. Avanzini, director of the Italian Mission to Oman (IMTO, University of Pisa – Dipartimento di Civiltà e Forme del Sapere), for allowing the study of the site's stratigraphy and material culture.

Excavations at Salūt are made possible by the invaluable support of the Office of HE the Adviser to HM the Sultan for Cultural Affairs (Muscat – Sultanate of Oman).

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Proceedings of the Seminar for Arabian Studies 49 (2019): 115–127

The Bronze Age cultural landscape of Wādī al-Zahaimi

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Summary

On the north bank of Wādī al-Zahaimi, east of the town of Liwaʾ in northern Oman, a remarkably well-preserved Bronze Age cultural landscape was discovered and documented in January 2018 by the Wadi al-Jizzi Archaeological Project. It includes first, a well-preserved Umm an-Nar settlement with two circular tombs, a possible watchtower, and imported pottery from the Indus and Dilmun; second, a large transitional cemetery, with about 170 tombs dating to the late Umm an-Nar and early Wadi Suq periods, which has striking parallels with the famous linear alignments from ʿAsimah; and third, a small Wadi Suq settlement with stone-built houses. In this paper, we present this well-preserved Bronze Age cultural landscape and its relevance to our understanding of the late third and early second millennia BC in south-eastern Arabia.

Keywords: Umm an-Nar, Wadi Suq, domestic architecture, funerary traditions, prehistoric pottery

Introduction

In this paper we present new data on remains from the Umm an-Nar and Wadi Suq periods that were documented along the north bank of Wādī al-Zahaimi. Wādī al-Zahaimi is located in the north of Oman, in the hinterlands of the town of Liwaʾ. In this remote part of the Bāṭinah, a remarkably well-preserved cultural landscape of the Bronze Age was encountered, and we will present a summary of the sites and their associated structures here.

These data were obtained in the course of the January 2018 season of the Wadi al-Jizzi Archaeological Project. This is a systematic and multi-period survey of an area of about 1800 km^2 in the hinterlands of modern Ṣuḥar. Over the past five seasons we have focused on the documentation of two wadi corridors connecting the coast to the mountains: Wādī Sūq/Wādī al-Jīzī, on the one hand, and Wādī Fizḥ/Wādī al-Zahaimi, on the other. The archaeological remains of these two corridors differ markedly: whereas historic sites predominate along the Wādī Sūq/Wādī al-Jīzī corridor, there is a rich and well-preserved prehistoric landscape along Wādī Fizḥ/Wādī al-Zahaimi, and we have reported on some of these data previously (Düring & Olijdam 2015; Düring, Olijdam & Botan 2017; Düring & Botan 2018).

The area along the north bank of Wādī al-Zahaimi that is discussed in this contribution is located between the village of Fizḥ to the east, and the hamlet of Qaṭṭārīyah, located to the west at the foot of the al-Ḥajar mountains, and is about 4.5 km in length. At its centre is a flat alluvial terrain fed by various minor wadi systems, which is probably the main reason this landscape was selected for occupation in the past. Within this part of Wādī al-Zahaimi we have encountered a series of sites (Fig. 1) dating to the Umm an-Nar period; the transition between the Umm an-Nar and the Wadi Suq; the Wadi Suq Period; the Iron Age, including the cemetery at site 50/51 (Düring, Olijdam & Botan 2017); and the Islamic period (middle to late Islamic). In this study the focus is on the Bronze Age remains; evidence from the later periods will be addressed in future publications.

The Umm an-Nar settlement

A substantial Umm an-Nar settlement was found at a site that we labelled WAJAP-S73. It is located in a depression due north of Wādī al-Zahaimi that has good agricultural soils and captures moisture from the surrounding hills. In the Islamic period a *qanāt*-type *falaj* was built to irrigate this depression with water captured from Wādī al-Zahaimi upstream, and it is unclear whether the area could have been farmed in the Umm an-Nar period and if so, how it might have been irrigated.

Site 73 includes various components. Towards Wādī al-Zahaimi there are two substantial slag concentrations

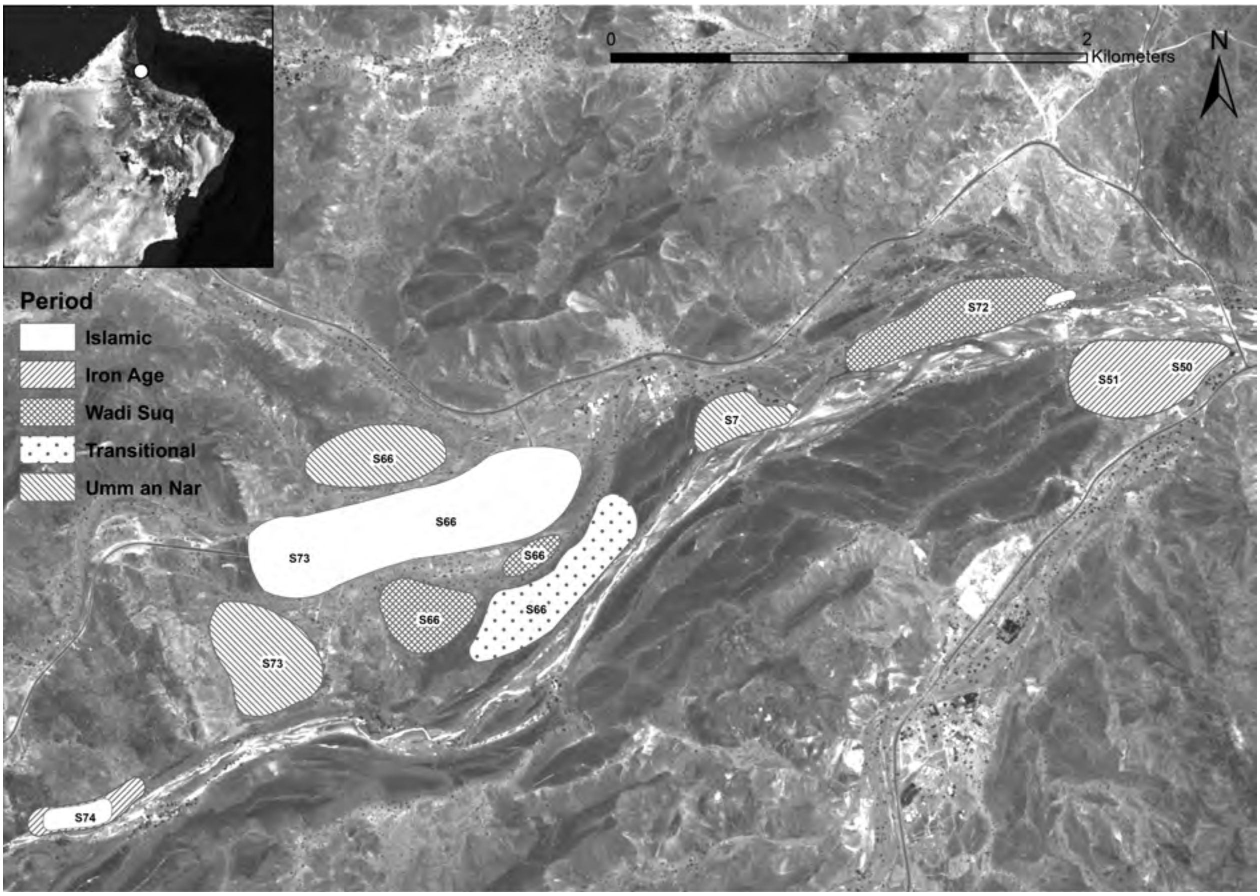

FIGURE 1. *A map showing the distribution of archaeological sites in Wādī al-Zahaimi as documented during the WAJAP 2018 season.*

that are most likely dated to the Bronze Age (Umm an-Nar or Wadi Suq periods). This interpretation is based on circumstantial evidence, consisting of the complete absence of associated Iron Age or Islamic pottery, and the morphology of the slag, which differs from the typical bowl slags that can be dated to the late antique and Islamic periods (Weisgerber 1987). The slag at Site 73 did not contain any charcoal and therefore cannot be dated with ^{14}C. The site also has two small tombs, a possible watchtower, an Umm an-Nar settlement, and a smaller Wadi Suq settlement (Fig. 2).

The Umm an-Nar settlement has a core area in which buildings are clustered relatively close to one another, but there are also numerous buildings that are spread out across a larger area (Fig. 3). Some of these are in secluded locations and might not have been visible from the central area of the settlement. The buildings are not arranged in any clear orientation and do not have a specific alignment — there are no streets or courtyards around which buildings are placed. Most buildings are located on sloping terrain, with their entrances seemingly on the lower side of the building, although there are also some buildings in flat areas. No standard orientation of the buildings can be determined, instead the orientations generally appear to be determined by the terrain of the settlement.

In total about thirty buildings were documented that can be dated to the Umm an-Nar period. Their walls are double faced, about 0.7 to 1 m wide, with two flat wall faces, often consisting of slabs placed upright with uneven and narrow top surfaces, and a rubble and gravel core. This type of wall construction and the lack of substantial

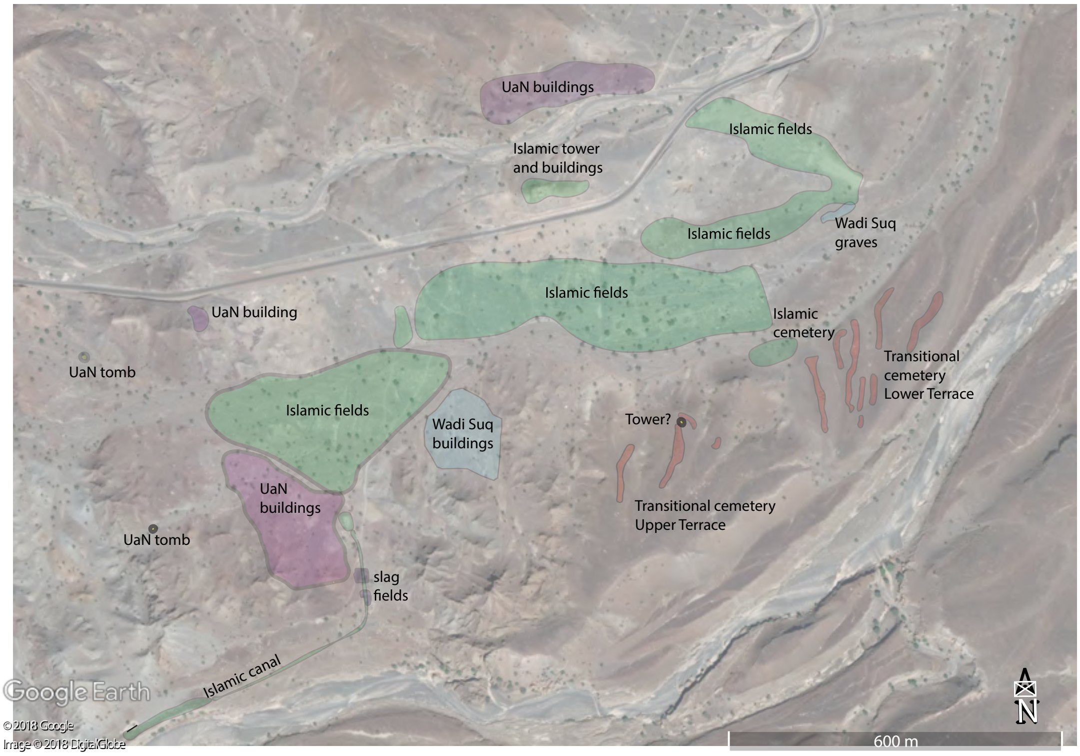

FIGURE 2. *A map showing the various components of Sites 66 and 73 in Wādī al-Zahaimi (B. Düring).*

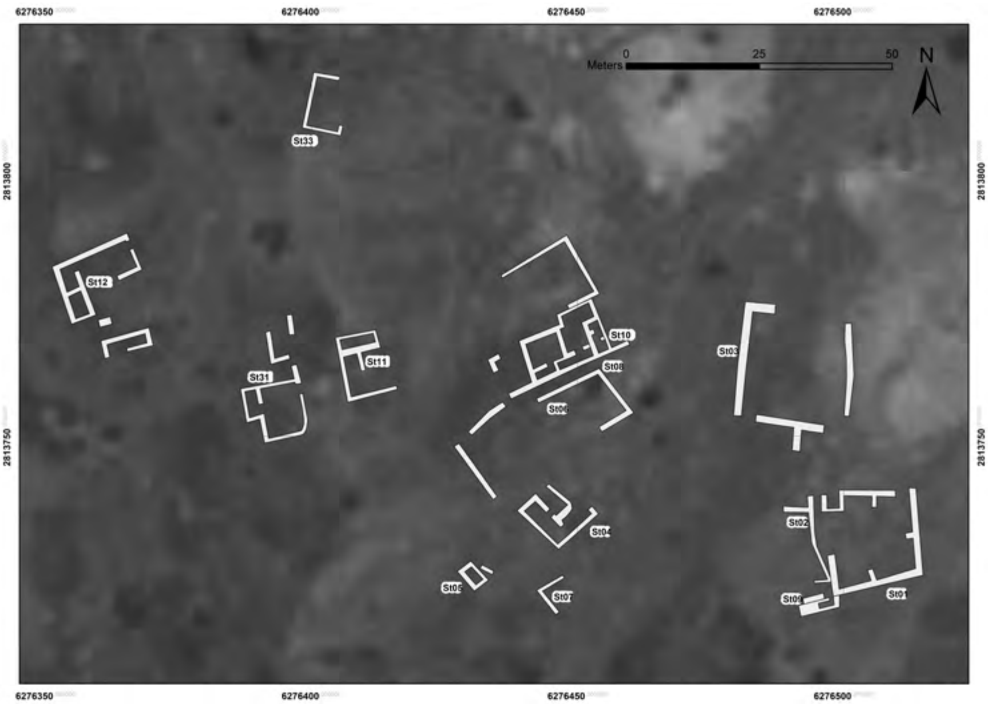

FIGURE 3. *The central area of the Umm an-Nar settlement at WAJAP-S73 (J. Aal).*

Figure 4. *Umm an-Nar tomb S73_St60 (photograph B. Düring).*

amounts of stones in their immediate surroundings indicate that these walls were not originally much higher than what is visible today. It is possible that these walls had a superstructure of loam, or that brushwood was stacked on top to raise their height, but no evidence survives to support these suggestions.

The buildings at Site 73 vary considerably in size, from *c.*30 to *c.*400 m². The large dimensions of many of these structures are remarkable. The buildings take on several forms. First, there is a good number of more or less square buildings, *c.*20 x 20 m. In some cases the large courtyard structures seem to lack a wall on one side and appear as large U-shaped structures. Given the considerable size of these structures and the apparent lack of division walls it is unlikely that these structures were roofed. Instead it seems more plausible that they served as courtyard structures. Similar large square courtyard structures have been documented at our WAJAP-S63, a smaller Umm an-Nar settlement located some 9 km downstream, and just to the east of Fizḥ (Düring & Botan 2018), and possibly at al-ᶜAyn (Blin 2007; 2012), although the dating of the latter site is not entirely clear. Some of these large courtyard structures have one or more small rooms attached to one of their sides, *c.*2.5 m wide, which could have been roofed with palm trunks or in other ways, for example with *barasti*-type structures (buildings made of woven palm frond). These spaces could have been used as living spaces, storage rooms, workshops, or some combination of these. Here it should be noted that very little slag was found in association with these courtyard structures, and this contrasts with the structures at nearby Dahwa, where there is clear evidence of metallurgical activities inside the buildings (al-Jahwari et al. 2018). It is therefore perhaps more plausible to associate these courtyard structures with pastoralists and with a seasonal use of the site, something that has also been suggested for other Umm an-Nar settlement sites, such as al-Zībā (Blin 2007; al-Tikriti 2012: 90; Schmidt 2018; Düring & Botan 2018).

Apart from these large courtyard structures, there are also some smaller buildings with one or two rooms, resembling more closely what we might expect a house to look like. However, the surface finds do not help us to distinguish differences between these 'domestic' buildings and other structures.

As at Dahwa, there are Umm an-Nar tombs associated with the settlement area. To the west in the immediate vicinity of the settlement, we have identified two relatively small round tombs, both with diameters of *c.*5 m. No so-called 'sugar lumps' or dressed stones were found in association with these tombs. Their walls stood only about 0.4 m above the surface with few stones in the surrounding area, making it likely that these were mainly subterranean tombs. No internal partition walls could be discerned on the surface, but the shape of these

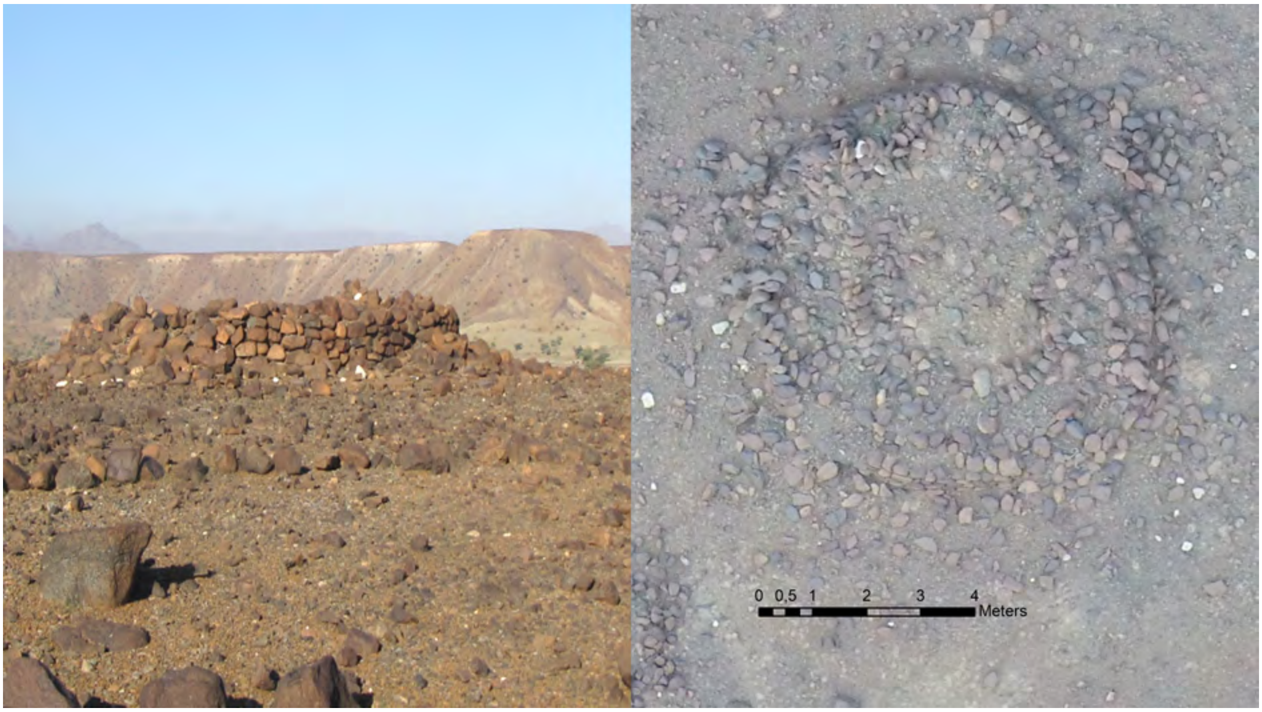

Figure 5. *Tomb S66_St184 viewed from the side and from above (B. Düring).*

structures, the large size of the stones used, and their location clearly suggest that they are tombs.[1]

On a spur directly adjacent to and overlooking the settlement, we documented a monumental round structure with a diameter of 7 m (S66_St184) and with an inner round chamber measuring *c.*3 m across. It was *c.*0.8 m high and had a layer of flat slabs on its surface (Fig. 5). In some respects, this structure resembles the Umm an-Nar watchtower from Wādī Ḥilo (Kutterer 2013: 126–134), but given its close proximity and alignment with other tombs on the upper terrace of the transitional cemetery that is discussed below, and the presence of a round chamber in the centre of our structure, we think it is more plausibly a significant and large tomb.

Over 300 sherds were collected at Site 73, many large and well preserved (Fig. 6). The Umm an-Nar assemblage is defined by large domestic jars made of Sandy Red Ware (de Vreeze 2016: 66). The few rims that were recovered display similarities with jars reported from Hīlī, al-Zībā, and Bāt, such as St02_L01_C02 (Méry 2000: fig. 91.3). Several fragments of the Sandy Red Ware with ridged appliqué decoration were also collected. At Hīlī 8 ridged appliqué decorations only appear in phases IIc2 and IId which date to *c.*2500–2300 BC (Cleuziou 1989: 76). A total of sixty-two pieces of Umm an-Nar Fine Ware were collected from this settlement, mostly body sherds. This type of ceramics, which has sometimes been designated as ‘funerary ware’, appears to have been widely used in domestic contexts as it occurs across various structures. Likewise, Umm an-Nar Fine Ware was found at the nearby Umm an-Nar settlement WAJAP-S63 mentioned above (Düring & Botan 2018).

In addition, twenty-four fragments of Indus Black Slipped jars were collected from several buildings within the Umm an-Nar settlement. There are only three different rims, such as St08_L13_C01 (Fig. 6), and it is possible that the Indus sherds derive from a few vessels only. However, the sherds were widely spread across the settlement rather than clustered, which suggests that this ware was quite common at site 73.

[1] The structures are too large to be interpreted as wells, which could be an alternative interpretation.

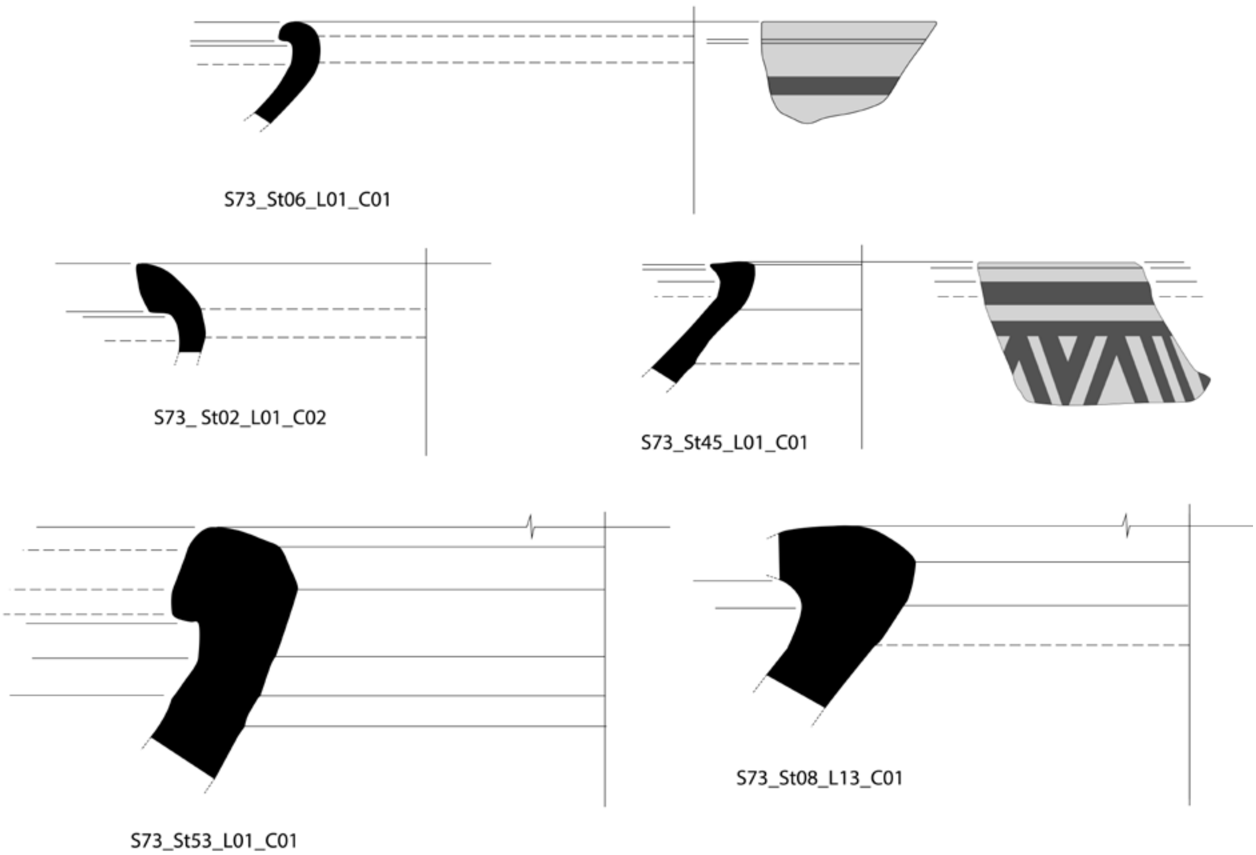

FIGURE 6. *Diagnostic Umm an-Nar and Indus ceramics from the settlement at WAJAP-S73 (J. Porck).*

The transitional Umm an-Nar–Wadi Suq cemetery

Immediately adjacent to the Umm-an Nar settlement lies a large cemetery that we have dated to the transition between the late Umm an-Nar and early Wadi Suq periods (WAJAP-S66). This dating is based on two considerations: first, the pottery found in association with these tombs; and second, the architectural parallels of the tombs with the cemetery at ʿAsimah (Vogt 1994). The transitional cemetery consists of about 170 tombs arranged in linear alignments along a roughly north–south axis, which are distributed over a lower and an upper terrace situated along Wādī al-Zahaimi.[2]

On the ground these tombs take on the form of low platforms, with walls raised about 40 cm above the surface (Fig. 7). The platform has walls on either side, which are made of wadi cobbles and are about 0.6 m wide, with a loose packing of soil and gravel in the centre. The tombs take on two forms. They occur as rectangles, which can measure up to 12 m long and *c.*2.5 m wide, or as round platforms with a diameter between 3 and 5 m. In some cases the two types are combined and bonded.

From above, these tombs appear as linear arrangements of rectangular and circular tombs, which are highly reminiscent of the ʿAsimah tombs (Fig. 8). ʿAsimah has been presented as an exceptional cemetery (Cleuziou & Tosi 2007: 274–275). Although additional alignments have been suggested at Wādī ʿAshwānī, Qidfaʾ, and Kalbāʾ (Vogt 1994: 134–135), they have been dismissed by colleagues (Christian Velde and Carl Philips, personal communications). The cemetery in Wādī al-Zahaimi is more than a 100 km from ʿAsimah as the crow

[2] In some areas of the cemetery, oval terraced tombs dating to the mid-first millennium AD have been built on top of these Bronze Age tombs.

FIGURE 7. *A typical rectangular grave of the transitional cemetery at WAJAP-S66 (photograph B. Düring).*

flies, and is much larger and much better preserved than ʿAsimah when it was excavated by Burkhard Vogt.

Relatively few finds were found at the transitional cemetery of Site 66. Miscellaneous finds consist of a mere two fragments of small, undecorated soft-stone vessels (one base and one body sherd) and a shell bead. This uncharacteristic dearth of materials, combined with the undisturbed appearance of the tombs, strongly suggests that this cemetery has not been looted and is in near pristine condition. The pottery found in association with the graves consists predominantly of domestic rather than funerary fabrics. Remarkably they are commonly found on one side of the tomb, in the east central area. This distribution pattern of domestic pottery has, as far as we know, not been observed elsewhere. We tentatively link this pottery with post-funerary activities performed next to the grave.

Several Umm an-Nar fragments were recovered from the cemetery. Most third-millennium sherds were extremely fragmented and the collection yielded no clear diagnostic fragments. No Umm an-Nar Fine Ware was recovered from the cemetery. Interestingly, we did record one piece of Slag Tempered Ware, a type of domestic pottery identified for the first time at the nearby Umm an-Nar settlement at WAJAP-S63 (Düring & Botan 2018).

The Wadi Suq period is much better attested in the cemetery. It must be stated, however, that the amount of painted pottery is very limited, in stark contrast to assemblages from other Wadi Suq cemeteries in our study area, again supporting the impression of only limited disturbance of this cemetery (Fig. 9). The vast majority of fragments consist of beakers/cups and spouted jars. This predominance of beakers and spouted jars has been attested at other Wadi Suq burial sites such as Shimāl and Qarn al-Ḥarf (Velde 2003; de Vreeze 2016; Méry 2000: figs 166.4 and 167). The Wadi Suq period has been described as a period in which decorative motifs on ceramics became more naturalistic and more elaborate (de Vreeze 2016: 69). There is one body sherd that fits this description. The fragment, which consists of a sandy, pinkish fabric with no visible inclusions, bears a plant-like motif painted in maroon on a cream-coloured slip.

FIGURE 8. *A composite of aerial photographs of some graves in the transitional cemetery at WAJAP-S66 showing rectangular and circular tombs (photographs S. Weijgertse).*

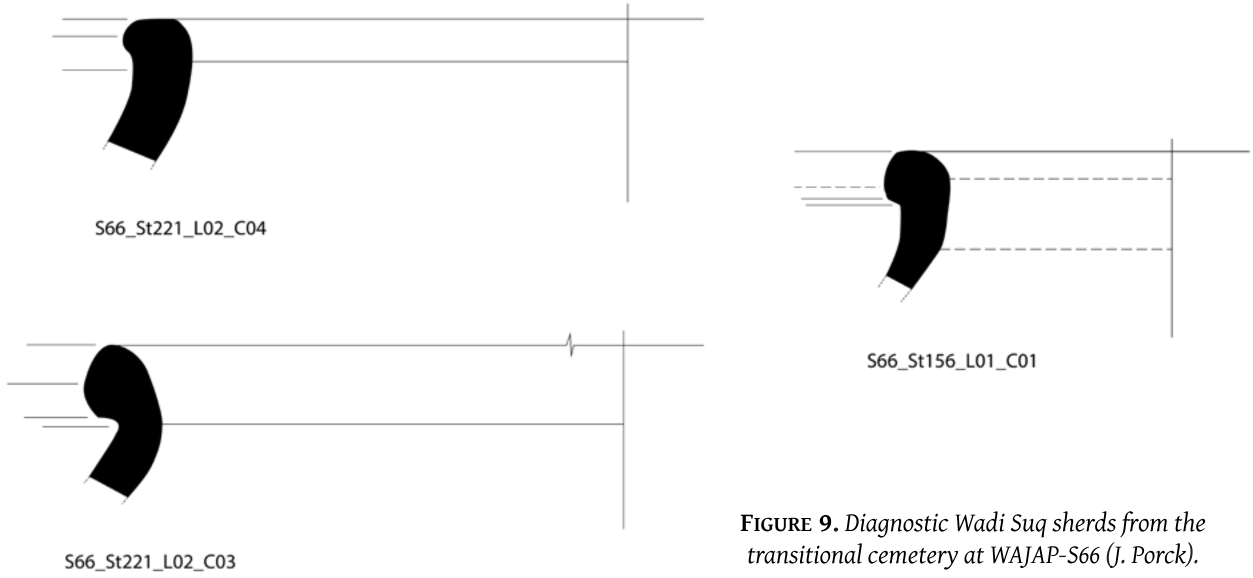

FIGURE 9. *Diagnostic Wadi Suq sherds from the transitional cemetery at WAJAP-S66 (J. Porck).*

If we compare the transition cemetery of WAJAP-S66 with ʿAsimah alignment A, we note two similarities. First, there are similar alignments of rectangular and circular tombs, with a tomb architecture and dimensions that are interchangeable. Second, at both sites there is also a clear marking of orientations, which in ʿAsimah takes the form of the use of white stone on one side of the alignment, and in Site 66, in the presence of pottery to one side of the tombs.

The finds from alignment A at ʿAsimah — a particularly significant amount of metal artefacts, including weapons — and the apparent singularization of an important individual, have led to the interpretation that this might be evidence of a local chief of some sort (Cleuziou & Tosi 2007: 274–275). The finds from ʿAsimah suggest a date at the transition between the Umm an-Nar and Wadi Suq periods (Vogt 1994: 130), and we think our — admittedly scant — assemblages also fit into that time period.

The Wadi Suq period in Wādī al-Zahami

Apart from the transitional cemetery, there are a number of typical Wadi Suq-type tombs in Wādī al-Zahaimi. At Site 72, located about 1.5 km to the west of Site 66, we discovered a series of circular tombs that had invariably been looted. They could still be identified as Wadi Suq graves due to the presence of Wadi Suq sherds and by the stone oval alignments with a central cist that are more typical of the Wadi Suq period in our region. These are located in the lower part of Site 66 in Wādī al-Zahaimi, and we have found hundreds of these graves in various cemeteries in the eponymous Wādī Sūq (Frifelt 1975; Düring & Olijdam 2015); scores of additional graves have been excavated in rescue excavations for the industrial area east of the Ṣuḥar port, which remain unpublished. The diversity of Wadi Suq grave types in the Ṣuḥar hinterland calls for excavations which could establish whether they can be explained in chronological terms or in other ways.

Remarkably, however, there is also good evidence of a Wadi Suq settlement at Site 73 (Fig. 10). Known settlements of the Wadi Suq period are very few — they include Raʾs al-Jinz 1, and the tell sites of Hīlī, Kalbāʾ, Tell Abraq, and possibly Nawd Zubā (Carter 1997; Cleuziou & Tosi 2007; Magee 2014: 182) — and there is limited data on these settlements because of a lack of excavations and/or publications. In our 2014 season we found a settlement, WAJAP-S2, that we provisionally dated to the Wadi Suq period (Düring & Olijdam 2015; Düring & Botan 2018), despite only having found a few sherds that support this date.

By contrast, the Wadi Suq hamlet at Site 73, provides a relatively strong dataset. We have found clear building remains, which are distinct in location, construction, size, and shape from the nearby Umm an-Nar

FIGURE 10. *The central area of the Wadi Suq hamlet at WAJAP-S73. Additional buildings are found dispersed within the landscape (J. Aal).*

structures, and are associated with a significant amount of diagnostic Wadi Suq pottery.

The buildings are structures with one or two rooms, measuring between 7 and 4.5 m long and 5.5 and 2.5 m wide (see Monchablon et al. 2003 for very similar-sized structures of the Wadi Suq period at Raʾs al-Jinz 1). The walls are only about 0.4 m wide and built with much smaller stones than the nearby, but spatially distinct, Umm an-Nar structures. No clear features were visible in any of these buildings, but they were surrounded by a considerable number of large hearth features, and there were large amounts of *Terebralia* shells present, suggesting that these might have been consumed in the settlement.

A considerable amount of Wadi Suq pottery was found at Site 73, including some remarkable domestic types, such as St53_L01_C01 (Fig. 6). The Wadi Suq ceramics primarily consist of medium-sized jars and large storage vessels. This is in contrast with the Wadi Suq ceramics from the adjacent transitional cemetery at Site 66, where the majority of ceramics consist of beakers/cups and spouted jars.[3]

Almost all of the recovered sherds display a dark red-/maroon-coloured slip on the exterior and interior. The medium-sized jars are often painted, in contrast to the larger storage vessels which are usually plain. The Wadi Suq ceramics from Site 73 show parallels with several other contemporary sites. Fragment St45_L01_C01 (Fig. 6) displays close parallels with Hīlī 8 period III ceramics, while fragment St06_L01_C01 closely resembles Wadi Suq domestic vessels recovered at Nawd Zubā (Kennet & Velde 1995: 93–94; Méry 2000: 250).

Somewhat surprisingly given the location and the size of the settlements, WAJAP-S73 appears to have been linked to networks that also maintained international contacts with the northern part of the Persian Gulf, as is attested by a sherd from Dilmun (Fig. 11). The red-coloured fabric with many lime and shell inclusions is characteristic of the Barbar ceramic tradition. The sherd comes from Structure 39, which is part of the Wadi Suq settlement. The Ridged Ware fragment, St_39_L02_C06,

FIGURE 11. *A Barbar sherd from Dilmun found in a Wadi Suq context at WAJAP-S73.*

is well attested in early second-millennium contexts in the eastern part of the Emirates (e.g. Grave et al. 1996). The thickness of the body fragment indicates it is from a medium-sized storage jar. This chance discovery confirms there was a continuation of contacts with Dilmun after the demise of the Umm an-Nar period.

Summary and conclusion

To summarize, we found a remarkably well-preserved Bronze Age cultural landscape in Wādī al-Zahaimi that includes significant remains from the Umm an-Nar period (*c.*2600–2000 BC), the transition between the Umm an-Nar and the Wadi Suq periods (*c.*2100–1900 BC), and the Wadi Suq period (*c.*2000–1600 BC). First, we documented a well-preserved Umm an-Nar settlement, with two associated slag concentrations and two Umm an-Nar tombs, and Umm an-Nar ceramic assemblages that clearly demonstrate that this remotely located settlement was part of long-distance exchange networks and relatively affluent. Second, we have documented a remarkable large transitional Umm an-Nar–Wadi Suq cemetery, that mirrors the well-known site of ʿAsimah,

[3] The different ceramic assemblages found at the Umm an-Nar and Wadi Suq cemeteries and subsequent settlements has been discussed in several articles by various authors in the past decades (e.g. de Vreeze 2016; Schmidt & Döpper 2016). It is interesting to note that in our study region this dichotomy seems applicable only for the later period.

but which is much larger and in an excellent state of preservation, and is currently the only preserved cemetery of its kind. Third, there is good evidence of the subsequent Wadi Suq period, which includes both tombs and a well-dated and clearly defined settlement, with some evidence of being connected to long-distance exchange networks. Taken together, the Wādī al-Zahaimi Bronze Age landscape is therefore highly significant for the prehistory of south-eastern Arabia. We intend to conduct additional research on this well-preserved and important Bronze Age cultural landscape in Wādī al-Zahaimi in the coming years, and to contribute to the protection of this crucial cultural heritage.

Acknowledgements

The Wadi al-Jizzi Archaeological Project is a collaboration between Leiden University and the Ministry of Heritage and Culture of Oman. We are grateful for the support of the Ministry of Heritage and Culture, in particular Sultan Al-Bakry, Khamis Al-Asma, Mohammed Al-Waily, and Ibrahim Al-Kabi. We would also like to thank Nasser Al-Hosni, Christian Velde, Leiden University, and our field team members of the 2018 season.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 129–146

New project on Islamic ceramics from al-Balīd: chronology, technology, tradition, and provenance

Agnese Fusaro

Summary

A new project on the pottery has begun since excavations resumed in 2016 at the site of al-Balīd (Ẓafār), Dhofar in southern Oman. The work concentrates on the Husn, a fortified palace, in this Islamic port. The paper presents the current project on the pottery, exploring methodology, objectives, and preliminary results.

The study suggests a dating for the occupational phases of the palace identified so far (fourteenth–eighteenth century AD). The examination of the ceramic material is supported by archaeometric analysis and ethnoarchaeological work on the modern Dhofari production, the latter contributing to a better understanding of the ancient manufacturing process and the transfer of knowledge. This multidisciplinary study allows an exhaustive stylistic, technological, and archaeometric characterization of the pottery, with a special focus on local wares, also proposing or revising their chronological attribution. Moreover, a provenance study is conducted, particularly to establish the origin of the abundant and diverse imports, thus identifying the regions trading with al-Balīd during different periods.

Despite previous work on al-Balīd, the study of the ceramic material has never been published properly — the project aims to fill this gap. Furthermore, it is one of the few ongoing research projects on Islamic ceramics of Dhofar and present-day Oman.

Keywords: Islamic pottery, al-Balīd, Dhofar, local productions, Indian Ocean trade

Introduction

The paper presents the current project on the Islamic pottery from the fortified palace, also known as Husn, at the site of al-Balīd.

Al-Balīd is located in the Dhofar region, the southern Governorate of present-day Oman, 5 km east of Ṣalālah. The site has been identified as the ancient city port Ẓafār, one of the main centres in the so-called Frankincense Land, but also one of the most important ports in the Indian Ocean trade network, at least from the thirteenth until the seventeenth–eighteenth century AD (Tkatsch 1934; Guest 1935; Smith 2005).

The site consists of a fortified city on the ocean littoral; unfortified suburbs existed to the north, while a marketplace and a large cemetery were located to the west. The western part of the fortified site was probably the most important, housing the Husn and a congregational mosque (Costa 1979; Albright 1982: 51–69; Zarins 2007). The Husn is the highest mound of the site (about 13 m a.s.l.) and is roughly square in plan, with a side measuring 60 m (Fig. 1). The fortified palace has been interpreted as the residence of the local ruler.

Since 1930 this mound has undergone much archaeological research, frequently associated with restoration activities, including the expedition of the American Foundation for the Study of Man, led by Wendell Phillips and Frank Albright, since 1952 (Albright 1982); the work by Michael Jansen (RWTH Aachen University), within the framework of UNESCO, between 1996 and 2003 (Powell 1998; Jansen 2003); and the American archaeological mission led by Juris Zarins (Missouri State University) and Lynne Newton (University of Minnesota), from 2005 to 2012 (Zarins 2007; Zarins & Newton 2012; Newton & Zarins 2017). The archaeological investigations of the Husn resumed in 2016, under the direction of Alexia Pavan, archaeological consultant for the Omani Office of the Adviser to His Majesty the Sultan for Cultural Affairs. The excavations currently being carried out concentrate on different areas of the palace, both inside and outside the walls. A huge amount of archaeological materials — mostly pottery — has been collected so far. The study of

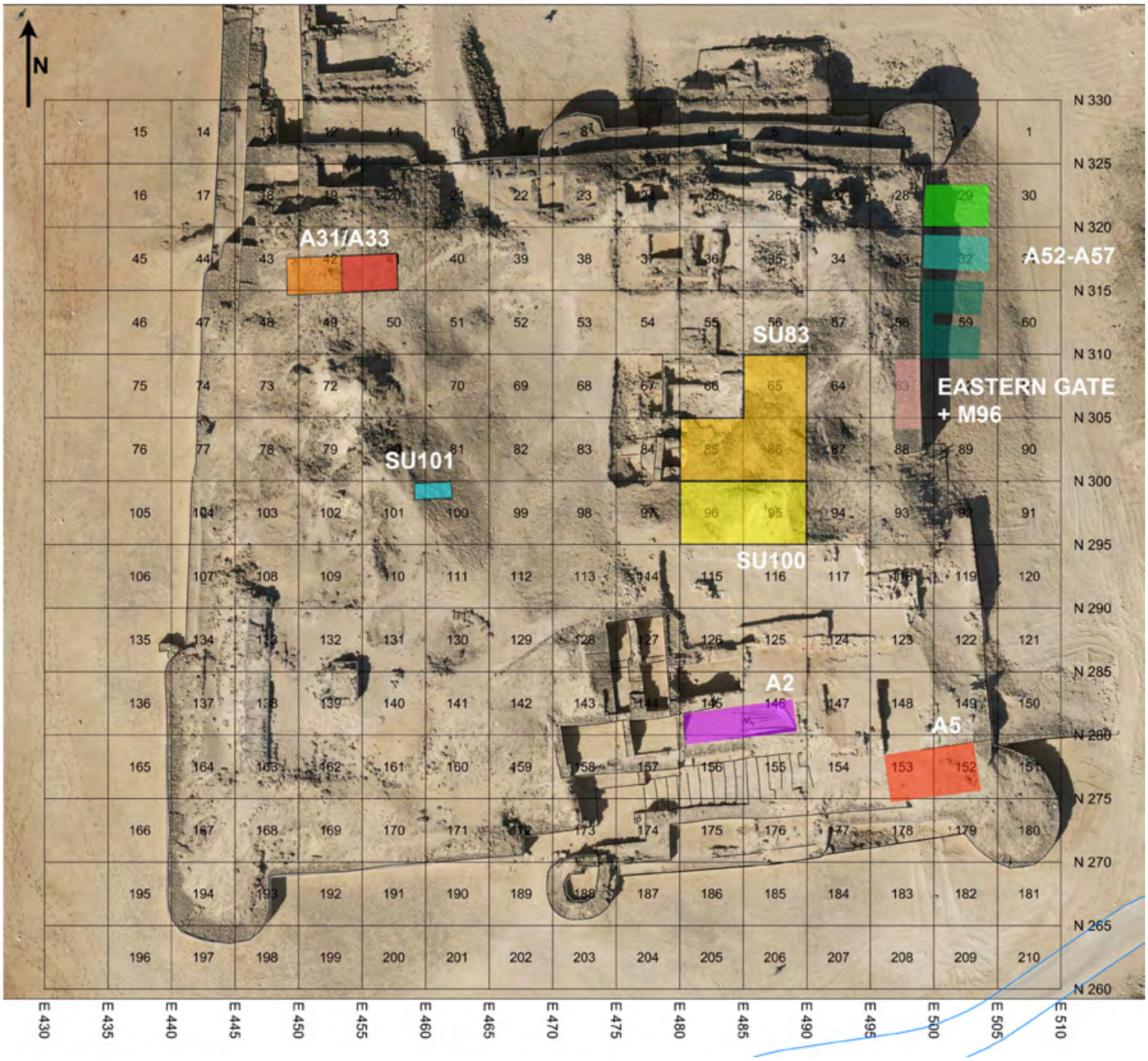

FIGURE 1. *A photograph of the Husn overlapped with an archaeological grid (each square: 5 x 5 m), with an indication of the contexts where the analysed pottery has been collected (© Bill Eisenberger, 2012, modified by A. Fusaro).*

the ceramic material from the ongoing excavations at the Husn is the focus of a new project led by the present author since 2016.

The pottery study

A total amount of 12,973 ceramic items has already been classified and analysed, according to their technological, stylistic, and morphological features, and through a macroscopic examination of the ceramic bodies.

The research project has a multidisciplinary approach — the archaeological study is supported by archaeometric analysis and ethnoarchaeological work on the modern Dhofari production.

Before this project began, previous studies on ceramics had already been conducted (Yule & Mohammad 2006, first ed. 1998; Franke-Vogt 2002; Zarins & Newton 2012; see also Zarins 2007: 311); they provide a useful overview of the wares found at the site. Nonetheless, until now there has been no exhaustive publication of the ceramic material from al-Balīd, except for a booklet (Yule & Mohammad 2006).[1]This has left discrepancies on the identification of specific wares and their provenance and a lack of information on the relation between wares and stratigraphy. Moreover, there are still little research work being conducted on sites in Dhofar dating to the Islamic period and even less work on the pottery circulating in this area,[2] especially regarding the local unglazed manufacture (Priestman 2008: 260–261).

All things considered, the project aims to complete the work on the pottery from al-Balīd, and trying to guarantee continuity among all the studies carried out so far, for a final comprehensive publication.

The main aims of this pottery study are as follows:

- to provide an exhaustive stylistic, technological, and archaeometric characterization of the ceramics circulating at al-Balīd, with a particular focus on local and regional productions;
- to propose or revise the chronological attribution of the identified wares;
- to suggest more precise provenance for the wares analysed at a local, regional, and trans-regional level;
- to establish the origin of the imported items, thus obtaining information on the trading networks in which al-Balīd was involved and changes in the circulation of items during different periods;
- to offer reliable dating for the phases of the Husn.

Archaeometry is providing valuable support for the pottery analysis, allowing us to gather detailed information on technology (clay procurement areas, nature of clay and temper and their processing, shaping techniques, firing process) and on the provenance centres of the wares analysed.

The first stage of the archaeometric study was the sampling of ceramic items, with a special focus on unglazed local and regional wares and the glazed Bahla ware (see below).

Fifty-eight samples were selected from the Husn, representing different groups according to their stylistic, technological, and body features, along with fourteen samples from the sites of al-Ḥamrā᾽ al-Sharqiyya (Dhofar) and Salūt (northern Oman),[3] for comparisons with specimens from al-Balīd. The sampling also includes items collected during the ethnoarchaeological investigation — clay from a procurement area in the Dhofar hinterland behind Ṭāqah, modern unfired and fired artefacts, and processed clay from three workshops (Ṣalālah, Ṭāqah, Mirbāṭ). More samples will be collected in future seasons.

Detailed photographic documentation with an Olympus SZ61TR micro-stereoscope was conducted for a preliminary screening. Those samples considered worth further investigation were prepared for X-ray diffraction, X-ray fluorescence, loss on ignition tests, and thin-section analysis that will be performed at the laboratories of the University of Barcelona (CCiTUB — Centres Científics i Tecnològics de la Universitat de Barcelona), with the scientific support of Verònica Martínez Ferreras, researcher member of the ERAAUB team (Equip de Recerca Arqueològica i Arqueomètrica de la Universitat de Barcelona).

The ethnoarchaeological work on the modern pottery production in Dhofar proved to be very useful for this project (for previous ethnographic work, see Richardson & Dorr 2003: 503–507). It involved visits to workshops in Ṣalālah, Ṭāqah, and Mirbāṭ, and interviews with four women potters. In November 2017, Fatima Salima Jebel and Amina Fatallah al-Farid were interviewed during several meetings at the shopping area of the Museum of the Frankincense Land, where they are currently working. Fatima has made pottery in the past, within a household production, while Amina is still producing ceramics in the Ṣalālah Handicraft Center, where we met and interviewed her a second time in April 2018. On 9 November 2017, during a visit to the Women Association in Ṭāqah, the president of the Association, Fatima Obeyd Amri, and a woman potter, Tuful Sayyd Sohil al-Mashani, were also interviewed. The research provided interesting information on several aspects of the manufacturing process, such as sources of raw materials, timing, tools, motifs, forms, and techniques.

[1] In their most recent publication, Newton and Zarins dedicate a few pages to the ceramics (2017: 88–94).

[2] D.S. Whitcomb addressed this issue several years ago (1975). The study of the pottery from al-Ḥamrā᾽ al-Sharqiyya (Rougeulle 2008) is among the few works published.

[3] I am grateful to the IMTO (Italian Mission to Oman) for their collaboration.

This data helps to gain a better understanding of the ancient local and regional wares, clarify questions concerning the past manufacturing process, find the clay procurement areas and finally, examine continuity and changes of the handicraft tradition throughout the centuries.

The pottery corpus

The corpus mainly consists of local productions; it also includes vessels related to the regional manufacture and abundant and diverse imports, most of them glazed.

Local wares

The local production is the best represented, totalling between 80 and 90% of the whole corpus. All specimens are unglazed and handmade; most vessels were probably fired using an open-firing technique, which involved setting vessels and fuel together in a heap, in large pits or simple kiln-like structures.[4]

With the label 'local' we are referring to a Dhofari production most probably localized in the Ṣalālah plain. Even if no pottery kilns or proper wasters have been found so far, the massive amount of these ceramics leaves no doubt as to the existence of production in the area, as also suggested by the archaeometric preliminary screening. In-depth investigations are needed to find the clay procurement areas but, based on the information collected from the ethnoarchaeological study, it is possible that they could be near Ṭawī Attīr (Ṭāqah) or in the area of Ṣalālah al-Wusṭā.

To guarantee continuity with the previous studies on ceramics from al-Balīd, a comparison of labels and descriptions attributed to different wares was conducted, and some terms chosen by other scholars were kept for the local pottery. Moreover, these groups and the related fabrics have been better defined and associated with specific functional categories; sub-groups were created according to the quality and thickness of the specimens.

Shell temper ware is mainly represented by cooking pots and jars; it comprises two sub-groups (Fig. 2). Shell 1 includes almost exclusively cooking vessels made of a coarse fabric (Fig. 2/a–c), while specimens belonging to Shell 2 (Fig. 2/d–e) have a finer fabric and thinner body walls and also comprise small storage containers and tableware.

Grit temper ware includes two sub-groups (Fig. 3). Grit 1 comprises kitchen vessels related to food preparation and are also associated with fire, and storage (bowls, pots, a few jars; Fig. 3/b–c). They are made of coarse fabric and the surfaces are often left unfinished. Specimens of the sub-group Grit 2 have less coarse fabric, are better finished, and have decorated surfaces. They consist of bowls, pots, and jars that were probably used for preparing and serving food, and for storage (Fig. 3/d–e).

The red ware consists of tableware, such as bowls and small bowls, dishes, jugs, and small storage jars as well as a few pots (Fig. 4). They have a fine fabric and are characterized by smoothed, burnished, polished surfaces frequently decorated with incisions, impressions, and red painting.

The dot-and-circle ware is well represented (Fig. 5). Its name derives from the principal motif stamped or rouletted on the vessels. This ware has raised the interest of many scholars. Nonetheless, to date the technological features of this ware, the production centres, and the chronology are still largely debated (see, for example, Yule & Kervran 1993: 80–81, 93; Zarins 1997: 668–672; 2001: 112, 126; Newton 2009: 61, 64; Newton & Zarins 2010: 254; 2017: 70). Benefitting from the abundance of this ware within the al-Balīd corpus, the ongoing study is shedding light into all these aspects. First, the preliminary stratigraphic analysis enables a revision of the dating of the ware, suggesting that it circulated until the fourteenth–fifteenth century. Furthermore, the examination of the fabrics (Fig. 5/a) and its comparison with the local ceramic bodies (especially those of the Grit 2 and red wares) indicate that at least part of the production was located in the Ṣalālah plain.

A typology is starting to be outlined, with five types identified. One group is characterized by coarse fabric, rough and unfinished surfaces, and very simple decoration (Fig. 5/b). The second is the most widespread type. It mainly consists of globular pots and inturned bowls, with well-burnished or polished surfaces and a decorative pattern comprising rows of dot-and-circle motifs, incised lines, and shell-impressed segments, sometimes with rouletted notches on the rim; the fabric is often rich in vegetal temper (Fig. 5/c–e). A third type comprises mainly pots, but also small jars made of a

[4] This technique is still used today.

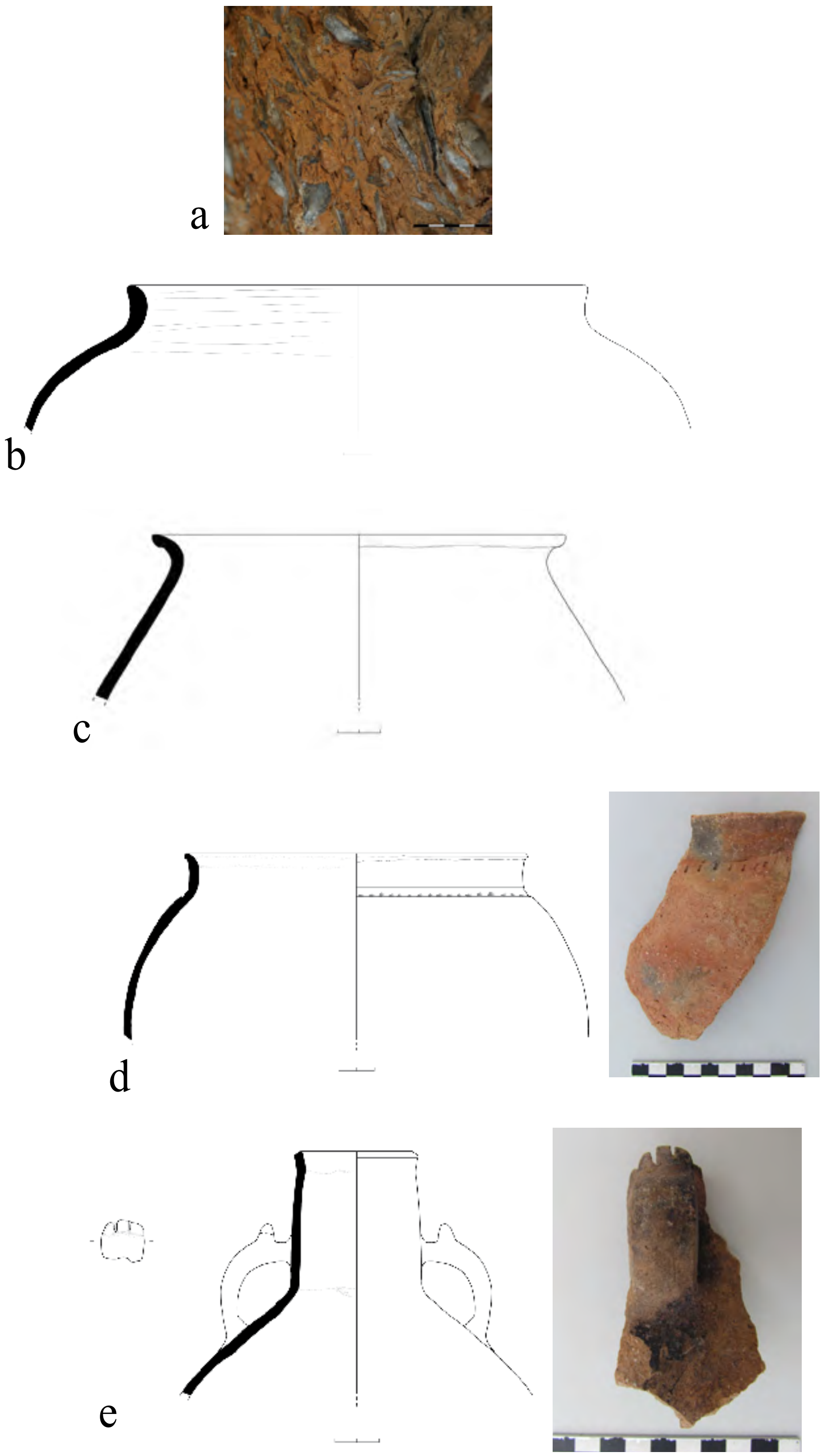

Figure 2. *Specimens of shell temper ware collected at the Husn:* **a.** *a micro-photograph of sample ASBA45 from SU 48;* **b.** *inv. no. 22,288;* **c.** *inv. no. 19,15;* **d.** *inv. no. 100,24;* **e.** *inv. no. 83,26 (© A. Fusaro).*

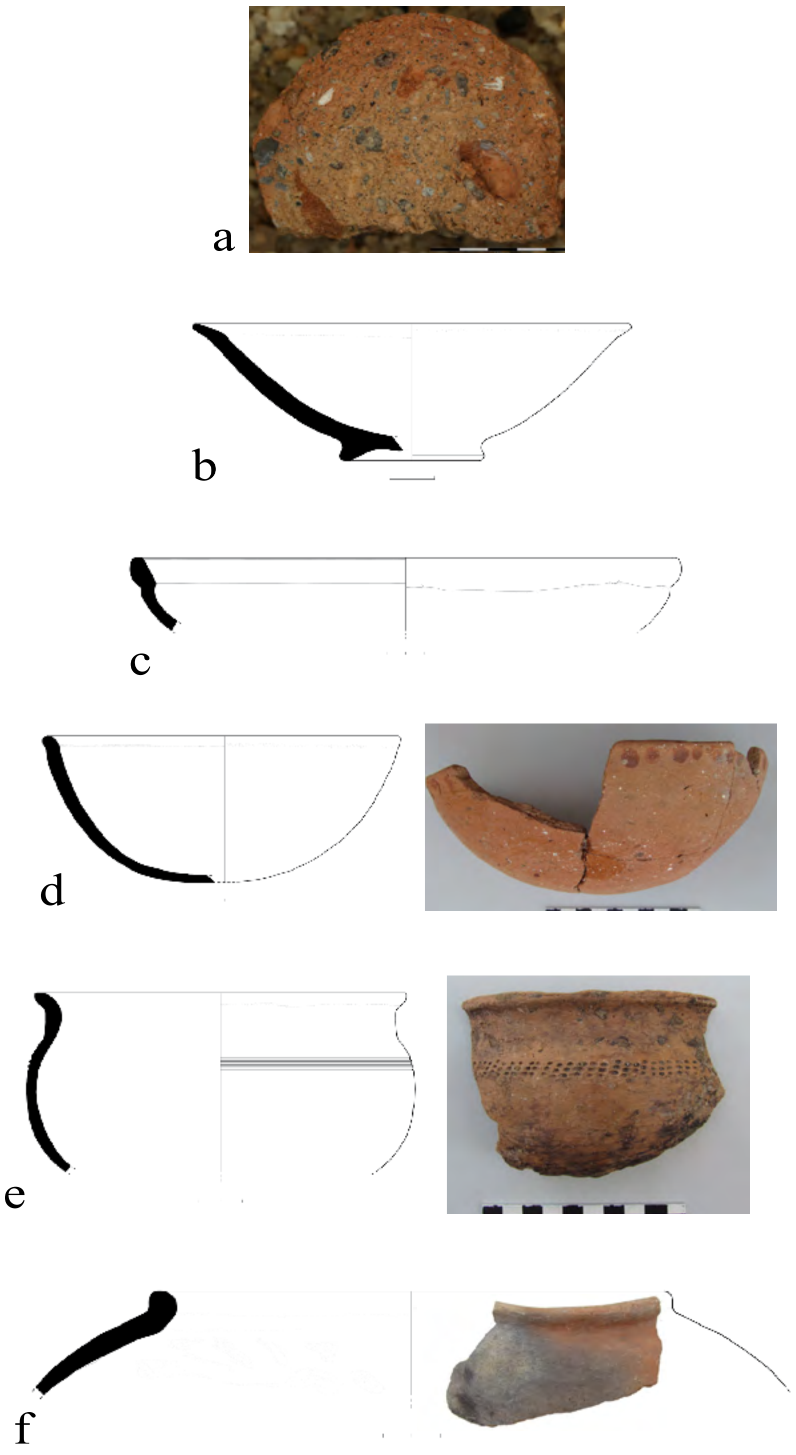

Figure 3. *Specimens of grit temper ware collected at the Husn:* **a.** *a micro-photograph of sample ASBA38 (inv. no. 61,85);* **b.** *inv. no. 73LW,54;* **c.** *inv. no. 19,101;* **d.** *inv. no. 105,3;* **e.** *inv. no. 61,94;* **f.** *inv.no. 100,28 (© A. Fusaro).*

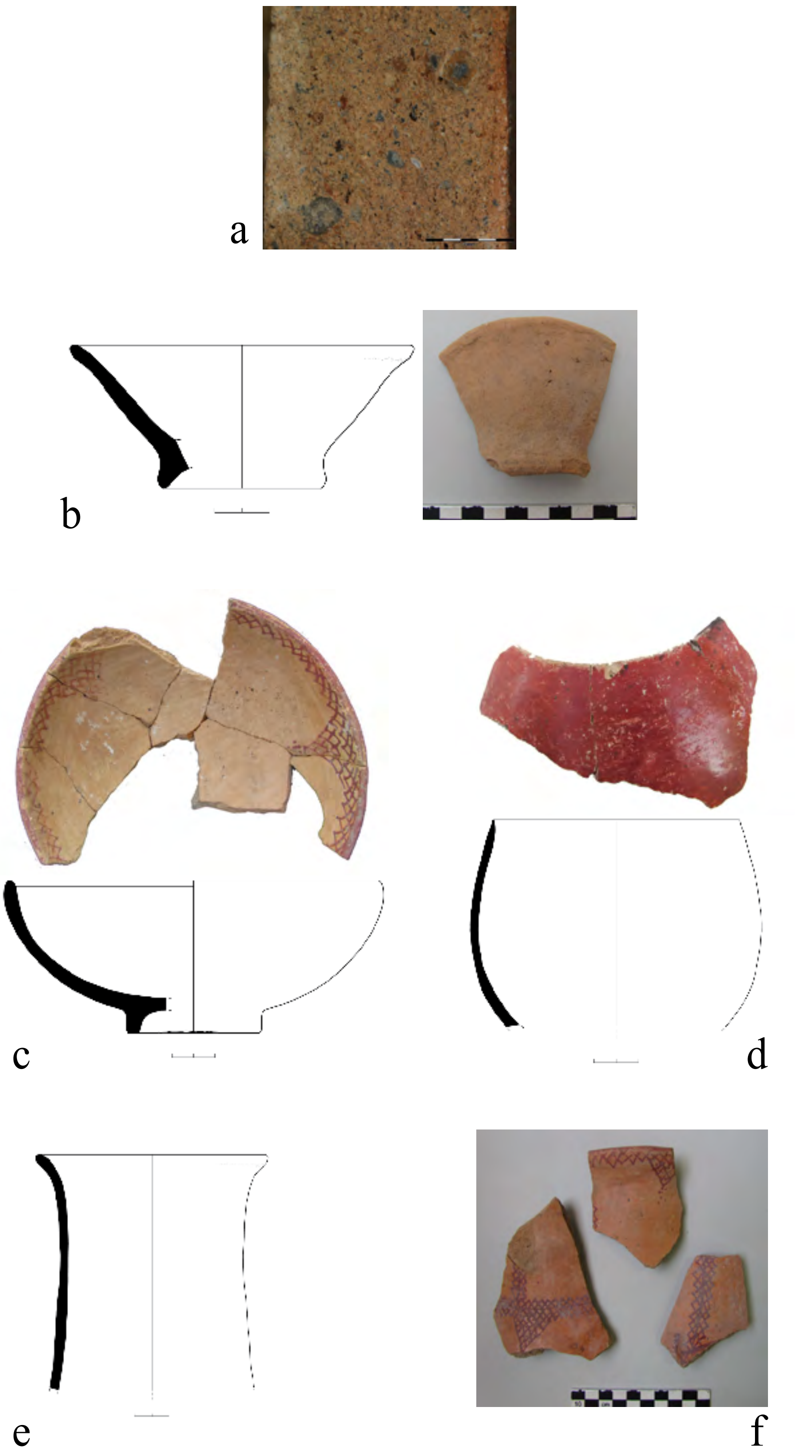

Figure 4. *Specimens of red ware collected at the Husn:* **a.** *a micro-photograph of sample ASBA51 from SU 100;* **b.** *inv. no. 73L,33;* **c.** *inv. no. 22,39;* **d.** *inv. no. 22,54;* **e.** *inv. no. 83,8;* **f.** *jug from SU 22 (© A. Fusaro).*

finer fabric. The decorative pattern consists of dot-and-circle motifs and many thin comb-incised horizontal lines on smoothed or burnished surfaces (Fig. 5/f). The fourth type is represented by larger and thicker vessels, mainly jars, and with less refined decoration also comprising comb-incised and comb-impressed motifs (Fig. 5/g). The fifth type can be clearly distinguished by the presence of red painted decoration (Fig. 5/h) added to a quite complex decorative pattern, composed of dot-and-circle motifs, comb-incised straight, wavy, and zigzag lines and comb-impressed dotted segments. The morphological typology is quite limited and usually consists of jars. It has been noted that some specimens belonging to other productions (e.g. Grit 2 ware) imitate the decorative pattern peculiar to the dot-and-circle ware, without using this specific motif.

The stratigraphic analysis and the preliminary chrono-typology of the local ceramic manufacture indicate that evolution and change in technology, morphology, and fashion can be traced, with at least two main stages within the chronological range considered (fourteenth-eighteenth century).

In the case of the grit temper ware, the major changes regard the morphology. In an earlier stage there are more inturned and conical bowls (Fig. 3/b), also with almost vertical walls. In the later stage there is an increase in wider hemispherical or conical bowls, frequently with a triangular-section thickened rim projecting inwards (Fig. 3/c); in the same period there is a higher amount of large pots and medium jars. Moreover, during the later stage of production, the variety of sub-fabrics of the grit temper ware is considerable, the variants rich in vegetal temper or with abundant red inclusions being common. In general, the quality of the grit temper ware improves, the fabric being more compact and the surfaces often better finished.

Conversely, sub-group 1 of the shell temper ware remains quite homogeneous over the centuries, large cooking pots always prevailing, even if a slight increase in medium and small jars with a short neck (Fig. 2/d) has been noted in the latest stage.

The assemblages associated with the latest occupational phase of the Husn demonstrate that local potters reached quite high technological skills, especially in manufacturing fine tableware. Indeed, the red ware shows a wider variety of forms, decorations, and surface treatments. Polishing and red slip, also used in association, are widespread. The slipped vessels are especially noteworthy for the high quality of the surface finishing and the thinness of the body walls (Fig. 4/d). The most common forms are deep bowls, sometimes slightly inturned, and jars with a very high cone-truncated neck and everted rim (Fig. 4/e–f). The tableware is also represented by richly decorated small pots and spouted jugs of the sub-group Shell 2 (Fig. 2/d–e), which increases in quantity and whose manufacture becomes more refined in this last phase.

Furthermore, the proportion of the wares changes over the centuries. In the fourteenth–fifteenth century, the grit temper ware is the best represented (Fig. 6/a); in the sixteenth century and especially in the seventeenth–eighteenth century, the shell temper and red wares markedly increase in quantity, while there is a decrease of the grit temper ware (Fig. 6/b–c). Meanwhile, a new ware appears, almost equalling the grit temper ware: the grit-angular ware, labelled after its temper, with angular brown/grey inclusions; its surface treatments and forms are similar to those of the coeval Grit 2 and the red wares (Fig. 3/f).

Regional productions

A small distinct group of vessels has been recovered. They resemble the local wares in many aspects, as for shaping techniques, forms, decoration, and surface treatments, thus suggesting similar traditions. Nonetheless, they are made of different fabrics, whose raw materials might come from other supply areas and therefore might belong to a regional manufacture located in Dhofar or neighbouring regions. Three regional productions have been identified so far.

The regional grit ware (Fig. 7) closely resembles the red ware: the surfaces are burnished; the decoration consists of incisions and impressed notches; and the forms identified are inturned bowls and jars of different dimensions. However, differences between the ceramic bodies of this ware (Fig. 7/a) and the local productions emerge from the preliminary archaeometric screening, suggesting the use of distinct raw materials and procurement areas. It is worth noting that similarities have been identified with modern Dhofari products from Ṭāqah.

A small group of unglazed handmade globular pots, mainly used as cooking vessels (Fig. 8/c–d), is

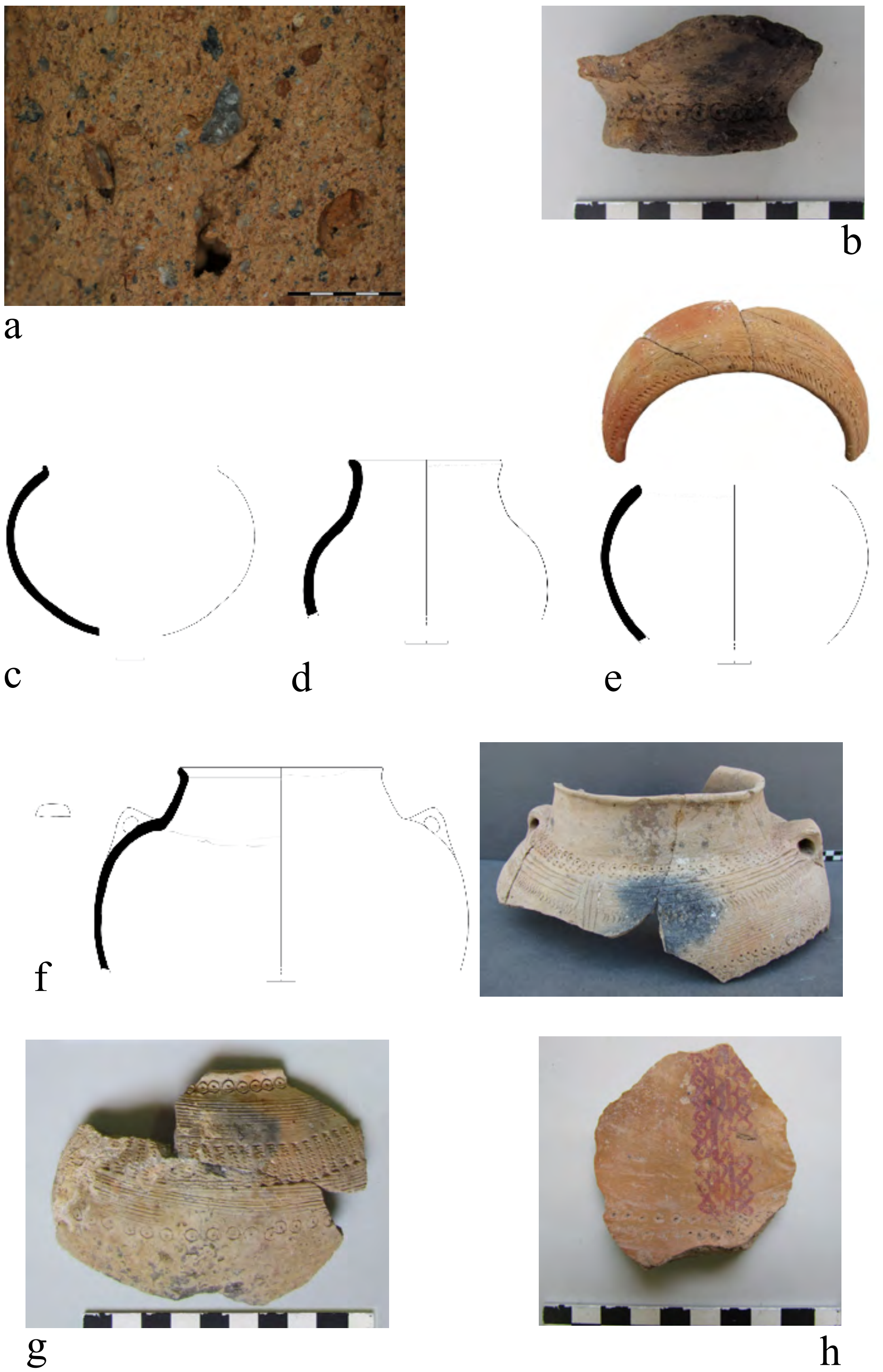

Figure 5. *Specimens of dot-and-circle ware collected at the Husn:* **a.** *a micro-photograph of sample ASBA34 from SU 22;* **b.** *inv. no. 61,7;* **c.** *inv. no. 43,59;* **d.** *inv. no. 73LW,58;* **e.** *inv. no. 73L,45;* **f.** *inv. no. 73L,48;* **g.** *a globular pot from SU 22;* **h.** *the neck of a jar from SU 22 (© A. Fusaro).*

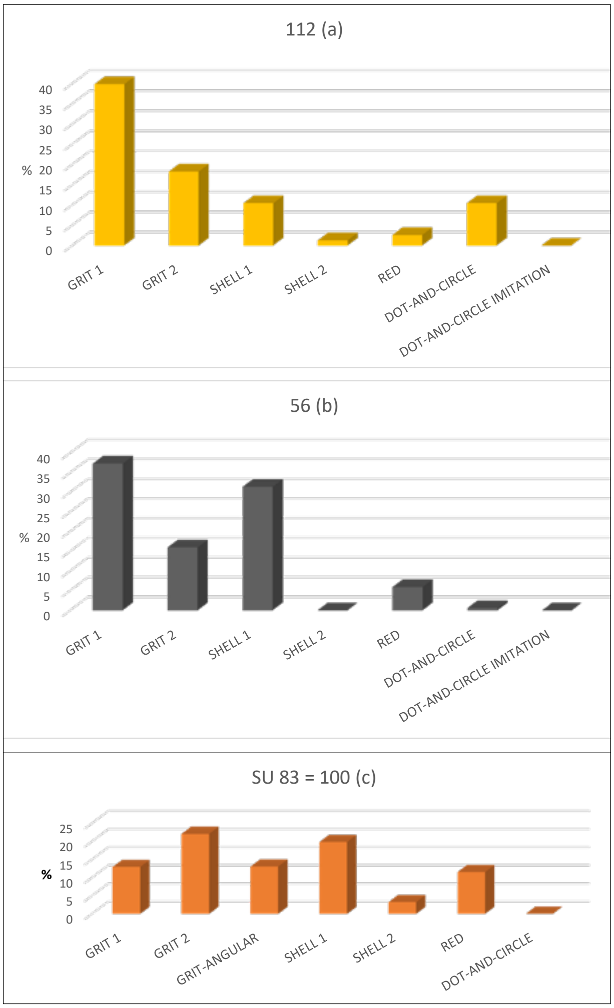

Figure 6. *Percentages of local wares found in the assemblages of the Husn:* **a.** *from SU 112;* **b.** *from SU 56;* **c.** *from SU 83 = 100 (© A. Fusaro).*

characterized by a high amount of shiny lustre flakes, possibly chlorite and steatite, and a soapy feeling (Fig. 8/a–b). According to the geological nature of the temper, this production could be associated with southern Arabia (Pavan 2017: 30–31), more specifically Yemen (Porter 2018), eastern Oman (David-Cluny 2001: 319–324), or Maṣīrah island (Rollinson 2017).

There are a few handmade basins and jars characterized by white cream surfaces (Fig. 8/e), whose ceramic bodies show similarities with the local grit wares and even with the ethnoarchaeological samples; it is therefore possible to suggest a regional or even local manufacture.

The archaeometric and ethnoarchaeological works will lead to specifying the production centres of these wares. The study will finally contribute to a better understanding of the relationships that al-Balīd maintained with other settlements on the coast and in the inland of Dhofar and neighbouring regions.

Imported items

A remarkable quantity of imported items was collected in all the layers examined, thus testifying that al-Balīd was a very active port at least from the fourteenth century until the abandonment of the palace. Indian products and Chinese and Far Eastern items are the most abundant imports.

Indian specimens mainly consist of unglazed coarse red and grey pots and jars of different sizes. Most of them have soot marks, suggesting their use as cooking vessels. The variety of forms and fabrics is remarkable, not only within each archaeological phase but also along the stratigraphic sequence of the Husn. There are a few higher-quality unglazed wheel-thrown bowls with polished surfaces, sometimes associated with red slip and painted decoration. From a preliminary comparative analysis, a provenance from southern India, for example Kerala,[5] and north-western regions, especially Gujarat (Tomber, Cartwright & Gupta 2011) and Sindh,[6] can be suggested.

The most common Chinese imports circulating at al-Balīd are celadon dishes, bowls, and jars along with blue and white porcelain bowls. Some stonewares and earthenwares also come from south-east Asia, such as the so-called Martaban jars.[7]

A good number of Yemeni imports circulated at al-Balīd throughout the time span under consideration. The so-called Yemeni Yellow ware, mainly comprising conical bowls, spread at least during the fourteenth–fifteenth century. Also from Yemen, as suggested by the fabric and glaze features, are two unique bowls from SU 105 belonging to a bichrome glazed ware, whose

[5] Some pots, made with the paddle and anvil technique, show parallel fine lines on the inside, which were probably left by a bamboo or other vegetal stick; the paddle technique is usually associated with the Indian southern regions and the use of a bamboo stick is still widespread in Kerala pottery manufacture (A. Pavan, personal communication).

[6] Coarse red pots with splayed rim can be compared with vessels found by the author at the site of Lahori Bandar.

[7] The Far Eastern imports are currently being studied by Chiara Visconti (University of Naples 'L'Orientale').

Figure 7. *Specimens of regional grit ware collected at the Husn:* **a.** *a micro-photograph of sample ASBA2 (inv. no. 22,164);* **b.** *inv. no. 22,164;* **c.** *inv. no. 22,461;* **d.** *a deep bowl from SU 61;* **e.** *inv. no. 22,41 (© A. Fusaro).*

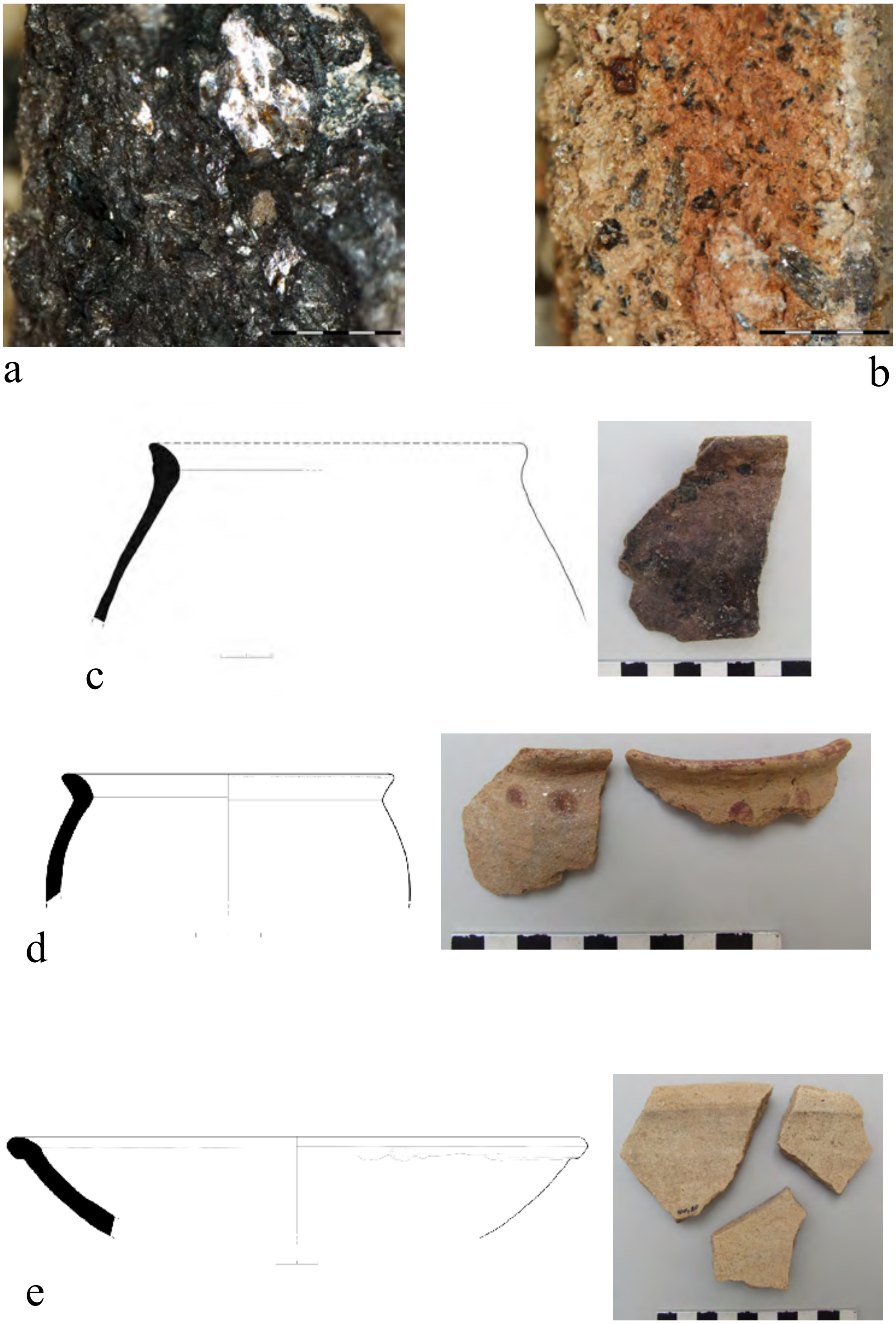

Figure 8. *Specimens of regional wares collected at the Husn:* **a.** *a micro-photograph of sample ASBA11 (inv. no. 43,67);* **b.** *a micro-photograph of sample ASBA10 (inv. no. 73L,16);* **c.** *inv. no. 43,67;* **d.** *inv. no. 73L,16;* **e.** *inv. no. 100,20 (© A. Fusaro).*

decoration is obtained by juxtaposing large vertical bands of turquoise and yellow glazes (Whitcomb & Johnson 1982: 138, 148, Yellow-Blue ware, pl. 138/v, x, z, aa). Turquoise monochrome bowls of Yemeni production[8] are frequent and widespread throughout the stratigraphy investigated, as well as underglaze painted vessels with black, blue, and turquoise decoration. The so-called Blue Tihamah ware (Keall 1983: 383; Hardy-Guilbert & Rougeulle 1995: 33–35), with white slip-painting under transparent turquoise glaze, is represented by a very few fragments found in layers not earlier than the fifteenth century (Keall 1991: 81–82). Coffee cups and a fragmentary pipe of the Haysi production (Keall 1983: 383, fig. 4/14) have been found exclusively in the uppermost layers, and have been dated to the seventeenth–eighteenth century (Keall 1991: 83–84, figs 10–11; 1992: 30–32).

There are also unglazed vessels, characterized by white slipped or light-coloured surfaces and incised decoration, interpreted as Yemeni products. Some show a close resemblance with pots, jars, and jugs from the Zabīd area (Keall 1983: 383, fig. 5; Ciuk & Keall 1996: pl. 95/12, 14, 17, 41).

Imports from Iranian regions are represented in all the layers, varying the wares according to the phases. Unglazed products consist of buff, light grey, or white cream fine jugs and pilgrim flasks, usually bearing very fine incised and pierced decoration (Priestman 2005: 201–202); they circulated at al-Balīd probably until the fifteenth century. Numerous underglaze painted stonepaste bowls and dishes dated to the Timurid and Safavid periods have been found, most of them characterized by blue painted decoration; some small bowls and cups of the Safavid period bear black and blue painted motifs, in one case the blue is combined with a red colour.[9] Some stonepaste vessels are high-quality products, as suggested by the compact fabric and the fine and complex decorative patterns, consisting of floral, vegetal, and zoomorphic motifs sometimes influenced by coeval Chinese porcelain. It is worth mentioning a stonepaste piece with outer ribbed surface under a sea-green glaze which imitates celadon, dated to the seventeenth century (Watson 2004: 465, cat. U.17; Kennet 2004: 55–57). Monochrome green-turquoise glazed conical bowls and a few small jars have been identified as Iranian products (Kennet 2004: 56, GMONO.2 group), lesser specimens belong to the so-called Persian blue speckled ware (2004: 53–54). They are widespread in almost all the layers, except those uppermost, suggesting a circulation at least from the fourteenth to the sixteenth century. Buff earthenware large bowls with underglaze black and/or turquoise painting have been mainly found in layers of the sixteenth–eighteenth century. The so-called Red-Yellow ware is represented exclusively by two specimens found in the latest occupation phase of the Husn (seventeenth–eighteenth century). They have a fine buff body, the red/brownish slip is incised and carved to create a geometric pattern, and the glaze is a transparent mustard yellow. Identical items were found in Ra's al-Khaymah and al-ʿAin (Kennet 2004: 56; Power 2015: fig. 7).

Contacts with Egypt (or possibly Syria, see David-Weill 1960; Tonghini 1998: fritware 3, 51–55, figs 74/j,o and 75/a–e) are testified since the fourteenth–fifteenth century by the finding of coarse stonepaste medium and small bowls with underglaze blue painting, sometimes associated with black; the motifs are mostly vegetal and floral, and frequently imitate contemporary Chinese porcelain (Peterson 1980: 66, pl. 4/XIII; Scanlon 1984: pls 10–11; Watson 2004: 418–423, cat. S.4; Vezzoli 2011: 132, 136–137, pls 12, 14, 16). These contacts also extend in the latest phase, as demonstrated by the presence of a few unglazed fine grey jugs with high necks, ring bases, and incised decoration dated to the seventeenth–eighteenth century (Smith et al. 2012: 180–181). Moreover, it is worth mentioning that an incomplete overfired earthenware sphero-conical vessel was found in a layer attributed to the fourteenth–fifteenth century. It has a dense, compact grey-violet fabric and a wheel-thrown body with a pointed base and bears stamped relief decoration, showing a strong resemblance to items from Egypt of the Mamluk period (Monchamp 2016: 200–202).

A single vessel found in SU 125 has been identified as a product from East Africa. It is the high neck of a large jar, characterized by dark brown fabric with sandy/quartz fine temper and burnished surface that shows similarities especially with items from Kilwa (Chittick 1974: 329, type 33, fig. 136 (b); Rougeulle 2015: fig. 179.8).

A few unglazed large pots and jars might come from regions of the Gulf area; they are made of coarse dark red compact fabrics and some show ribbed

[8] Similarities have also been identified with vessels from Zabīd; see Ciuk & Keall 1996: pls 95/46, j–m and 95/48, j–l.

[9] For the painting technique, see Watson 2004: 461, cat. U.12.5, 472, cat. U.26.

surfaces. Two handmade painted jars could have been manufactured at Julfār, as suggested by their fabric, decoration, and form (Kennet 2004: 70–71; Mitsuishi & Kennet 2013: 3, fig. 4 style 5); they were found only in the latest occupational phase of the Husn. A few handmade coarse vessels with abundant vegetal/chaff temper possibly come from southern Arabia (Whitcomb 1988: 186).

The so-called Bahla/Khunj monochrome green-brown glazed ware[10] is well represented at al-Balīd. It is a widespread ware in the Arabian Peninsula and the Gulf area during the late Islamic period. Different hypotheses have been proposed concerning its manufacturing centres: Bahlā', other centres of northern Oman, or Khunj (Iran) (Hansman 1985: 52–53; Kennet 2004: 54–55; Priestman 2008: 278; Power 2015: 10–11). The discovery of its specimens at the Husn within their original stratigraphic contexts will enable an outline of a chrono-typology for this production, giving accurate dating of its beginning and spread and suggesting its morphological evolution; at present, stratigraphic analysis indicates that this ware started circulating at al-Balīd from the fifteenth–sixteenth century, with a maximum spread during the seventeenth–eighteenth century. Furthermore, archaeometry will help solve the still debated question on its provenance.

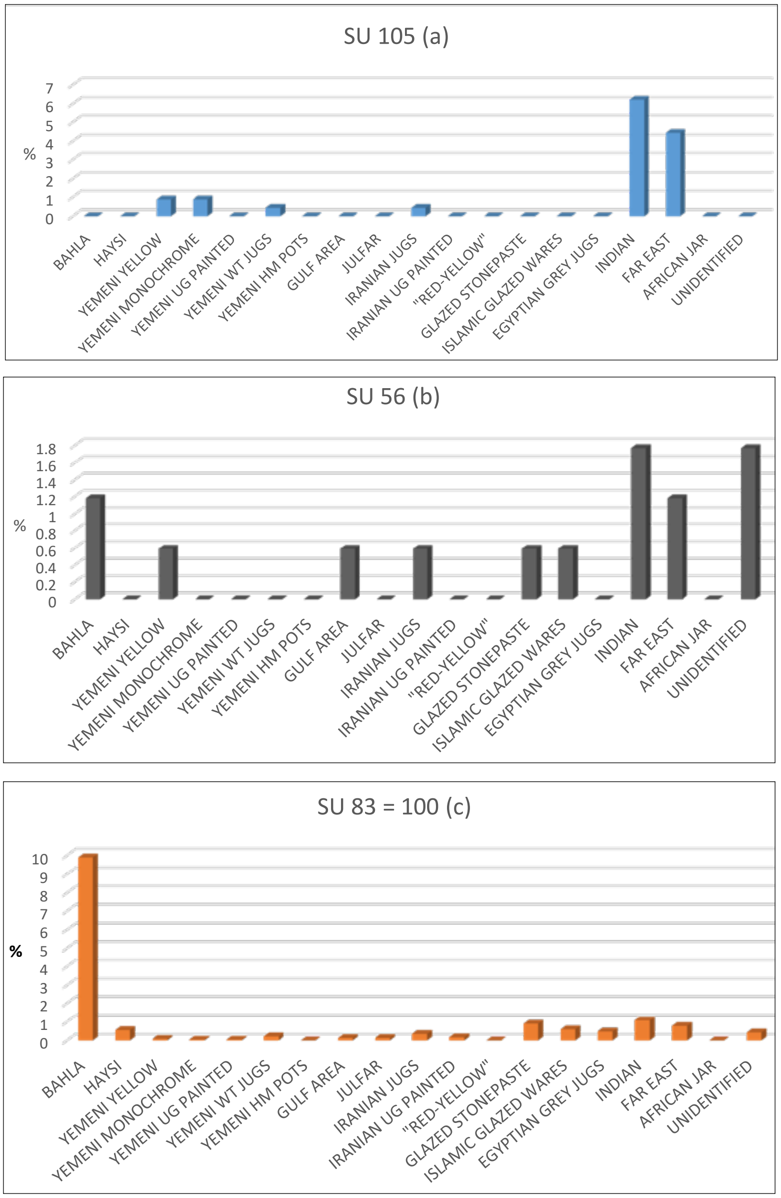

FIGURE 9. *Percentages of imported items found in the assemblages of the Husn:* **a.** *from SU 105;* **b.** *from SU 56;* **c.** *from SU 83 = 100 (© A. Fusaro).*

According to the preliminary stratigraphic and statistical analysis of the ceramic assemblages of the Husn, a change in the arrival, circulation, and disappearance of imported wares at al-Balīd can be observed, thus suggesting changes in the trade relationships between the fourteenth and the eighteenth century.[11]

In general, during the fourteenth and fifteenth century there was an intense trade, both short- and

[10] To date, there are only a very few studies on the Bahla ware, see Rougeulle et al. 2014 and the research work of Jelena Živković mentioned in Power 2015: 10–11.

[11] Data are still lacking for the previous chronological periods. As the excavations are investigating deeper layers, further study could result in a complete chronological sequence up to the most ancient phases.

long-distance, as testified especially by a good quantity of Yemeni items and abundant celadons, totalling about 60% of all Chinese imports, and blue and white porcelain; moreover, an impressive amount of Indian coarse wares was found (Fig. 9/a). During the sixteenth century, there was a decrease in imports (Fig. 9/b). Later, a new impulse of the trade towards and through Dhofar is visible in the seventeenth–eighteenth century: vessels of the Bahla ware, items from the Gulf area, blue and white porcelain bowls, and products from Safavid Iran reached al-Balīd. Conversely, the number of Indian items strongly decreased (Fig. 9/c). In the same period, a significant refinement in the quality of the local wares has been detected.

The new ceramic data on the last occupational phase of the Husn, which testify still lively local craftsmanship and revitalized international trade during the seventeenth–eighteenth century, reveal a different scenario than the one of decay and collapse previously described for the city of al-Balīd (Newton & Zarins 2017: 67).

The phases of the Husn

The whole Husn underwent several activities which inevitably affected its original stratigraphy, such as previous archaeological excavations and restorations as well as the plundering of building material in modern times. For this reason, the research work focuses on the ceramic material from the most reliable and untouched archaeological contexts. The selected areas are (see Fig. 1): rooms A31 and A33, and the larger room underneath; room A2 and the room underneath, just behind the staircase of the southern entrance; room A5, just behind the south-eastern perimeter wall and the corner tower; the central eastern area; a trench in the central southern area; a sequence of rooms (A52–A57) leaning against the eastern perimeter wall of the Husn, possibly interpreted as horses' stables; and an east gate in the same perimeter wall.

Preliminary analysis of the ceramic assemblages from these contexts allows establishing a sequence for the areas of the Husn investigated so far, suggesting at least five archaeological phases, from the thirteenth–fourteenth up to the eighteenth century (Fig. 10).[12]

In the first phase identified, during the thirteenth–fourteenth century, the rooms of the first main floor of the building, such as the large room under A31/A33, rooms A2 and A5, were fully occupied, as well as the rooms leaning against the eastern perimeter wall. In rooms A52 and A57, very good-quality mortar floors are associated with this phase. An east entrance to the palace had probably existed in an earlier period. This monumental phase is associated with massive walls made of cut stone blocks and was surely preceded by earlier constructional and occupational phases.

[12] For a comparison with the periods previously proposed for the Husn, see Newton & Zarins 2017: 67–68.

Phases (in centuries)	Rooms A31/A33	Room A2	Rooom A5	South-Central Area	Central-Eastern Area	Outside the Husn Room A52	Outside the Husn Room A57	Eastern Gate
ABANDONMENT: AFTER THE 18TH C.	COLLAPSE 48	COLLAPSE 17=3						
LATEST PHASE OF OCCUPATION: 17TH-18TH C.	MATERIAL OF SU 48	MATERIAL OF SU 17=3		SU 101	SU 83 + 100			
15TH-16TH C.	FILLING 56; USE OF ROOM A33							
ARCHITECTURAL CHANGE: SINCE THE 15TH C.	FILLING 43=61	FILLING 22=18=19	FILLING 10			DEPOSIT 73 FILLING 112	DEPOSIT 73 FILLINGS 105-106	WALL M96 + FILLING SU 125
13TH-14TH C.	USE OF ROOM UNDER A31/A33	USE OF ROOM A2	USE OF ROOM A5			FLOOR 112	FLOOR 106	USE OF THE EASTERN GATE

Figure 10. *A table showing the stratigraphic units excavated at the Husn with the associated archaeological phases and the related chronological attribution proposed (© A. Fusaro).*

The following three phases concern significant architectural transformations.

From the fifteenth century, some rooms on the main floor were intentionally filled, and the eastern entrance of the palace was obstructed by a stone wall (M96). These changes were probably made to prevent movement in the floor, raise the level of the building, and strengthen the defensive system. Around the fifteenth–sixteenth century, room A33 was probably used for the production of gunpowder and other weapons.

The latest occupational phase of the building is represented by accumulation layers 83 and 100, on the central eastern part of the palace, and SU 101 in the central southern area. Their ceramic assemblages date to the seventeenth–eighteenth century.

From the stratigraphic context of SU 101, it is possible to infer that at least some of the latest structures of the Husn were built of brick walls covered with plaster. Furthermore, it seems that — also after the collapse of those structures — the area was still occupied because a mortar floor in a central inner courtyard was laid over the debris of the brick walls.

The collapse of the stone walls, excavated in rooms A31/A33 and A2, testify to the abandonment of the Husn, probably after the eighteenth century.

Future prospects

The project and its multidisciplinary approach can respond fully to the need for a ceramic typology of al-Balīd and, more generally, can help to delineate a wider chrono-typology concerning the middle and late Islamic period for the Dhofar region, and indirectly for the western Indian Ocean. Moreover, the research work carried out so far shows that the study of ceramics contributes to a definition of a reliable chronology of the Husn. Finally, the study also allows a definition and a better understanding of the social and economic aspects of life at al-Balīd, one of the largest cities of the Islamic period in southern Oman and one of the main Islamic ports in the western Indian Ocean.

Acknowledgements

The project is conducted under the authority of the Omani office of the Adviser to His Majesty the Sultan for Cultural Affairs. For the year 2017–2018, the project was sponsored by the Max van Berchem Foundation, established in 1973 in memory of Max van Berchem (1863–1921), founder of Arabic epigraphy. Based in Geneva, the aim of the Foundation is to promote the study of Islamic and Arabic archaeology, history, geography, art, epigraphy, religion, and literature.

My deepest gratitude to Alexia Pavan, the staff of the Museum of the Frankincense Land, and Amina and Fatima for their help and support.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 147–158

Triliths, the stone monuments of southern Arabia: preliminary results and a path towards interpretation

Roman Garba

Summary

Triliths are stone monuments distributed in the landscape throughout the coastal highlands of southern Arabia, from Ḥaḍramawt in Yemen to Raʾs al-Ḥādd in Oman. They consist of three standing flat stones forming a pyramid which stands in line with others on a low platform complemented by arranged square-shaped boulders and large fireplaces. Triliths' site stone compositions mark a special space of particular meaning for rituals we still do not know. They were ^{14}C dated (from the charcoal of the fireplaces) to the Late Iron Age period (200 BC–AD 400). The interpretation is challenging due to a lack of underlying archaeological evidence. The first in-depth study on the triliths of southern Arabia yielded a consolidated trilith dataset of 554 trilith sites consisting of 2162 trilith clusters. It showed great variability in the spatial configuration of trilith elements, architectural design, and level of preservation. The increased number of trilith sites has started to reveal trails of mobility across southern Arabia. Some trilith sites are exceptional in size and unique in layout, which needs further attention. Field missions in Oman are planned in 2018–2020 to collect more relevant data, challenge trilith chronology, and test existing trilith interpretation hypotheses.

Keywords: triliths, Arabian archaeology, Oman, Yemen, stone monuments

Introduction

Triliths are stone monuments distributed in the landscape throughout the coastal highlands of southern Arabia, from Ḥaḍramawt in Yemen up to Raʾs al-Ḥādd in Oman (al-Shahri 1991; Bin ʿAqil & McCorriston 2009; Cleuziou & Tosi 2007; 2018; de Cardi, Doe & Roskams 1977; Garba 2013; 2017; 2018; Jagher et al. 2008; 2011; McCorriston 2014; McCorriston et al. 2011; 2014; Newton & Zarins 2010; Rougeulle 1999; Yule 2013; 2019; Zarins 1997; 2001; 2007). Triliths consist of three standing flat stones 30–70 cm high, leaning against each other to form a steep pyramid. They are on occasion complemented by a fourth horizontal stone on the top (Thomas 1929a: 107; Thesiger 1946: 133; Al-Shahri 1991: 191). Triliths stand in line on a low platform filled with small pebbles or stones with an exterior boundary made of elongated cobbles. The pyramids stand 30 to 50 cm from each other, forming groups of up to fifteen (Thomas 1929a: 107; 1929b: 210), twenty-five (Thesiger 1946: 133), and forty-four triliths (Genchi et al. 2016). A trilith group is associated with additional arranged square-shaped boulders and fireplaces filled with pebbles. Together these form a 'trilith cluster' (Fig. 1), a term introduced during the Duqm Survey in 2015 (Genchi et al. 2016).

One or more trilith clusters aligned on the same orientation is the most common manifestation and is known as a 'trilith site'. Locations with five or more trilith clusters were designated as a 'trilith complex' (Fig. 2) due to their size and higher significance.

Trilith clusters sometimes occur together with various auxiliary stone structures such as tumulus tombs, stone circles, or boulders with inscriptions (Thomas 1929a: 107). In some cases, the overall layout is complex, with a specific spatial configuration going beyond the typological stereotype found in the majority of trilith sites. The recording of the spatial configuration of trilith clusters and the typology definition were generally omitted in large-scale area surveys. For this reason, a trilith nomenclature was defined during the Duqm Survey 2015 (Genchi et al. 2016). The more comprehensive hierarchy of elements, modules, clusters, and associated auxiliary features (Fig. 3) was elaborated subsequently (Garba 2018: 501).

Triliths have been ^{14}C dated (based on charcoal from the fireplaces) and it is generally assumed that they belong to the Late Iron Age 200 BC–AD 400 as

Figure 1. *Typical configuration of a trilith cluster, Wādī Ṣayy, Duqm (photograph Garba 2013).*

Figure 2. *A trilith complex, Wādī Ḥamr, Duqm (photograph Duqm Survey 2015).*

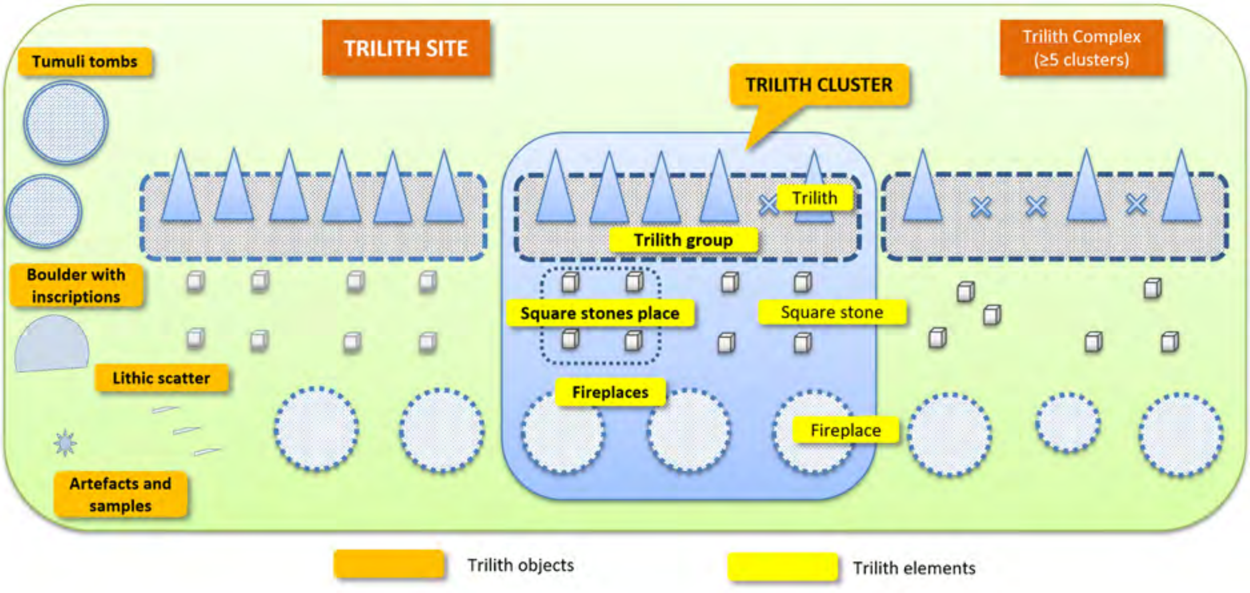

Figure 3. *Extended trilith nomenclature (Garba 2018: 501).*

the majority of dating results falls within this range (Al-Shahri 1991: 193; 2000: 57; Bin ʿAqil & McCorriston 2009: 608; Cremaschi & Negrino 2002: 342; de Cardi, Doe & Roskams 1977: 28; McCorriston et al. 2011: 4; 2014: 135-136). Today's trilith dating (Fig. 4) is still not fully representative as the number of samples is low; well-preserved trilith fireplaces were likely selected for excavations; and dates are capturing the latest use of fireplaces, thus not necessarily the time of trilith inception. Additionally, a dating sample from Ẓufār (Ḥanūn, D043-004d) yielded an earlier date (McCorriston et al. 2014: 135). This could have been caused either by contamination, or by sampling from earlier sediments supported accretive construction of the trilith fireplaces, or the sample originated from the pre-trilith layer.

#	Source	Site ID	Location	Lab Ref.	^{14}C yr BP	Calibrated *
1	**de Cardi, Doe & Roskams 1977: 28**	61	Jebel al Hammah	BM1352	1899 ± 56	**2 BC–AD 241**
2	**Al-Shahri 1991: 193**	OM.ZU.012	Wādī Dhahbūn	BRGM	2050 ± 100	**362 BC–AD 131**
3	**Al-Shahri 1991: 193**	OM.ZU.143	Wādī Naṣaḥ	BRGM	2100 ± 120	**401 BC–AD 130**
4	**Cremaschi & Negrino 2002: 342**	KR237	Wādī Dhahbūn	GX27966	2020 ± 70	**204 BC–AD 130**
5	**Cremaschi & Negrino 2002: 342**	KR245	Ḥanūn	GX27967	1870 ± 80	**41 BC–AD 337**
6	**McCorriston et al. 2011: 4**	C58-1	Wādī Ḥarou	AA79763	1749 ± 35	**AD 212 – 391**
7	**McCorriston et al. 2011: 4**	SU134-1	Wādī Sanāʾ	AA79769	2026 ± 35	**115 BC–AD 57**
8	**McCorriston et al. 2014: 136**	D043-004d	Ḥanūn	AA90333	2141 ± 42	**236–51 BC**
9	**McCorriston et al. 2014: 136**	D043-004d	Ḥanūn	AA90337	3230 ± 100	**1746–1264 BC**

* OxCal 4.3, IntCal 13

Figure 4. *Overview of trilith radiocarbon dating.*

Challenging the existing trilith chronology is a central part of the 'Triliths: The Stone Monuments of coastal highlands of Oman (TSMO)' field research project scheduled for 2018–2020 with the first field season starting in November 2018. This will be done by acquiring more dating samples from stratigraphically excavated trilith fireplaces at sites with weathered fireplaces and sites with a mixture of well-preserved and weathered trilith clusters, and attached tombs. A dozen fireplaces and two tombs have already been identified with the aim of providing archaeological data to test the null hypothesis (that triliths are not Late Iron Age monuments). Additionally, palaeoenvironmental proxy data from the micro-survey of trilith space will be added. Testing trilith chronology will be a crucial input for testing existing interpretation hypotheses and to formulate a trilith interpretation framework.

Trilith sites are more complex than previously assumed. They are not just upright stones placed in the landscape but occur in a zone where trilith stones are one of the many spatially distributed and hierarchically structured components forming a 'space' or 'sacred place' with a special meaning. The purpose of building trilith clusters remains obscure. So far, various historical and archaeological sources have tried to interpret the triliths. The early hypotheses suggested that triliths were graves (Thomas 1929a: 108) and such views still prevail among the modern local Omani population. This hypothesis began to be questioned (Al-Shahri 1991: 194; 2000: 57) and interpretation shifted to the opinion that trilith function seems to be ritual, due to the lack of skeletal remains under the triliths (Zarins 2007: 323). The funerary context is not completely ruled out as in many cases one or more tumuli tombs appear in close proximity of trilith clusters (de Cardi, Doe & Roskams 1977: 30; Thesiger 1946: 133). Many untested hypotheses appeared in the course of time. Triliths were thought to be connected with the following: segmentation of groups in tribal communities including visitors/guests represented by a square of four boulders (Bin 'Aqil & McCorriston 2009: 609); frankincense collection and trade (Newton & Zarins 2010: 254; Harrower, Senn & McCorriston 2014: 149); people travelling across the desert between Yemen and northern Oman (Zarins 2007: 323); Mahri tribe territory of the late first millennium BC and first millennium AD (Dostal 1968; Yule 2014: 74; 2019); funerary practice of an important individual buried in close proximity of triliths (Thesiger 1946: 133); a place of communal feasts with ritual fires, sacrificial function, slaughtering of animals, and food preparation (McCorriston et al. 2011: 17; McCorriston 2013: 625); a place of worship of four pre-Islamic gods associated with celestial bodies (moon, sun, morning star, and evening star) on particular days of the year (Al-Shahri, personal communication; Harrower, Senn & McCorriston 2014); symbols of the South Arabian trinity of the sun god, moon god, and Zahra (Venus) (Thomas 1929b: 209; 1932: 126); a place of Zoroastrian ritual harvest practices (Zarins 1997: 674); a place of commemorative ritual (de Cardi, Doe & Roskams 1977: 30); a place where nomads and settled pastoralists came together (Reade 2000: 133); and the marking of passageways or ritual stopping points (Harrower 2008: 197). The early historical hypothesis that triliths are graves (Thomas 1929a: 108; 1932: 128) can be ruled out as all existing archaeological investigations support the null hypothesis such as the lack of skeletal remains under the triliths (Zarins 2007: 323) and intact natural stratigraphy below the triliths, with no graves or pits (de Cardi, Doe & Roskams 1977: 27). The only common denominator of all existing hypotheses is that triliths were built by people. Placing people in the centre might lead to a working hypothesis of trilith sites as a meme, a replicable piece of cultural identity that can spread in space and time. Considering trilith sites as a footprint of activity and meme at a general level might, for example, deprioritize other hypotheses binding triliths exclusively with physical objects such as water sources, wadis, or frankincense. It is still too early to conduct any sound test of existing interpretation hypotheses without challenging trilith chronology and without studying the archaeological data obtained from trilith space micro-surveys, activities planned in 2018–2020 as part of the TMSO project.

Trilith distribution patterns

The triliths' geographical distribution was archaeologically recorded in Ḥaḍramawt and the al-Mahra Governorates of Yemen (Banks et al. 2017; Bin 'Aqil & McCorriston 2009; McCorriston et al. 2011; Rougeulle 1999); in the Ẓufār Governorate (Harrower, Senn & McCorriston 2014; McCorriston et al. 2014; Newton & Zarins 2010; Al-Shahri 1991; Zarins 2001), al-Wusṭā Governorate (Genchi et al. 2016; 2017; Jagher et al. 2008; 2011; Jagher & Pümpin 2010), and Ǧanūb aš-Šarqīyah and Šamāl aš-Šarqīyah Governorates of Oman (de Cardi, Doe & Roskams 1977: 26–32; Doe 1977; Al-Jahwari 2013). The island of Suquṭrā is not a confirmed special inclusion, as their inhabitants are ethnically and culturally close to tribes on whose territories triliths are distributed. Triliths on Suquṭrā island were listed by W. Dorstal (1968) but were mentioned as destroyed (de Cardi, Doe & Roskams 1977: 29). They were potentially reported from south-western Saudi Arabia (Zarins, Murad & Al-Yaish 1981: 30). Walter Dostal published the first trilith distribution map (1968: between pp. 54 and 55) with twenty-four trilith sites. He was the first to associate triliths with Mahri tribes and the spread of Modern South Arabian languages. The next major work on trilith distribution was Beatrice de Cardi's report on the Sharqiyah survey in 1976 (de Cardi, Doe & Roskams 1977). She consolidated all available trilith references into a trilith distribution map (1977: 30–31, fig. 7) with forty-six trilith sites. This was, for a long time, the most comprehensive study of triliths. In 2013 Paul Yule and Curt Hilbrig compiled a new trilith distribution map consisting of fifty-two trilith sites (Yule 2013: 25, fig. 14) based largely on de Cardi's results. Walter Müller enlarged Dostal's analysis of the local place name endings in the Mehri language (Müller 1991). Recently Yule reiterated and articulated Dostal's theory that the trilith distribution area indicates the ancient spread of Mehri speakers (Yule, 2019). Trilith data consolidated from different sources and remote sensing enabled the updating of the trilith dataset to a total of 231 trilith sites of 647 clusters (Garba 2017: 51; 2018: 503). In 2018, after site validation trips in Oman and extensive remote-sensing desktop work, the trilith dataset grew to the current 554 trilith sites consisting of 2162 trilith clusters. This is significantly higher than any other previous trilith datasets and distribution lists, as shown in Figure 5.

Source	Study area	Number of trilith sites / clusters
Dostal 1968	OM, YE	**24**
de Cardi, Doe & Roskams 1977	OM, YE	**46**
Jagher & Pümpkin 2000	OM.WU	**36**
McCorriston 2010	OM.ZU	**31**
Newton & Zarins 2010	OM.ZU	**61**
Yule 2013	OM	**52**
Rose 2017 (personal communication)	OM	**34**
Garba 2017 (dB v.5.1, Sep 2017)	OM, YE	**231 / 647**
Garba (dB v.9.5, Jul 2018)	OM, YE	**554 / 2162**

FIGURE 5. *Overview of trilith datasets and distribution lists.*

Out of Oman's dataset, 166 trilith sites have been validated. On Yemeni territory, due to the lack of physical access only remote sensing was possible. The recent increase in the number of sites is mainly associated to newly acquired sites in Yemen triggered by the availability of better satellite imagery and the introduction of a systematic wadi by wadi approach. The process of building a trilith dataset has specific challenges and relies on several inputs such as already existing archaeological data and remote-sensing acquisition of new sites. Archaeological data from Oman were fragmented, geographically limited datasets of archaeological missions, with their own naming and labelling. Another major entry into the trilith dataset was desktop-based remote-sensing data acquisition. The combination of Microsoft Bing and Google Earth maps proved to be the most efficient. The Bing maps were in many cases better than Google Earth, especially for Ḥaḍramawt, Mahra, and al-Wusṭā Governorates. Using the timeline in Google Earth sometimes gives better results with older satellite images. Recent advancements in object detection software techniques and work on remote-sensing detection of cairn tombs in southern Arabia (Harrower et al. 2013; Schuetter et al. 2013) can automate the initial process of trilith site acquisition after learning specific trilith patterns (e.g. fireplace sequencing and linearity). However, in many cases, it will not completely replace on-site field validation and human inspection. The use of automated site detection in Ḥaḍramawt, Mahra, and Ẓufār could be more efficient as trilith patterns have proved to be more distinct and typologically homogeneous than in other areas. Further north the al-Wusṭā and al-Šarqīyah/al-Dāẖilīyah/al-Buraimī trilith patterns become more heterogeneous and difficult to distinguish from the biomass and geological outcrops. An example of a geological outcrop resembling a trilith site is shown on Figure 6. The remote-sensing exercise identified a 'clear' trilith site OM.SS.016,

Figure 6. *A geological outcrop resembling a trilith site.*

but field validation yielded negative evidence. The use of automated object detection techniques in trilith site acquisition is planned in the future. The newly extended trilith site/cluster dataset is delivering a dramatically larger training set that will enable an adjustment of the detection algorithm, thus reducing the number of false detections.

The preliminary statistics have shown that the average number of trilith clusters per site is the highest in Ḥaḍramawt and Mahra, which decreases in Ẓufār and al-Wusṭā and increases again in al-Šarqīyah. In the frontier areas trilith sites tend to have more trilith clusters and thus more fireplaces, suggesting more people at the same time. Isolated trilith sites alongside possible transport corridors generally tend to be smaller, thus indicating that they were visited by smaller groups of people travelling in caravans, and were probably used as markers and stopping places on a route. This pattern and its dynamics will be further investigated. The updated new trilith distribution map (Fig. 7) significantly improves knowledge of trilith distribution throughout southern Arabia.

The recent additions to the trilith dataset represent the discovery of previously unknown trilith sites such as a trilith complex in Adam, trilith-like structures in Buraimī, a high concentration of trilith sites around Duqm, and a high number of trilith sites in eastern Yemen, which have previously never been mapped by number. The area around Duqm is one of the major trilith 'hotspots' and a new discovery in trilith studies. This might suggest a sizable permanent population in the area with speculative interpretations such as a place of sourcing and export of flint material and tools, a favourable living area for sedentary pastorals, a neutral zone for meeting places between different tribes in the north and south, or an emporium — an area of trade and goods exchange, etc. Regrettably, we do not yet have enough solid evidence to be more confident in supporting any of the listed interpretations.

The presence of trilith sites provides material representation of the existence of mobility corridors along the Omani coast and potential secondary routes. Probably the most interesting preliminarily result to come from the new trilith distribution dataset is the

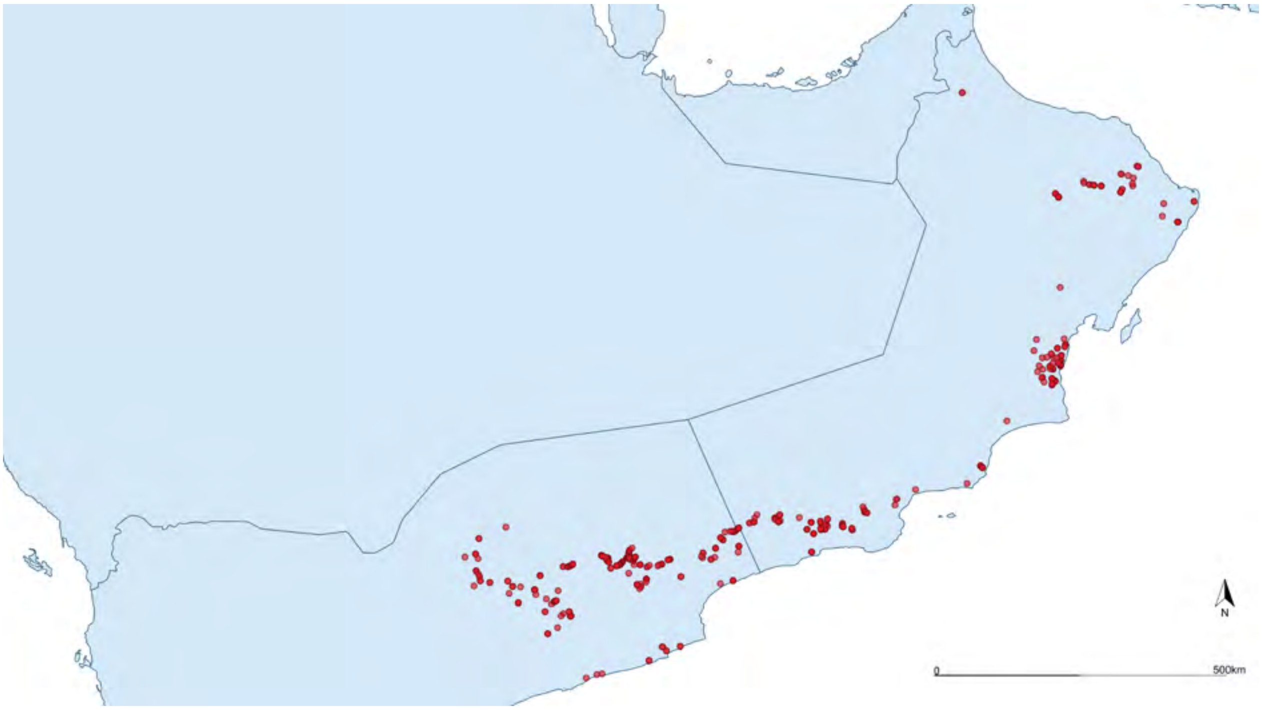

Figure 7. *Updated trilith distribution map (trilith dB v.9.5, July 2018).*

evidence (based on regional densities of the trilith sites) of the existence of a land route connecting Ẓufār with Ḥaḍramawt at the peak of the frankincense trade in the early first millennium AD. The trilith site density heat map illustrates this land route (Fig. 8). This contrasts with the perception that a sea route was used to connect Ẓufār with Ḥaḍramawt, but very likely both routes were used at the height of the frankincense trade. This new working hypothesis is planned to be tested with the results of research on trilith chronology and the collection of palaeoenvironmental data as part of the TSMO field project. Additionally, GIS-based spatial analyses for this route will be undertaken.

Typological variations

Despite the initial perception that trilith sites are similar over the entire region, this study has showed a gradual transition of typological characteristics of the trilith sites from the south-west (Ḥaḍramawt and al-Mahra Governorates of Yemen) towards the north-east (al-Šarqīyah Governorates of Oman). One of them is a change in the design of trilith platforms (Fig. 9, right), from the robust and distinct in Ẓufār, to the subtler and less distinct in al-Wusṭā and al-Šarqīyah (Garba 2017: 57–58; 2018: 506–507).

Apart from structural characteristics there are a few typologically specific cases in al-Wusṭā represented by the trilith complexes of Wādī ʿAīnain (OM.WU.073-084), Wādī Ṣayy (OM.WU.058-070; OM.WU.085-088), and Wādī Nafūn (OM.WU.022-041; OM.WU.089-090) as they appear to be unique. The Wādī ʿAīnain trilith complex is characterized by a mixture of weathered trilith clusters and well-preserved trilith clusters suggesting different periods. One standing trilith has a capstone that suggests an incense burner as it contains traces of burning (Fig. 9, bottom left). Material research (stratigraphic excavation of the weathered and well-preserved fireplaces and a micro-survey of trilith clusters) of the Wādī ʿAīnain trilith complex is planned in the coming field seasons. There are puzzling trilith-like structures made of stone monoliths (Fig. 9, upper left). They are located in Wādī Ajran (OM.BU.001) close to Buraimī, but a similar line of monoliths can also be found in al-Šarqīyah (OM.SS.022

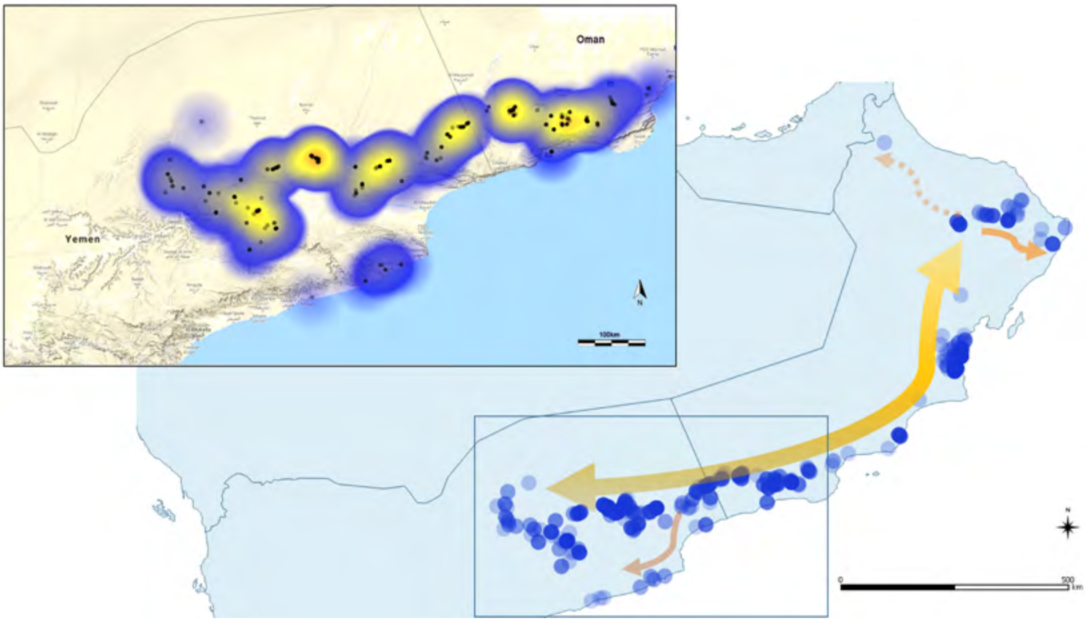

Figure 8. *Trilith site density-based land route connecting Ẓufār with Ḥaḍramawt and other potential mobility corridors.*

Figure 9. *Trilith platform variations and other peculiarities (photographs R. Garba).*

in Wilayat Dama Wa At Taiyyin). These trilith-like sites with lines of monoliths need further investigation to discover the relationship with 'standard' trilith monuments. Furthermore, monoliths are presented among triliths in some cases also in Ẓufār (e.g. Mudday). The Wādī Ṣayy trilith complex (OM.WU.086) is an area with various trilith features measuring 300 x 90 m with many badly weathered clusters. The spatial configuration is unconventional and complex. In addition to long lines of nine trilith clusters, there are also two neighbouring clusters. An interesting feature is the large Umm an-Nar-like tomb attached to the trilith complex. Probably the most significant area is Wādī Nafūn, a 'trilith landscape' of fifty-five trilith clusters with a high degree of variability. Among others, there is an extremely long trilith group OM.WU.031 consisting of thirty-three triliths and associated fireplaces unconventionally placed at the foot of the neighbouring conical hill, and a massive trilith site OM.WU.026 (Fig. 10) with eleven heavily weathered trilith clusters, with a total length of 140 m and thirty large fireplaces. All the trilith groups lack any standing triliths, in contrast to preserved fireplaces and square stone compositions. What actually happened is not known and an intensive material research of the Nafūn triliths is an important part of the planned TSMO field seasons in Duqm.

Conclusion and further development

The first focused study of the triliths of southern Arabia was conducted with the aim of developing a knowledge base, consolidating a trilith dataset, and creating a basis for trilith interpretation (Garba 2017; 2018). An updated trilith distribution map numbered 554 trilith sites, of which 166 trilith sites in Oman were ground-validated. The consolidated trilith dataset includes information on 2162 trilith clusters. This is significantly higher than any other previously recorded trilith dataset. The preliminary research results show great variability in the spatial configuration of trilith elements, architectural design, and level of preservation. Some variations have inter-regional trajectories. Recorded data from Duqm (al-Wusṭā, Oman) show a high quantity and great diversity of trilith sites in central Oman. Some of the trilith complexes are exceptional in size and unique in spatial layout; there are 'trilith hotspots' characterized by abnormalities such as 'sacred hill' trilith sites, zigzag lines, drifted fireplaces, capstones, or monoliths that need further attention. The research based on trilith site regional densities has created a working hypothesis for the existence of a land route that connected Ẓufār with Ḥaḍramawt at the peak of the frankincense trade in the early first millennium AD, which will be tested further. It is still too early for a sound, evidence-backed new hypothesis of the function of triliths. A working path towards trilith interpretation runs via the TSMO field project in Oman scheduled for 2018–2020. Fieldwork will be focused on challenging the trilith chronology (e.g. stratigraphic excavation of trilith fireplaces and collection of more 14C dating samples), the study of typological aberrations (e.g. 'sacred hill' sites, trilith complexes, monoliths), and micro-survey of material remains within and around the trilith sites. The results of the TSMO project are crucial for testing

Figure 10. *Trilith site OM.WU.026 in the Wādī Nafūn trilith complex (photograph Duqm Survey 2015).*

all existing trilith interpretation hypotheses and for the development of a trilith interpretation framework. Systematic and focused multi-year research on triliths could shed more light on the function and meaning of these mysterious monuments, which are still not fully understood and/or clearly interpreted.

Acknowledgements

My thanks to the late Prof. Maurizio Tosi (1944–2017), who guided me to the world of archaeology in south-eastern Arabia and Central Asia and who encouraged me to get involved in research on triliths. I would like to thank my tutor Prof. Andrea Manzo and co-tutor Dr Romolo Loreto at the Università L'Orientale (Naples, Italy) for their valuable feedback and continuous support of my PhD research programme on triliths. I would also like to express my deep gratitude to the Ministry of Heritage & Culture (MoHC) of the Sultanate of Oman representatives, Mr Sultan al-Bakri and Khamis al-Asmi for their support of the forthcoming field missions. This study would not be the same without a significant amount of trilith data from Duqm in central Oman recorded during our Duqm Survey 2015 project, an archaeological expedition headed by Dr Francesco Genchi with participants Dr Gabriele Martino, Ms Maria Pia Maiorano, and Mr Waleed Hamad Al-Ghafri (MoHC). I would like to thank Khamis Al-Asmi (MoHC), Dr Jeff Rose, Mr Tony Welsh, and Dr Manfred Böhme for their valuable inputs into the trilith database and interpretation. Special thanks to Prof. Paul Yule for his continuous support, suggestions, and for editing my text. Finally, my thanks to the two anonymous reviewers for valuable inputs and to the copy editor for her patient work. My research on triliths is dedicated to Maurizio Tosi and Beatrice de Cardi, two great Arabian archaeologists.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 159–165

The gendered household: making space for women in the study of Islamic archaeology in Qatar (poster)

Elizabeth R. Hicks

Summary

This paper outlines the archaeological evidence for the activities of women within domestic compounds in Qatar, from the eighteenth to the early twentieth century. The work of feminist scholars within Western archaeology has established that gender is an important component of a person's social life. When the focus shifts to the archaeological literature of the Arabian Gulf, the narrative of women's lives is lost.

This research paper presents evidence from recent excavations of domestic compounds at three key sites in Qatar: Fuwayrit, Furayḥah, and al-Zubārah. This investigation synthesizes historical, ethnographic, and archaeological research not only to envisage the presence of women, but also to explore the processes that create gender identity in the context of Qatar. This paper will demonstrate that in recognizing the activities of women within the archaeological record, a more complete understanding can be gained of the society and economy of Qatar during this period.

Keywords: gender, household activity, Islamic archaeology, Qatar, women

Introduction

The archaeological remains of domestic structures in Qatar, dating from the eighteenth to the early twentieth century, present us with an opportunity to investigate and amend our understanding of gender identity and the economic and social roles of women. This paper proposes that recent excavations at the sites of Fuwayrit (Carter & Eddisford 2016; 2017), al-Zubārah (Richter, Wordsworth & Walmsley 2011; Humphrey 2011; Richter & Walmsley 2011), and Furayḥah (Rees et al. 2012) can provide the archaeological evidence for the activities of women, that previously have only been identified in historical and ethnoarchaeological sources (Figs 1 and 2). This analysis will demonstrate that the work of women in the Arabian Gulf was a vital component of their gender identity, in addition to demonstrating that household industries and the activities that women performed within domestic space were important to the economic development of Qatar.

The domestic compound was selected as the focus for this study as androcentric bias and outdated theoretical perspectives are pervasive within the interpretation of these contexts. The use of binary divisions within the analysis of archaeological data is universal within this field of study. By developing a new theoretical approach, applying it to archaeological data and critiquing the findings, this paper has created a theoretical model that is applicable to the archaeology of Qatar. It is through this approach that this study departs from merely identifying women in the realm of the household, and instead working towards a more comprehensive understanding of the creation of gender identity through a person's interaction with material and space.

Literature review

A number of theoretical approaches have influenced the development of this study, most evidently the work of feminist gender theorists (Wylie, Okruhlik & Thielen-Wilson 1989; Conkey & Spector 1984; Classen 1992; Conkey & Gero 1997; Gero & Conkey 1995; Butler 1999; Gilchrist 1994; 1999; Perry & Joyce 2001; Rubio 2011) and the concept of reflexive relationships (Donley-Reid 1990: 119). Up until now, to the best of the author's knowledge, there has not been a single study devoted to discussing women and gender in the archaeological record of the Arabian Gulf. It is essential that a point of reflection and re-evaluation is reached, so that archaeologists working in this region recognize gender as an essential

FIGURE 1. *A map showing the location of Fuwairit, Al-Zubārah, and Furayḥah in Qatar (map created with Google My Maps, mymaps@google.com).*

and complex consideration when interpreting the social structures of past societies.

The use of oppositional binaries to interpret domestic space in the archaeology of the Arabian Gulf is pervasive; to divide the roles of women and the use of space in this way often limits the ability of archaeologists to conceptualize activity, movement, and the variability of gender identity. The influence of unreflexive structuralist approaches is particularly apparent in discussions about Islamic household space (Small 1991: 338; Nevett 1999: 105–107). It is essential to remember that a Western interpretation of privacy is a culturally specific construction and, in many cases, does not correlate with how privacy is conceived in the Arabian Gulf (El Guindi 1999: 81; Sciama 1981: 109). If we continue to restrict women to our current concept of privacy, we narrow our own understanding of gender and the roles of women in historic Islamic contexts.

The theoretical approach applied within this study aims to identify how women use space and interact with material culture in order to understand how gender identity is constructed in historic Qatar. This research draws on Donley-Reid's (1990: 116) concept of reflexive relationships to examine how the interaction between people and space and people and objects represents key components in the construction of gender identity. This perspective is integrated with the work of Vom Bruck (1997: 166) who contends that space is created through practice, hence the cultural meanings invoked in this process are principally unstable and contextual. The application of Vom Bruck's (1997: 166) concept allows

FIGURE 2. *A map of the north of Qatar, showing the sites of Fuwairit, Furayḥah, and Al-Zubārah (map created with Google My Maps, mymaps@google.com).*

Figure 3. *Building 6 within Trench 1 at the site of Fuwairit, looking south (www.flickr.com/photos/originsofdoha/35046991375/in/photostream/).*

for the deconstruction of the perceived distinction between what is public and what is private space. These theories are consolidated through Butler's (1999: 178–179) theory of performance, linking the actions of everyday domestic activities to the creation of gender identity through an individual's interaction with the material world. This study will integrate these approaches and apply them to recent excavations at the sites of Fuwayrit, al-Zubārah, and Furayḥah. This critical analysis will bring women to the forefront as active agents and develop an understanding of how gendered roles and behaviour were structured and maintained.

Re-analysing the archaeological investigations from the site of Fuwayrit, Qatar

The archaeological excavations at the site of Fuwayrit have the potential to shed light on the activities of women within domestic space from the eighteenth to the early twentieth century. The data analysed within this study was collected over the course of 2016 and 2017, as part of the Origins of Doha Project (ODP) (Carter & Eddisford 2016; 2017). This research primarily focused on Trench 1; within this excavation area seven building phases were identified associated with conflated courtyard surfaces, post holes relating to ephemeral wooden structures, and midden deposits (Carter & Eddisford 2016: 25) (Fig. 3). The data from the finds lists, context lists, and extensive stratigraphic descriptions from Trench 1 were examined to identify concentrations of activity. In this section, a brief overview is given of the main conclusions arising from the discussion of the material evidence, alongside historical and ethnoarchaeological studies that helped to clarify the roles of women in these contexts.[1]

[1] The interpretations made in this paper were limited as post-excavation analysis was ongoing. It is hoped that once these processes are complete, the ODP team will be able to supplement the initial observations made here with more detailed findings.

Post holes from ephemeral courtyard structures were excavated within courtyard deposits, found across multiple building phases, and associated with layers of rich midden material linked to household activities (Carter & Eddisford 2016: 17; 2017: 25–28). The associated midden layers produced a typical assemblage of bone, shell, metal, and ceramics (Carter & Eddisford 2016: 17). Ethnographic evidence of ephemeral courtyard structures and their associated midden material (Kay & Zandi 1991: 64; Ziolkowski & Al-Sharqi 2005: 18) suggests that these shelters functioned as a place where women would cook and prepare food, socialize, and carry out domestic activities.

The evidence for *tannur* ovens and fire installations within Trench 1 indicates that the cooking and preparation of food occurred within both internal and external areas, suggesting that within these households there was no separate cooking area (Carter & Eddisford 2017: 29–32). Many women living in rural regions of the Arabian Gulf still cook using *tannur* ovens and it is common for women to cook inside the house during winter and outside during the summer (Kay & Zandi 1991: 53). The process of cooking and preparing food is evidence of women enacting a gendered role; the location of these fire installations and their associated finds has the potential to help us understand how women used space and interacted with material.

A number of diagnostic small finds were found associated with the building phases from within Trench 1 and indicate the activities of women. Glass bangles and other items of adornment would have been worn by the women of Fuwayrit (Ziolkowski & Al-Sharqi 2005: 237). These objects were commonly found in the fill of midden pits and within areas of accumulation associated with the collapse, levelling, and rebuilding of domestic structures (Carter & Eddisford 2016: 26–34; 2017: 45–61). In total, four *miflaqa* knives were found in both the internal rooms and external courtyard spaces. These knives are typically associated with the processing of pearl oysters (Carter 2012: 216). Further research is necessary to establish whether pearl oysters were processed within the domestic space and the role of women in this activity. This may alter our understanding of the boundary between economic activities, such as pearl fishing, and domestic space.

Discussion

When domestic structures excavated from the three sites of Fuwayrit, Furayḥah, and al-Zubārah are compared, it is apparent that there was significant variation in the use of space within these broadly contemporary households. The domestic structures at Furayḥah Excavation Point 4 and Trench 1 (Fuwayrit) correspond to Nagy's (1998: 284) description of a 'yard-orientated house'. The rooms of a yard-orientated house would have been shared by the whole family and may not have adhered to strict interpretations of space that stress a ridged separation between what is public, and what is private (1998: 284). Comparatively, the domestic compounds in al-Zubārah Excavation Point 1 (Fig. 4) do exhibit the features of an idealized Islamic courtyard house, with rooms arranged around a central courtyard (Eddisford & Carter 2017: 84). This study proposes that this variation could reflect disparity in the levels of wealth between these households, which altered how gender was performed within these different contexts.

The archaeological excavations from the site of al-Zubārah produced a wide range of porcelain cups, most likely used for serving coffee. Many porcelain pieces also show signs of repair, suggesting that these objects were curated and had an important meaning for their owners (Richter & Walmsley 2011: 357). The presence of a women's *majlis* is attested within ethnographic sources investigating the organization of domestic space in Yemen (Kotnik 2005: 475; Vom Bruck 1997: 151). The women's *majlis* is a space for the reception of female guests and has not previously been identified archaeologically in the Arabian Gulf; concentrations of objects, such as porcelain cups, may indicate where the reception of female guests took place. The role of women in receiving guests within the home was an important performance saturated with gender ideals and consolidated through interaction with objects, such as those used for the serving and preparation of coffee.

This research has argued that gendered activity and the work of women was an important component of gender identity in the Arabian Gulf region. The excavations from al-Zubārah and Furayḥah further validate the importance of household industries in the development of the economy of Qatar, indicated by the significant number of *madbasah* date presses within domestic structures (Richter, Wordsworth & Walmsley

Figure 4. *An overhead view of Zubārah Excavation Point 1, partially excavated (Walmsley [n.d.]).*

2011: 13; Rees et al. 2012: 321; Metcalf, Sultan & Weir 2011: 144), thus asserting that in the pre-oil era the women of the household were responsible for the date harvest in the oases, as most able-bodied men would be absent during the pearl fishing season. Further research into the migration of women for the date harvest, the role of women in managing and owning date plantations, and the process of preserving dates and making date *dibs*, is necessary before we can truly understand the relationship between the role of women in the date industry and the construction of gender identity.

Conclusion

This research set out to analyse the archaeological evidence for the activities of women within domestic compounds in Qatar, from the eighteenth to the early twentieth century. Through the application of theoretical approaches inspired by feminist gender theory, we can develop our understanding of the way in which the interaction of women with the domestic space and objects created gender identity. This study challenged the use of dichotomies and structural binaries to evaluate how gender is constructed and how space and objects were used. In conclusion, the structure of domestic space both enables and limits the gendered activity of women. However, further research is needed to understand the complex relationship between women, gender, and objects. In recognizing the activities of women, a more complete understanding can be gained of how the economy and society of Qatar operated during the eighteenth to early twentieth century. Current literature has systematically avoided discussing these contributions and future research is needed to address the androcentric bias within the historical and archaeological narratives of Qatar and in the wider Arabian Gulf region.

Acknowledgements

First and foremost, I would like to thank Dr Colleen Morgan for supervising my dissertation, for her support, and for highlighting the need for research that focuses on women in Arabian Gulf archaeology. I would also like to thank the head of the Origins of Doha Project, Prof. Robert Carter and UCL Qatar for allowing me to excavate at Fuwayrit during the 2017 field season and for funding my travel to Qatar. I would especially like to thank site director Daniel Eddisford and the rest of the Origins of Doha team for sharing their vast experience and for making me feel so welcome. I am indebted to Dr Stephanie Wynne-Jones; our discussions about theory and Swahili stone houses helped me to develop the concepts and methods explored within this research.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 167–186

The Palaeolithic of the northern Red Sea — new investigations in Tabuk and Al-Jawf provinces, Saudi Arabia

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Christopher Scott & Dhaifullah Al Otaibi

Summary
The land bridge formed by the Sinai Peninsula is one of the major routes proposed for hominin dispersal out of Africa for both *Homo erectus* and *H. sapiens* populations, and its neighbouring regions are, therefore, key to understanding these dispersals. Directly adjacent to the land bridge, the Saudi Arabian northern Red Sea and Gulf of Aqaba coastlines have, until now, been subject to only rapid survey for Palaeolithic archaeology in the 1970s–80s, locating a handful of Palaeolithic artefacts.

A twelve-day reconnaissance survey was undertaken by a Saudi-UK team along the northern Red Sea and Gulf of Aqaba coast in February 2018 for Palaeolithic artefacts, the results of which are presented in this paper. Thirty-four locations were surveyed, across a range of landscape settings, the majority yielding Acheulean and prepared-core technology lithic artefacts, traditionally ascribed to *Homo erectus* and *H. sapiens* populations in Arabia respectively. These observations, while descriptive and necessarily brief, identify a previously undocumented record of Palaeolithic archaeology in a largely unexplored part of Saudi Arabia. The landscape settings in which artefacts were observed provide a geomorphological framework for locating Palaeolithic material in future surveys to realize the potential of the region to understand hominin dispersals from Africa into Arabia and beyond.

Keywords: Palaeolithic, Saudi Arabia, Red Sea, dispersals, geoarchaeology

Introduction

Hominin populations dispersed from Africa into Europe and Asia from at least the beginning of the Pleistocene, with artefacts dated to 2.1 million years ago (mya) in China (Zhu et al. 2018), 1.8 mya in Georgia (Ferring et al. 2011), 1.6 mya in the Levant (Bar-Yosef & Belmaker 2010), 1.5 mya in India (Pappu et al. 2011), and 1.4 mya in Italy and Spain (Arzarello et al. 2007; Toro-Moyano et al. 2013). In this context of dispersal, the Sinai land bridge must always have been important for the movement of people and animals between Africa and Arabia throughout the Late Pleistocene. It has long been considered the primary, and probably the first, route taken by *Homo erectus*, and later *H. sapiens*, populations during their dispersals from Africa (Bar-Yosef & Belfer-Cohen 2013). The Palaeolithic record of this region, therefore, can inform on the routes, timing, and conditions of these first dispersals as well as the subsequent Palaeolithic occupation of Arabia.

A wealth of archaeological evidence deriving from a long history of research in the Levant, Jordan, East Africa, and latterly the interior of the Arabian Peninsula, illustrates the potential richness of the archaeological record of this region, yet some areas close to the route remain under-researched. In particular, while the interior of northern Saudi Arabia has been the subject of research since the Comprehensive Archaeological Survey Program (CASP) in the 1970s and 1980s (Ingraham et al. 1981; Gilmore, Al-Ibrahim & Murad 1982) followed by a programme of recent research associated with former lakes and water courses in the northern interior (see e.g. Breeze et al. 2017; Jennings et al. 2016; Scerri et al. 2015; Shipton et al. 2014; Petraglia et al. 2012), the Saudi Arabian littoral of the northern Red Sea, as well as the Gulf of Aqaba's eastern shoreline, have not been further investigated for Palaeolithic archaeological evidence since the 1980s. This first research in the 1980s identified two Palaeolithic find-spots near Al Muwaylih, but areas further north or along the Gulf of Aqaba were not included in this original survey (Ingraham et al. 1981; Gilmore, Al-Ibrahim & Murad 1982).

This paper reports on the findings of initial, exploratory fieldwork in the region undertaken by a

UK-Saudi team in spring 2018 and presents some initial interpretations. The team investigated thirty-four localities chosen across a range of landscape settings. Nearly all of these localities yielded surface lithic artefacts with Palaeolithic technological characteristics. The necessary speed of fieldwork means that most localities only yielded a small number of lithic artefacts, for which the interpretation remains preliminary. The common presence, however, of Palaeolithic artefacts in the survey region demonstrates that the littoral region of the northern Red Sea and Gulf of Aqaba, like many other under-researched regions, should not be ignored; the environments and resources within the region may have provided a draw for dispersing populations to move along and within, rendering the Red Sea coastline key to understanding the prehistory of the Arabian Peninsula, particularly in the dispersals of *H. sapiens c.*125,000 years ago during Marine Isotope Stage 5 (MIS5; Bailey et al. 2015; Inglis et al. 2018).

Geological setting

The far north-west of Saudi Arabia can be divided into a series of broad landscape zones (Fig. 1). The region is dominated by the Hejaz Mountains, the northernmost extension of the Arabian Escarpment which runs the length of the Red Sea (Vincent 2008). The Hejaz Mountains consist of the faulted and tilted Proterozoic

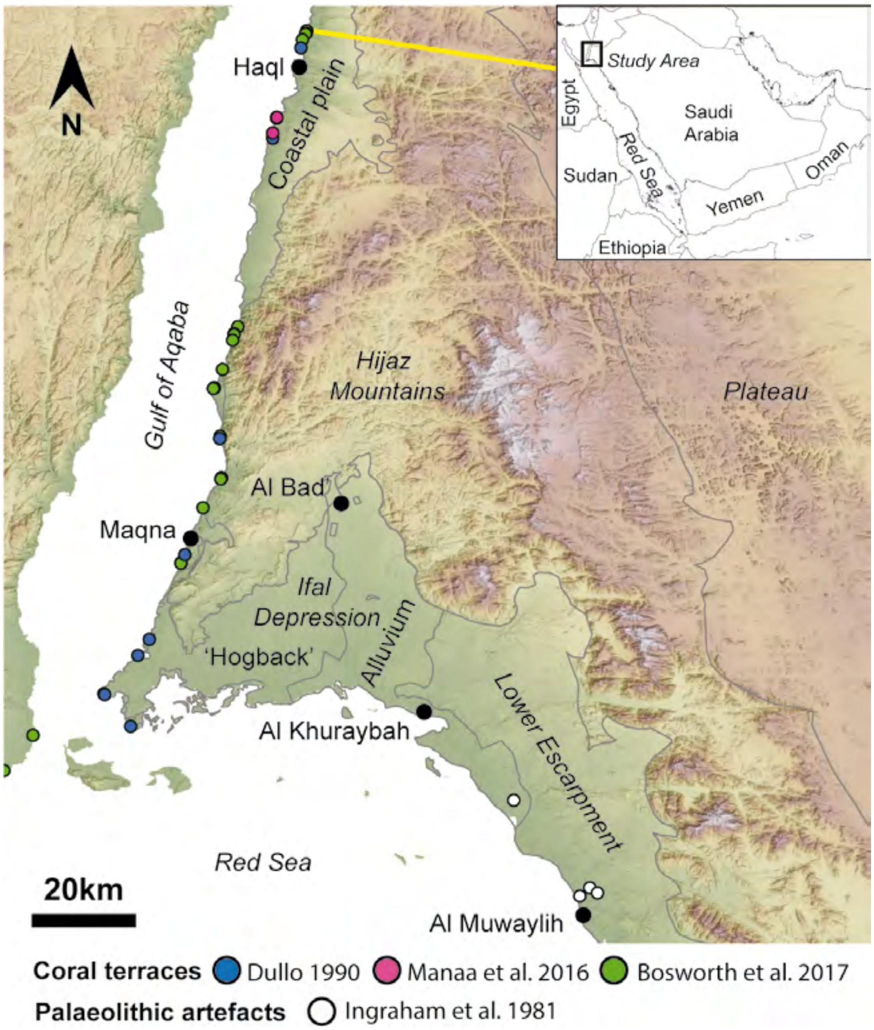

FIGURE 1. *The study region in north-western Saudi Arabia showing the main landscape zones discussed in the text, the locations of recorded MIS5 coral terraces, and known Palaeolithic find-spots (elevation data © CGIAR-CSI SRTM 90 v4.1 database).*

rocks of the Arabian shield (primarily granitic, but also including mafic plutons and sedimentary-volcaniclastic successions; Johnson 2006) and rise to a height of >2500 m in the study region. They are deeply incised by wadis providing a limited series of constricted routes inland to the Arabian Platform which, to the east of these mountains, broadly slopes eastwards to the Arabian Gulf.

The Gulf of Aqaba, the southern extension of the Aqaba/Dead Sea Transform, is 180 km long and 25 km wide at its widest point, reaching depths of over 1800 m in its centre. Its steep coastal topography is the result of ongoing tectonic uplift recorded in the heights of raised coral terraces (between 3 and 26 m a.s.l.) dated to MIS5e (Bosworth et al. 2017; Taviani et al. 2018; Manaa et al. 2016; Dullo 1990), and continues offshore leaving little by way of a continental shelf. During periods of low sea level therefore, the Gulf's shoreline would not have moved laterally far from its present location. The narrow coastal plain between the Hejaz Mountains and the Gulf (dominated by alluvial sedimentation from wadis draining the mountains) reaches a maximum of *c.*20 km close to Haql, but disappears almost completely in the central and southern Gulf (Bayer et al. 1984).

South-east of the Gulf of Aqaba lies the Ifal Depression, a broadly triangular, low-lying area running for 50 km south from Al Bad' town. It is surrounded on its north, east, and west by the Hejaz Mountains, and on its south by the Red Sea. The Depression, filled with sediments, is a northern extension of the Red Sea graben system, with multiple faults both within and bordering it (Briem & Blümel 1984). Wādī Ifal, the largest wadi draining the Depression, drains a large area of the Hejaz Mountains. Other wadis flow into the Depression forming alluvial fans of varying size, age, and height, particularly to the east where prominent alluvial terraces rising up to 50 m above the present baseline border wadis emerging from a fault scarp. While the northern and eastern parts of the Depression are covered by alluvial deposits, towards the south and east a large area of tilted Tertiary sands and gravels is exposed at the surface, the differential erosion of which has resulted in an undulating 'hogback' topography, with linear bands of gravel of mixed lithologies forming ridges following erosion of interleaved finer sediment bands (Briem & Blümel 1984).

To the south of the Ifal Depression, from Al Khuraybah southwards, the coastal zone of the northern Red Sea consists of a relatively low-lying (*c.*250 m a.s.l.) area of hills 15–25 km wide, dominated by the mafic plutons of the Muwaylih suite and the meta-volcanic and meta-sedimentary Ghawjah formation (Johnson 2006). These 'lower escarpment' hills separate higher mountains to the east from the narrow (*c.*3–7 km) alluvium-dominated coastal plain, and are deeply incised (>100 m in places), containing enclosed basins formed by localized faulting and differential erosion of basement rocks.

No MIS5e coral terraces have been identified on the Red Sea coastline north of Duba (45 km south of Al Muwaylih) where a fossil terrace at *c.*4 m a.s.l. extending for 500 m was dated to MIS5e (Manaa et al. 2016). A major geomorphological feature of the surveyed coastal zone, however, is a thick (up to 50 m) fossil reef complex of unknown and potentially significant age that is preserved at the western, seaward, edge of the lower escarpment hills at up to *c.*70–100 m a.s.l.

The study region is heterogeneous in its landscape history and geology, and in the landscape settings available to Palaeolithic hunter-gatherers. A number of features make it appealing for survey. Firstly, while the region is dominated by granitic rocks not conducive to stone-tool manufacture, substantial exposures of volcanic and metamorphic rocks (e.g. rhyolite, quartzite) would have provided raw material for tool manufacture. Wadis draining the Hejaz mountains would have transported raw materials as clasts from the interior into the coastal regions, increasing the range of accessible lithologies. Secondly, the narrow offshore topography constrains the extent to which late Pleistocene sea-level fluctuations impacted upon the area of terrestrial landscapes available to Palaeolithic populations. Given that coral terraces in the southern Red Sea have yielded Palaeolithic artefacts, the potential for similar finds in the northern Red Sea is high (Zarins, Murad & Al-Yaish 1981; Inglis et al. 2018; Bailey et al. 2015). Thirdly, the diversity of the landforms in the study region present multiple opportunities for the preservation of Late Pleistocene landscape surfaces and deposits where artefacts may have been deposited, preserved, and rendered visible to present-day survey. Particularly key are the coastal and marine terraces, which, if they yield artefacts embedded within them, may provide evidence of coastal occupation and activity.

Previous archaeological survey

Despite its proximity to the rich Palaeolithic record of the Levant (see papers in Enzel & Bar-Yosef 2017), as well as known sites in the Saudi Arabian interior (Breeze et al. 2017; Jennings et al. 2016; Scerri et al. 2015; Petraglia et al. 2012; Groucutt & Petraglia 2012), the study area was last surveyed for Palaeolithic archaeological materials as part of the Comprehensive Archaeological Survey Program (CASP) in the 1970–1980s (Ingraham et al. 1981). This survey identified four locations with Palaeolithic artefacts (as well as circular enclosures) on the coastal plain, all on terraces in wadis north-east of Al Muwaylih (Fig. 1). Unfortunately, the lithics discovered were mostly undiagnostic, aside from a single 'Middle Palaeolithic' transverse scraper found at 204-61 along with large basalt flakes and blades classified as 'probably' Palaeolithic (1981). The authors report no Palaeolithic sites from the Hejaz Mountains, noting that their absence might be attributable to either survey methodology or geomorphological factors including Quaternary sediment cover (1981). It should also be recognized that the CASP did not investigate the 'beach terraces' along this section of the Red Sea coastline even though it was noted by the authors that similar terraces had yielded artefacts in the southern Red Sea (1981).

The extremely limited nature of the previous survey history for this region, when considered alongside the rich finds of Palaeolithic age artefacts in other parts of Arabia, and the geographical proximity of this area to potential dispersal routes for hominins out of Africa highlights the need for further research and sets the context for a new programme of field survey initiated in 2018.

Survey aims and methodology

The 2018 fieldwork aimed to:

a) identify the major geomorphological units in the study region and assess their potential for preserving Palaeolithic artefacts and for informing models of landscape evolution;
a) locate and record Palaeolithic artefacts and their techno-typological affinities to begin to place the Palaeolithic record of the region in its temporal and regional context.

The landscape was assessed prior to survey using methods developed by the authors in the southern Red Sea (Devès et al. 2013; Inglis et al. 2014). Satellite imagery, remote-sensing data, and geological maps were used to build up a broad-scale understanding of landscape zones and the predominant geomorphological conditions within them, followed by more detailed mapping of landforms with apparent suitability for the preservation, exposure, and visibility of Palaeolithic artefacts on the surface. Three main areas were designated for survey: the eastern coastline of the Gulf of Aqaba; the Ifal Depression; and the northern Red Sea coastline between Al Khuraybah and Al Muwaylih. Within each area landscape settings with high potential for Palaeolithic archaeology were targeted (e.g. alluvial terraces), as well as a few settings with lower potential for comparison (wadi beds, sloping jebels).

Survey was carried out in February 2018 with a team of seven archaeologists completing twelve days of survey: three in the Gulf of Aqaba, four in the Ifal Depression, and a further five days around Al Khuraybah/Al Muwaylih. Each location investigated was given a 'locality' number (e.g. L0001) and basic descriptive characteristics were recorded (e.g. local lithology, topography, sediment, and vegetation cover). Survey strategy at each locality consisted of walking short transects, 100–500 m in length according to local conditions. Artefact finds, as well as key geomorphological features and transect ends were assigned 'waypoint' numbers (e.g. WP0001) and recorded using handheld GPS (Garmin GPS 62s). At L0006 (see below), given the quality and density of artefacts, artefact positions were recorded within a defined 10 x 5 m area using a Trimble Geo7X and Zephyr Model 2 external antenna running ArcPad 10, while also noting a wider set of techno-typological characteristics than at other localities.

Artefacts were photographed in the field and recorded with a brief techno-typological description, before being left in place, except for a small number (thirty-eight pieces) that were deposited in the care of the Saudi Commission for Tourism and National Heritage (SCTH), Tabuk. These artefacts were collected, in the absence of other available specimens, to facilitate the display of the region's Palaeolithic archaeology in the regional antiquities museum under construction in Tabuk. They may also serve as comparatives for future scholars.

The typological form of certain diagnostic artefacts has been used to offer a provisional chronological age for the localities. In the study area the presence of hand axes, biface cleavers, and other large flake-based tools are taken as evidence of Acheulean age occupation, while the presence of prepared cores and their prepared-core flake and prepared-core flake-blade products and, occasionally, large blades indicate a later age. Finally, we have recorded a few smaller retouched tools based on blades derived from prismatic cores and often made of raw materials, sometimes chert, that are exotic to the locality. These few blade-based tools are likely to be later in age than artefacts using prepared-core technology. All remaining pieces have been defined for the present as chronologically non-diagnostic.

In broader chronological terms, in the absence of absolute dates as yet, we also chronologically describe Acheulean artefacts as being of Early Stone Age (ESA), and those with prepared core technology as Middle Stone Age (MSA). These terms have been primarily used within an African geographic context, with other researchers in Arabia employing the terminology of Lower and Middle Palaeolithic, originally defined on European materials (Monnier 2006), for these two successive archaeological periods. This specific choice of terminology has been made since a primary question of this research is the identification of hominin dispersals into Arabia. A hypothesis shared among all researchers working in Arabia is that Africa represents the original geographical source of hominin populations bearing first Acheulean and later prepared-core technologies. East Africa is the probable source area for these dispersing hominin populations and here, Early Stone Age and Middle Stone Age are the higher-level chronological terms used pending absolute dates.

Results

Gulf of Aqaba

Survey localities along the Gulf of Aqaba targeted locations with fossil coral terraces preserved above the present-day shoreline, a number of which had been dated to MIS5e in earlier surveys (Manaa et al. 2016; Bosworth et al. 2017; Taviani et al. 2018). These terraces were targeted for two reasons: firstly, similar terraces in the southern Red Sea had yielded Palaeolithic artefacts, some embedded underneath and within marine deposits; secondly, such terraces preserved surfaces of at least MIS5 age where artefacts were likely to be isolated, and therefore preserved from, destruction or burial by wadi action. Nine localities (L0001–9) were surveyed along the Gulf (Fig. 2/a), with Palaeolithic artefacts identified at six of them (Fig. 3).

In the far north of the Gulf, where the coastal plain is relatively wide and covered by alluvium, the MIS5 fossil coral terraces form prominent cliffs standing up to 20 m above the surrounding sabkhas (Fig. 2/b) (Bosworth et al. 2017). Three localities (L0001–3) with coral terraces were investigated, and a total of six artefacts of prepared-core and prismatic blade typologies were recorded (Fig. 3).

In the central part of the Gulf, two localities (L0005 & L0006) were examined on Ras Suwayhil el Kabir, a triangular point extending 3 km into the Gulf from the scarp of the Hejaz Mountains, comprising gently sloping alluvial fan sediments (Fig. 2/a). L0005 is located on a fossil coral terrace capped by alluvium (Fig. 2/c); an exposed profile through this terrace suggests an interleaving of coral, alluvial fan, and shoreline deposits at the alluvial unit's base. No artefacts were recorded. Four kilometres to the south of L0005, a terrace of coral and alluvial fan deposits abutting the edge of the mountains was examined as L0006. This terrace is a major landscape feature, with incisions exposing sediments in cliffs up to 40 m tall. It was surveyed by the Saudi Geological Survey in 2013 and contains fossiliferous sands and coral heads up to 25 m a.s.l. (designated Stations 13 and 14 in Taviani et al. 2018), and while not directly dated, was interpreted as deposited during the MIS5e high sea stand (132–115 ka). The coralline deposit at L0006 is covered by a laminar sand unit (*c.*1 m thick) tilted towards the sea, which itself is overlain by a 2–3 m-thick (at its seaward extent) unit of rounded to angular gravel to cobbles in a sandy matrix (Fig. 4). On the surface of the terrace four Acheulean hand axes were found, as well as one discoidal or possibly prepared core and a range of other artefacts made on a variety of lithologies from quartzite to indurated shale mostly concentrated in one area (Sinclair et al., in preparation). The exceptional and localized nature of this assemblage was recorded by piece plotting of artefacts within a defined 10 x 5 m area, with forty-two artefacts recorded giving a density of 0.8 artefacts/metre.

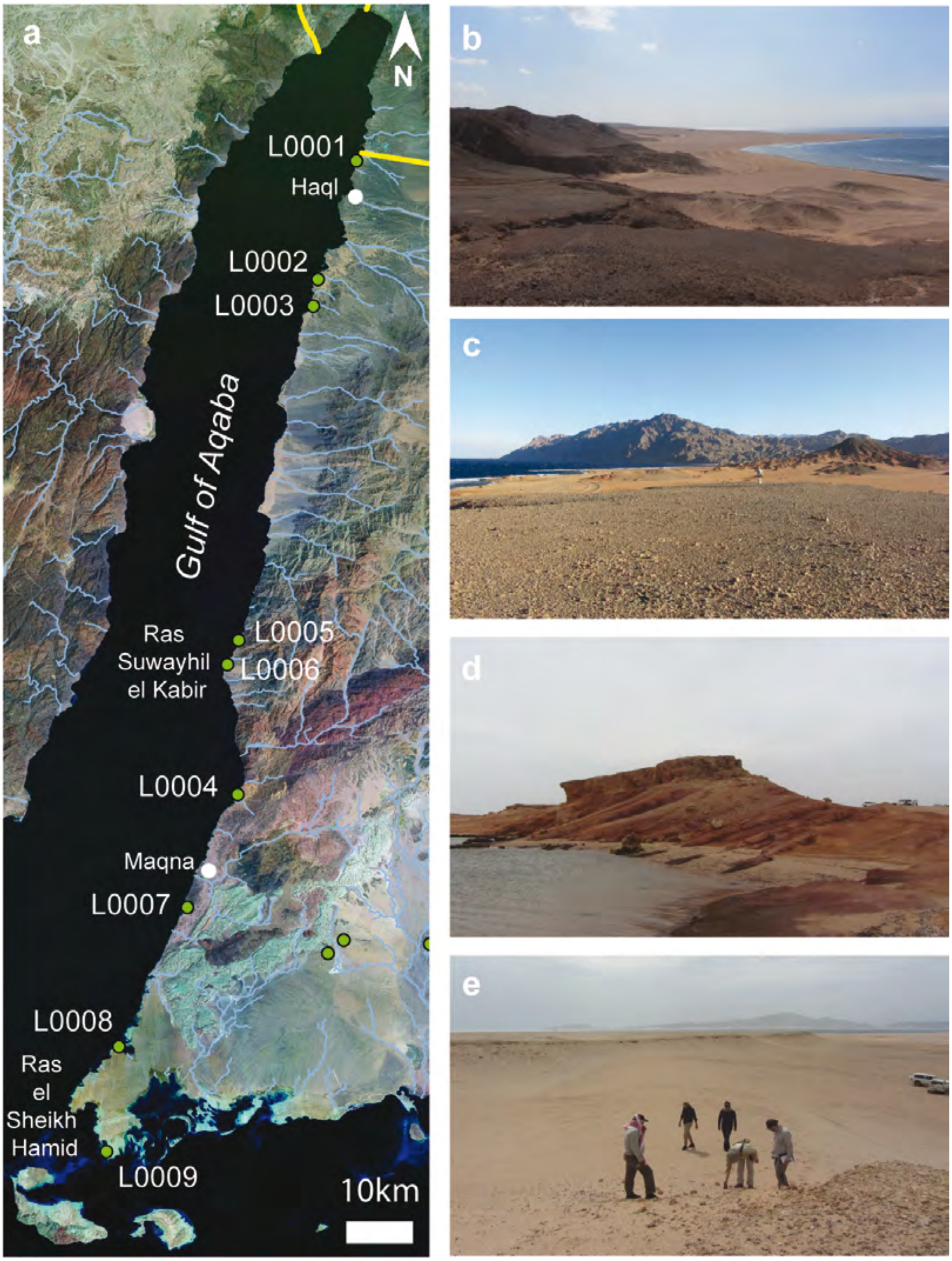

Figure 2. a. *Map and* **b–e.** *general views of localities visited in the Gulf of Aqaba.* **b.** *Coral terraces overlain by colluvial/alluvial deposits adjacent to a bedrock jebel at L0003;* **c.** *the surface of a coral terrace at L0005 showing the Hejaz Mountains forming steep cliffs at the northern end of Ras Suwayhil el Kabir;* **d.** *a coral terrace overlying tilted Tertiary sediments at L0008;* **e.** *a coral terrace above a present-day sabkha at L0009, Ras el Sheikh Hamid (satellite imagery © USGS Landsat ETM+ 2000 Gecover Mosaics; photographs R. Inglis).*

Locality	Coordinates	Landscape type	No. of artefacts recorded	Chronologically diagnostic artefact recorded			
				Acheulean	Prepared-core	Prismatic blade	Small blade / Neolithic
Gulf of Aqaba							
L0001	*N 29°20' 79.6" E 34°57'19.0"*	Coral terrace	2		1		
L0002	*N 29°09'16.1" E 34°53'45.1"*	Coral terrace	3			1	
L0003	*N 29°11'24.4" E 34°54'08.1"*	Coral terrace	1				
L0004	*N 28°30'25.8" E 34°47'45.3"*	Alluvial unit above coral terrace	2				1
L0005	*N 28°42'41.6" E 34°47'48.7"*	Alluvial unit over coral terrace	0				
L0006	*N 28°40'46.5" E 34°46'55.3"*	Alluvial unit over coral terrace	47	11			
L0007	*N 28°21'27.9" E 34°43'44.6"*	Alluvial unit over coral terrace	7	1			
L0008	*N 28°10'23.8" E 34°38'17.3"*	Coral terrace	0				
L0009	*N 28°02'03.3" E 34°37'17.7"*	Coral terrace	0				
Ifal Depression							
L0010	*N 28°17'49.0" E 34°54'55.7"*	Alluvial fan	9		1	4	
L0011	*N 28°18'51.5" E 34°56'11.0"*	Tertiary 'hogback' ridges	20 (3 cobbles with pecked markings)		1	2	
L0012	*N 28°32'53.7" E 35°03'41.6"*	Alluvial fan	0				
L0013	*N 28°25'25.4" E 35°04'12.3"*	Alluvial fan	5 (incl. 1 cobble with pecked marking)	1	1		
L0014	*N 28°27'44.3" E 35°04'57.9"*	Isolated outcrop of sedimentary rock	1				
L0015	*N 28°21'37.1" E 35°05'07.7"*	Alluvial fan	0				
L0016	*N 28°21'09.4" E 35°05 00.2"*	Alluvial fan	4	1	1		1
L0017	*N 28°18'33.2" E 35°03'02.2"*	Alluvial terrace	8		3		
Al Khuraybah to Al Muwaylih							
L0018	*N 28°03'28.9" E 35°17'56.4"*	Jebel of isolated alluvium	1 (incl. 1 cobble with pecked marking)				
L0019	*N 28°03'16.4" E 35°18'09.6"*	Alluvial terrace	9		2		1
L0020	*N 27°40'54.2" E 35°29'25.3"*	Alluvial terrace	9			1	1
L0021	*N 27°40'56.1" E 35°31'14.2"*	Alluvial terrace	2			1	
L0022	*N 27°41'24.4" E 35°32'09.1"*	Alluvial terrace	9	1	3		
L0023	*N 27°58'03.7" E 35°16'38.5"*	Alluvial terrace	23	5	7	1	
L0024	*N 27°51'13.7" E 35°35'00.2"*	Alluvial terrace	0				
L0025	*N 27°51'40.2" E 35°35'13.6"*	Alluvial terrace	12		3		
L0026	*N 27°50'13.2" E 35°36'11.7"*	Jebel of bedrock	0				
L0027	*N 27°48'10.6" E 35°36'08.0"*	Wadi bed	0				
L0028	*N 27°54'09.7" E 35°21'26.3"*	Alluvial terrace	20	2	3		
L0029	*N 27°58'02.3" E 35°16'26.5"*	Alluvial terrace	21	1	4	1	
L0030	*N 27°58'45.9" E 35°15'00.5"*	Fossil corral terrace	1		1		

FIGURE 3. *Localities and artefacts recorded in the 2018 reconnaissance survey. For diagnostic artefacts recorded: Acheulean includes hand axes and cleavers; prepared-core includes both prepared cores, prepared-core flakes, and flake-blades; small blade/Neolithic includes small blades made on prismatic cores that are similar to artefacts recorded from pre-pottery Neolithic sites in the region. The difference between the total number of artefacts recorded and the diagnostic artefacts is the number of non-diagnostic artefacts.*

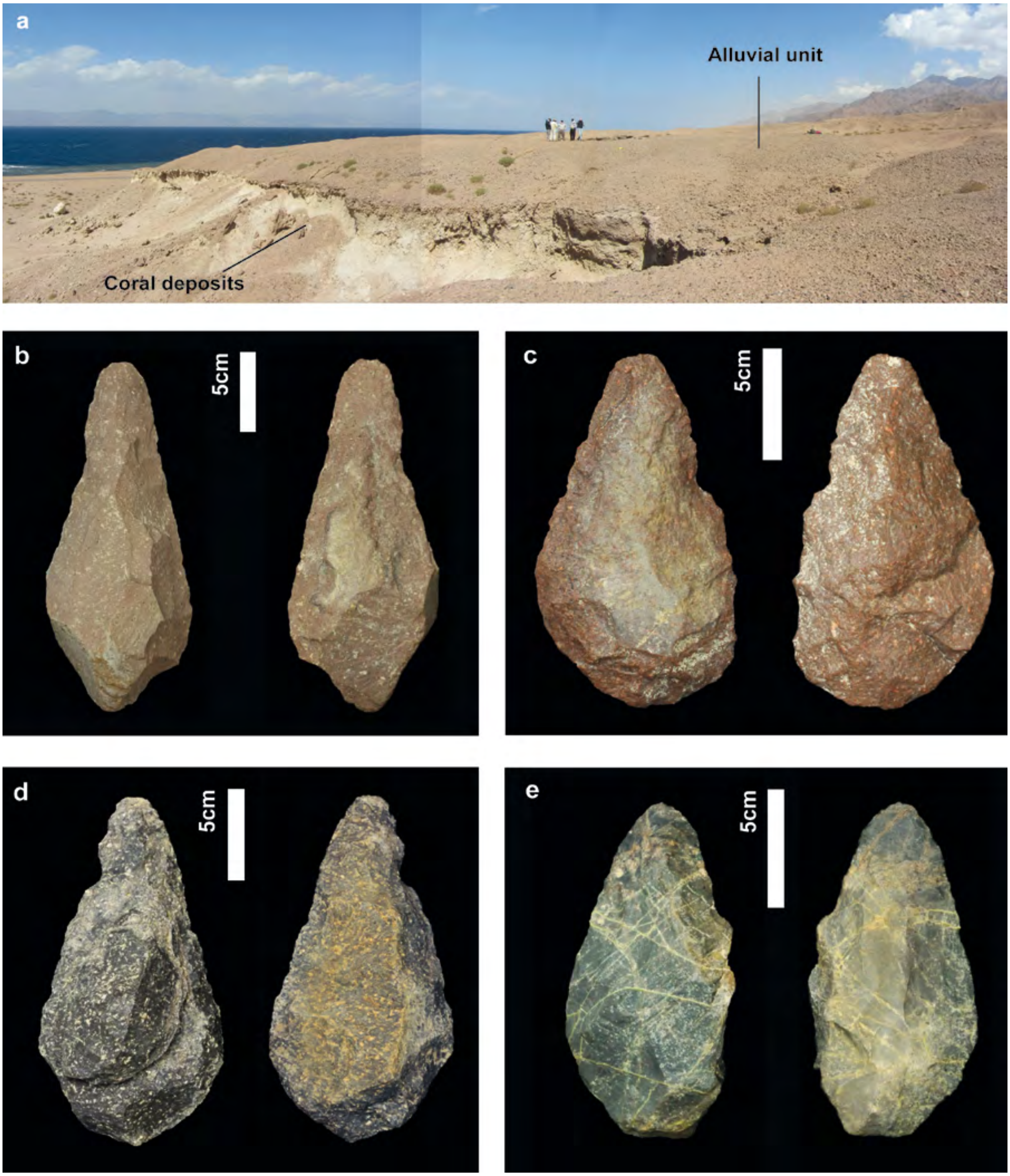

Figure 4. *L0006 geological setting and examples of hand axes from L0006:* **a.** *view of a terrace top formed of coral deposits overlain by a unit of cobbles interpreted as alluvial deposition. People are standing at the location of the detailed artefact recording grid;* **b.** *a large pointed hand axe with careful retouch to define the tip;* **c–e.** *three examples of hand axes made using different raw material. Careful retouch has been used to define one straight lateral cutting edge with the other remaining thicker, presumably for holding in the hand (photographs A. Sinclair).*

These hand axes range in length from 251 to 146 mm and in maximum breadth from 106 to 66 mm. Six have been clearly made on large flake blanks, but from different materials, including basalt, rhyolite, and quartzite, while the seventh may have been made on a naturally exfoliated, angular clast. There is variation in the degree of finishing with greater evidence of retouching of the tip rather than the butt where a possible cortical surface on one, and the original flake blank surface on the others, remain visible; each has a finely prepared cutting edge down one lateral margin.

The artefacts lying on the terrace surface at L0006 were either deposited on, or derived from, an apparently alluvial unit which is undergoing ongoing deflation and erosion; excavation at the locality is necessary to test this hypothesis. Examination of surfaces of the alluvium to the east revealed no further artefacts, suggesting that L0006 represents either a defined locus of activity or a restricted exposure of artefact-bearing sediment. Just beyond the grid, to both the north and the south, three more hand axes were recorded as single finds in gullies that cut through fine-grained, green-grey laminated sediments (indicative of low-energy deposition by water). Since these green sediments are capped by the alluvial unit, it is possible that these isolated hand axes also originate from the same context as those recorded in the grid, and have been washed down into the gullies. Significant questions remain about site stratigraphy and its environmental and taphonomic history, primarily how Acheulean age artefacts along with possible artefacts were made using prepared-core technology to be situated stratigraphically above (and therefore later than) an MIS5e coral terrace, requiring future detailed geomorphological and chronological investigation.

At the southern end of the Gulf of Aqaba, four localities were visited. L0004 and L0007 are both located on coral terrace deposits capped by alluvial deposits similar to the localities surveyed at L0006. At L0004, two artefacts were recorded, one a retouched blade tool made using chert; at L0007, a series of four lightly weathered lithics, including one non-diagnostic bifacial piece, were observed alongside a well-rolled brown quartzite hand axe. The variable condition of these artefacts suggests that pieces had both weathered out from the underlying alluvium (where they may already have been redeposited from their original environment, e.g. the rolled hand axe), as well as being later deposited on the terrace.

L0008 and L0009 are located on the low-lying, undulating hogback landscape of Ras el Sheikh Hamid, ridges that provide a large range of knappable materials. At L0008, where a coral terrace overlay both sandstone bedrock and Tertiary deposits, much of this gravel was thermally shattered. No artefacts were observed on either the coral terrace surface or the surrounding slopes (Fig. 2/d). At L0009 the landscape consists primarily of coralline carbonate rocks, with no obviously knappable materials present. No artefacts were observed.

Ifal Depression

Landscapes within the Ifal Depression can be broadly divided into two types: to the north and east, alluvial terraces border wadis that drain the mountains; to the west and south, low-lying hogback ridges of tilted Tertiary sediments (Briem & Blümel 1984). Localities in both types of landscape were visited, as the two landscapes have different potential for preservation, exposure, and visibility of Palaeolithic archaeology. The hogback landscape is predominantly erosional, and therefore has good potential for the exposure and visibility, but not preservation, of artefacts that may be removed by this erosion. By contrast, the alluvial deposits may conceal artefacts within them, but deflation of these deposits through winnowing of fine material may expose buried artefacts, as well as impacting little on the lateral location of artefacts deposited on top of them. This deflationary environment, and the ‘pavement’ of clasts it produces, also provide excellent artefact visibility and these alluvial deposits therefore possess potential for locating Palaeolithic artefacts.

Eight localities were examined in the Ifal Depression (Fig. 5), six on alluvial terraces (L0010, L0012, L0013, L0015, L0016, L0017), one on the hogback ridges (L0011), and one on an isolated hill of sedimentary rock to the east of the depression (L0014). No artefacts were observed at L0014, but at L0011, nine Palaeolithic artefacts were found as well as three rounded cobbles bearing pecked designs, possibly Thamudic in age (Fig. 6).

Four localities (L0010, L0013, L0016, and L0017) yielded Acheulean and prepared-core technology artefacts, as well as a number of prismatic blade artefacts that may be younger, and a few of potentially Neolithic age (Fig. 7). All artefacts were weathered and lightly or moderately rolled, and no localized concentrations of

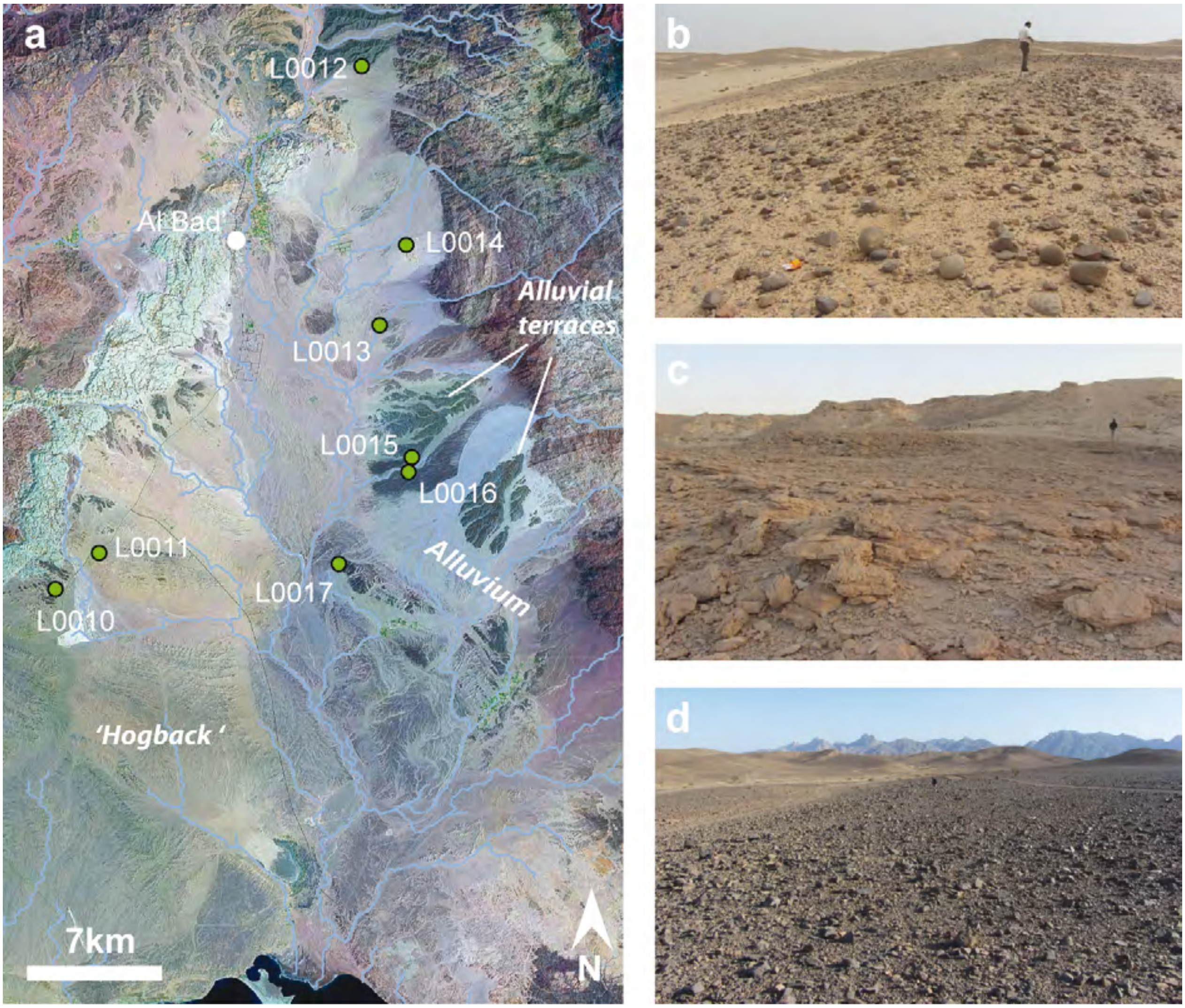

Figure 5. a. *Overview of localities visited in the Ifal Depression;* **b.** *'hogback' topography at L0011;* **c.** *the surface of a hill of sedimentary rock at L0014;* **d.** *the surface of an alluvial terrace at L0016 (satellite imagery © USGS Landsat ETM+ 2000 Gecover Mosaics; photographs R. Inglis).*

artefacts were found at these localities. Furthermore, the condition of the artefacts suggests that they had been moved from an original and different location of manufacture or use. The condition of clasts on the surface of the six alluvial terrace localities showed significant variation in the degree of 'polish' present; while the development of such polish is not a linear process, such variability probably results from multiple phases of alluvial deposition.

Al Khuraybah to Al Muwaylih

The coastline between the towns of Al Khuraybah and Al Muwaylih was a specific focus of investigation as it was the alluvial terraces above Al Muwaylih that had yielded the only reported Palaeolithic artefacts from the region (Ingraham et al. 1981). Due to their favourability for the preservation, exposure, and visibility of lithic artefacts, alluvial terraces were the predominant landscape

Figure 6. *Pecked Thamudic designs on quartzite cobbles at L0011 (photographs A. Sinclair).*

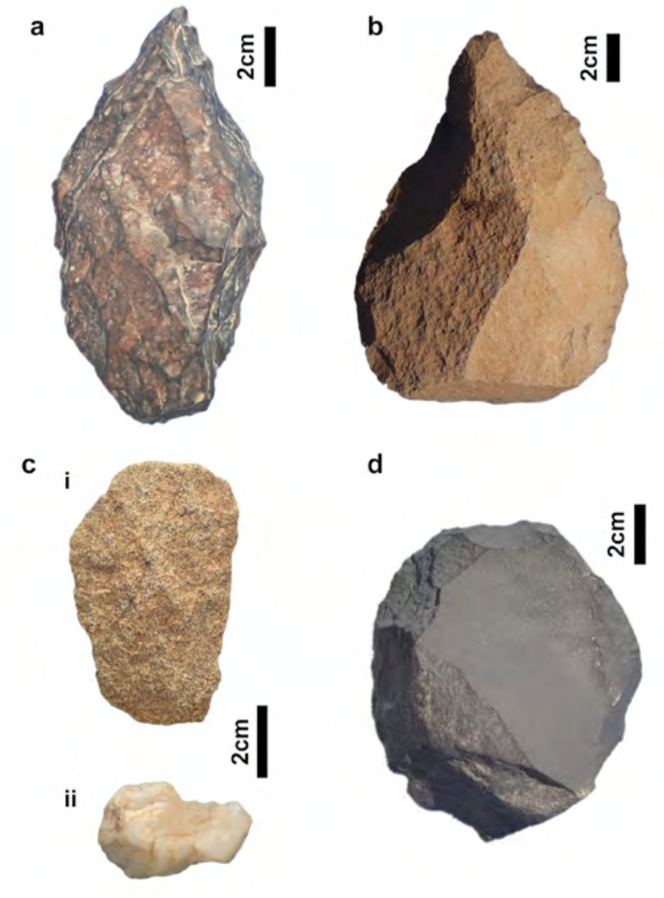

Figure 7. *A series of artefacts recorded from localities in the Ifal Depression:* **a.** *a pic;* **b.** *a large flake with a fine lateral edge created using bifacial retouch;* **c/i.** *a weathered convergent flake with a broken tip;* **c/ii.** *a quartz flake;* **d.** *a horse-hoof shaped core on a round cobble (photographs A. Sinclair).*

setting surveyed in this region, both the large terraces (tens of metres high) along the narrow coastal plain, and smaller alluvial terraces in enclosed basins situated within the lower escarpment area between the coastal plain and the Hejaz Mountains (Fig. 8).

Alluvial terraces

Three localities (L0020, L0021, and L0022) were surveyed on alluvial terraces directly to the south and east of Al Muwaylih, close to sites with Palaeolithic artefacts

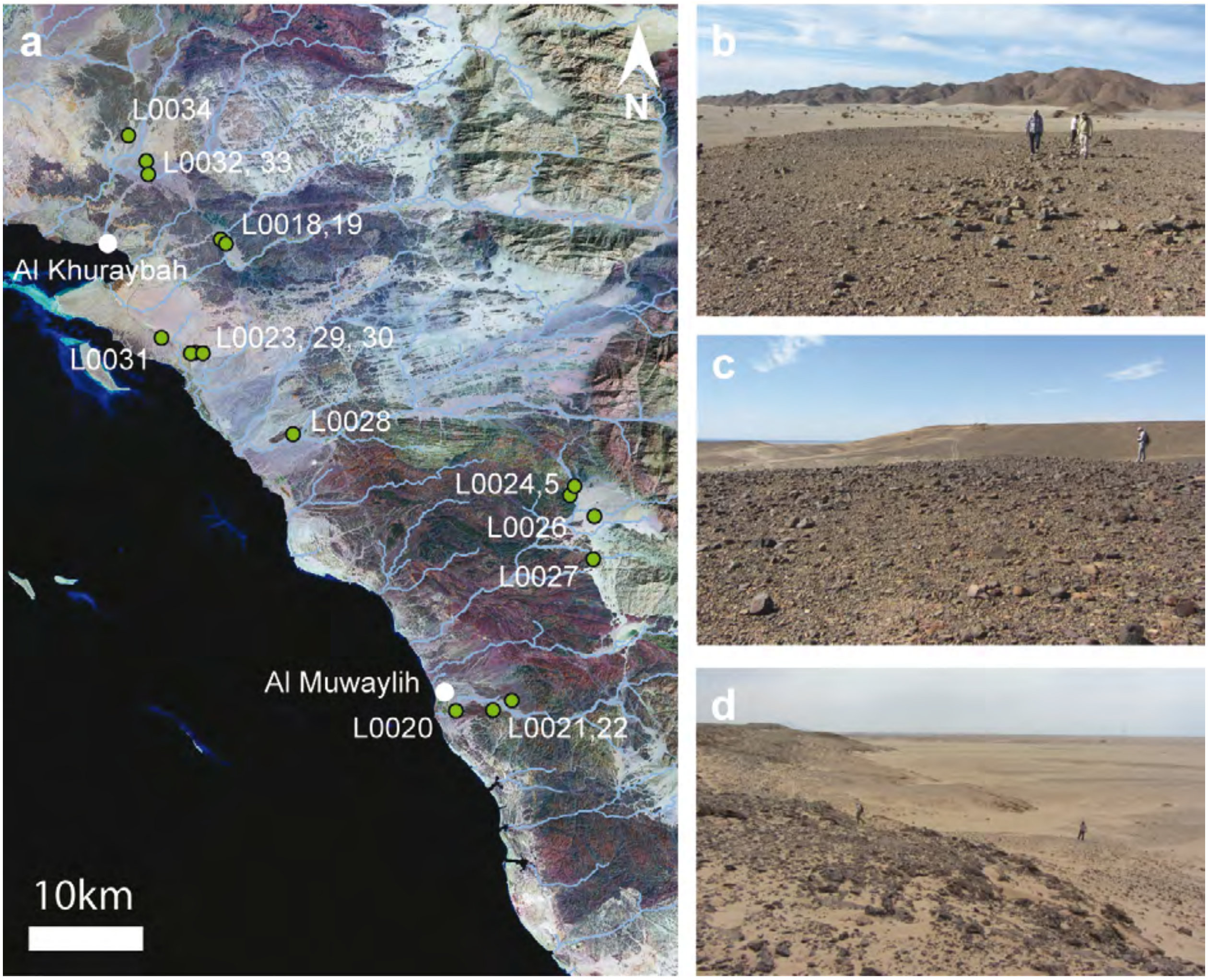

Figure 8. a. *The coastal area between Al Khuraybah and Al Muwaylih showing the localities visited;* **b.** *L0025: a row of funerary cairns on the surface of an alluvial terrace;* **c.** *the surface of an alluvial terrace at L0028;* **d.** *L0031: a fossil coral terrace at the edge of a lower escarpment (satellite imagery © USGS Landsat ETM+ 2000 Gecover Mosaics; photographs R. Inglis).*

discovered by the CASP (204-58, 204-60, and 204-61). The terraces here survive at two levels; a lower terrace (*c.*10 m above the present wadi bed) of clasts and sand with modern funerary cairns, and a higher terrace (*c.*20–30 m above the present wadi bed) consisting of a heavily polished and patinated desert pavement of rounded to sub-angular clasts on a slightly undulating surface. Twenty lithic artefacts were found across all three localities, with prismatic blade-based artefacts of post MSA or Neolithic age at L0020 and L0021 respectively. At L0022, the nine artefacts include Acheulean tools and prepared-core technology artefacts (see Fig. 3). On the north bank of the wadi at L0024, on a *c.*15 m terrace with clasts that are less polished than at the localities on the southern side, twelve artefacts made on a range of lithologies (basalt, schist/shale, quartzite) were observed, a small number are of clear prepared-core typology.

An isolated alluvial terrace 27 km north-west of Al Muwaylih, thought to be equivalent to CASP site 204-78 where undiagnostic Palaeolithic artefacts were observed (Ingraham et al. 1981) was surveyed as L0028. This terrace stands approximately 20 m high and is roughly rectangular; here, the surface comprises clasts with a moderate degree of polish that retains distinctions in colour between the various lithologies present (basalt, quartzite, shale, etc.). On this terrace, twenty artefacts were recorded with a small number of pieces showing clear Acheulean and prepared-core typology (see Fig. 3).

Seven kilometres south-east of the town of Sharma, a low terrace (*c.*25 m a.s.l.) of alluvium forms a 10 km-long peninsula (mostly now privately enclosed) that has been isolated by present-day wadi beds that flow around its landward edges. The alluvium was probably deposited by Wādī Sharma, with the later change in flow direction and terrace isolation related to tectonic activity or sea-level change. The main terrace was surveyed at L0031, with a second, smaller terrace remnant isolated from the south-eastern extent of the main terrace surveyed at L0023 and L0029. Finally, a transect was surveyed up onto the 70–100 m a.s.l. terrace which is capped by the ancient coral reef (L0030).

The survey localities on the alluvial terrace yielded a wide range of artefact types and lithologies and in places a range of pieces that look like coherent debitage assemblages (see Fig. 3). At L0031, six artefacts were recorded, two made using a prepared-core technology and another on a prismatic blade. At L0023, survey recorded twenty-three Acheulean and prepared-core artefacts as well as one prismatic blade piece (Fig. 9). Survey of the northern part of the alluvial remnant (L0029) confirmed a lower density scatter of artefacts with twenty-one artefacts across the wider surface, including some relatively recent clast reduction assemblages. Finally, at L0030 a single relatively fresh, MSA prepared core was found lying on alluvium and aeolian sand at the base of the terrace made on hornfels.

Enclosed basins

The southernmost surveyed basin, Al Jim, which is around 6 km wide, was investigated at four locations (L0024, L0025, L0026, and L0027). No artefacts were located on surfaces of active sedimentation at the edges of the basin (L0024), in the active wadi bed (L0027), or on top of an isolated hill of bedrock (L0026). At L0025, however, a low-lying alluvial terrace (Fig. 7/b), 400 m in length and *c.*3–4 m above the surrounding landscape, twelve artefacts of different typologies and lithologies (three of MSA type), were recorded as well as a line of funerary cairns along the long axis of the terrace (see Fig. 3).

Wādī Sharma and another, smaller, wadi flow through a roughly rectangular basin, 4.5 x 1 km, 35 km to the north-west of the Al Jim basin. This basin was surveyed at two localities: L0018 was located on a hill of alluvial sediments and bedrock, and L0019 on a low alluvial terrace (2–3 m) in the centre of the basin. No artefacts were found at L0018, although two robbed-out funerary cairns were observed at its top, one accompanied by a Thamudic inscription on a large quartzite clast. On the alluvial terrace, nine artefacts were recorded with two artefacts of prepared-core technology, including a single prepared core and one small prismatic blade.

The northernmost basin that was investigated lies at the foot of Jebel Zehad, north-east of Al Khuraybah. It is bisected by Wādī Ainounah, a major watercourse in the region, which until the 1970s contained perennial flow, indicative of springs in its catchment. Three localities were visited in this basin, all on alluvial terraces. L0032 is situated on a low (3–4 m) terrace in the centre of the basin; L0033 consists of two flat-topped terrace remnants up to 10 m high, the larger of which overlay a vein of caramel-coloured quartz utilized in many of the artefacts recovered from its surface. At L0032, fourteen artefacts were recorded with examples of Acheulean and prepared-core artefacts present; at L0033, ten artefacts were recorded with four diagnostic examples of Acheulean typology.

In the Jebel Zehad basin a final locality, L0034, was examined on the south-eastern edge of a large alluvial terrace that extends 12 km north-east of the Ifal Depression. At the foot of the terrace, three Acheulean hand axes and a cleaver were recovered from the surface. While two hand axes were rolled and weathered, another, with sharp edges and yellowish patina, appears to have emerged recently from the terrace sediment (Fig. 10). This is a distinct possibility since the lower part of the terrace has undergone limited bulldozing. It may also be a separate, lower terrace than the upper surface of the main terrace situated *c.*20 m higher. The clasts on the upper surface of the main terrace were very heavily patinated. Nine artefacts were recorded, with two artefacts made using prepared-core typology and two deriving from a prismatic blade core. Further work to discern the stratigraphy and origin of the lithics particularly in the

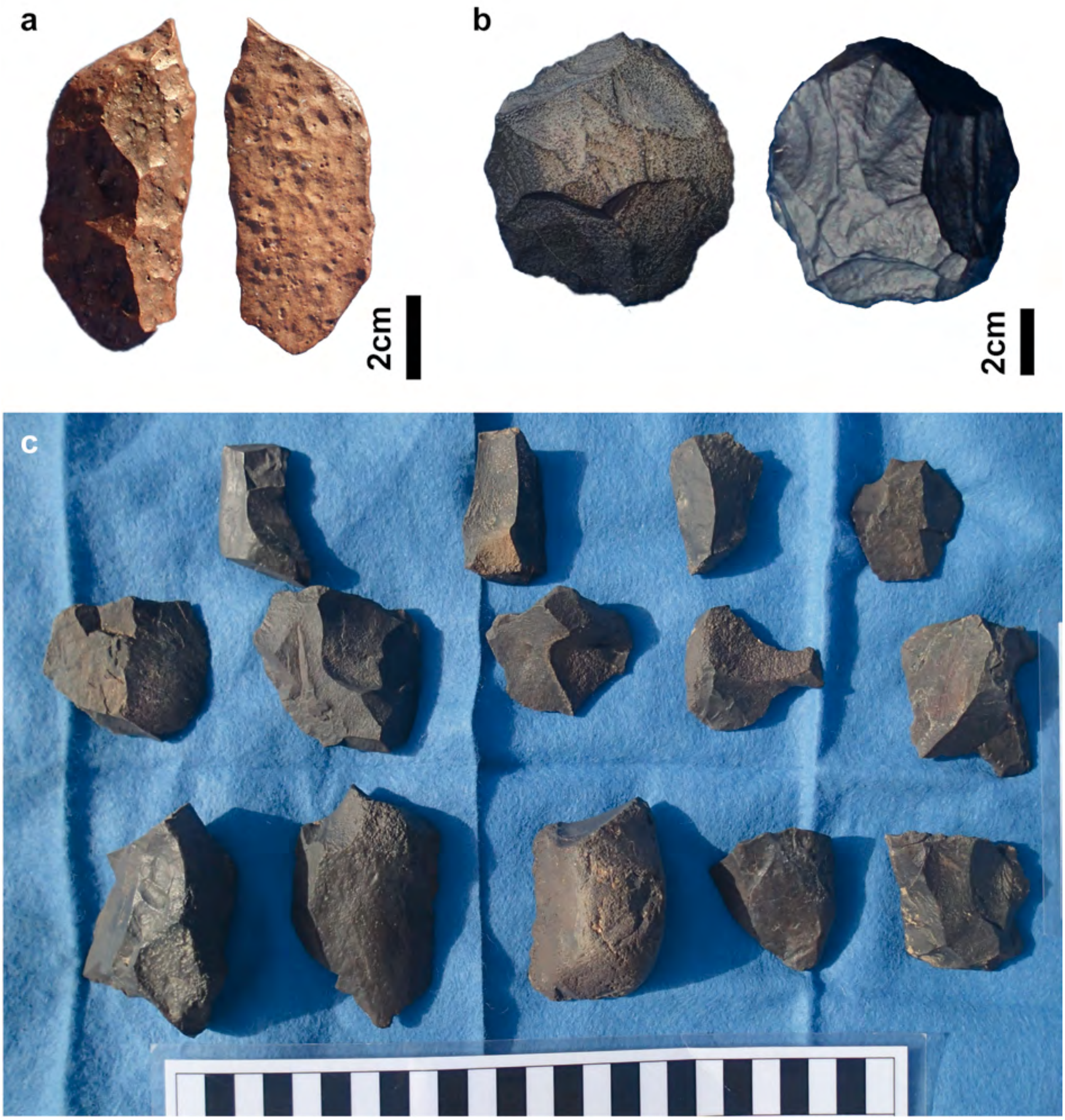

Figure 9. *Exemplar artefacts from L0023:* **a.** *a large piercer made on a heavily weathered chert — note the many instances of pot-lid fractures resulting from thermal damage to the surface;* **b.** *a large discoidal core on a rolled cobble — note the variation in weathering between the two sides of the artefact;* **c.** *a selection of flake debitage resulting from the working of a single rolled cobble (photographs A. Sinclair).*

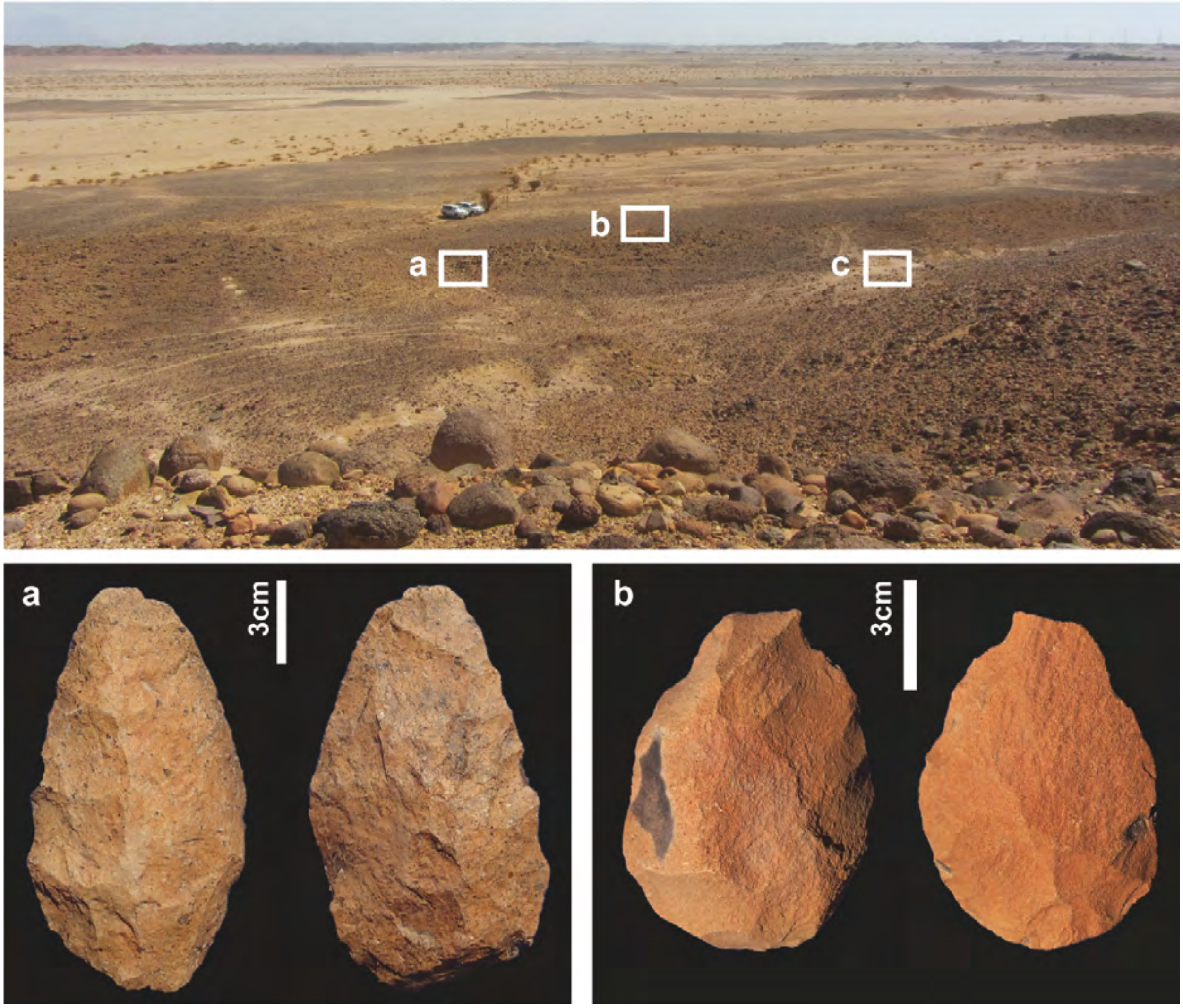

Figure 10. *View to the south-west from the upper alluvial terrace at L0034, looking out over the basin with the ESA find-spots indicated in the upper image including:* **a.** *a biface manufactured on a basalt flake with bifacial retouching used to create a refined lateral cutting edge, found in the side of a small gully;* **b.** *a chert hand axe with yellowish patina suggesting a recent exposure of artefacts — note the modern break damage showing the greyer character of chert underneath;* **c.** *the location of a basalt flake/cleaver from a bulldozed sediment area in gully (photographs R. Inglis).*

lower part of the terrace is a key priority for future survey, given the potential for *in situ* archaeology.

Discussion

The time constraints of a short, exploratory field season necessitated a rapid assessment of a restricted number of localities to evaluate the potential for Palaeolithic artefact-bearing deposits in this important but under-researched region. The restricted time at any one site, along with a policy of leaving artefacts on site for potential future research, also limits the information that could be recorded for any artefact to a brief typological description, some of which is sufficiently diagnostic to generate broad chronological information. The presence of artefacts in particular geomorphological contexts also helps to understand where, and under what conditions, Palaeolithic artefacts are preserved and accessible to present-day survey in this landscape.

Artefact typology, technology, and regional comparisons

Palaeolithic artefacts have been recorded at almost all the localities visited in all three areas of the survey region. Despite the small numbers of artefacts that could be recorded at any one locality, the presence of artefacts at so many of the localities briefly visited signals a potentially rich Palaeolithic record awaiting further investigation in this region. Artefact typology demonstrates clear evidence of both Acheulean occupation (hand axes and large flake-based tools) and occupation of the area by hominins who used a prepared-core technology for the production of flake and flake-blade tools comparable to other parts of Arabia. The majority of artefacts for both Acheulean and prepared-core technologies were made using basalt, quartzite, or metamorphosed schists and shales, exploited in the form of rolled or angular clasts or large naturally exfoliated flakes. Even though the majority of the artefacts observed cannot be definitively ascribed to a chronological period on the basis of typology alone, the raw materials used suggest that these other artefacts belong to the Acheulean or prepared-core assemblage. Finally, a small number of localities present artefacts made on prismatic blade cores, from apparently non-local materials such as chert. It is very likely that these artefacts will date later than the prepared-core industries, but the small number of such pieces observed to date, and the lack of clear diagnostic retouched types renders the assignment of a broader typological name inappropriate at this moment. These pieces, however, do not appear to be similar in materials used or reduction technique to the blade tools recovered from pre-pottery Neolithic sites in this region, such as Wādī Sharma (Fuji 2018).

Most lithic artefacts observed appear to have been heavily weathered and patinated, as might be expected of surface finds artefacts exposed to the harsh conditions of the Arabian climate. However, there are a small number of artefacts with fresh edges and surfaces (L0006 and L0023), suggesting the possibility for finding buried, *in situ* archaeological deposits.

Of all the localities investigated in 2018, L0006 is the most archaeological significant at this early stage of research and will require further investigation. As noted above, seven hand axes were recorded at this site, along with a range of flakes, some retouched, and simple flake cores with one possible prepared or discoidal core. All artefacts found at the site are in relatively good condition — unrolled with sharp edges to the lateral margins and well-defined ridges between the surface flake scars. While not *in situ* within a sealed stratigraphic context, their condition indicates that the artefacts in this locality have not been moved any significant distance by natural forces, although variation in surface patination between upper and lower surfaces of two hand axes may be indicative of their surface exposure at the current locality for some time.

While there is no absolute date as yet for this locality, the size and form of some of these hand axes allow preliminary comparisons with other Acheulean sites in Arabia and the Levant. A number of hand axes are similar in size, shape, and raw material to examples recorded at the site of Gesher Benet Ya'akov in the Levant (Goren-Inbar et al. 2018; Sharon, Alperson-Afil & Goren-Inbar 2011) and similar to hand axes recorded at Dawadmi in central Saudi Arabia (Petraglia, Drake & Alsharekh 2009) and at Qana 1 in the Nefud desert (Shipton et al. 2014). The Acheulean assemblages at Gesher Benet Ya'akov have been dated to between 800 and 700 kya/MIS20-19 (Goren-Inbar 2017), and signals the appearance of the Large Flake Acheulean (LFA) in the Levant (Sharon 2010; Sharon & Barsky 2015) an industrial complex with claimed African affinity (Sharon 2010), but the situation may be more complicated. There are, as yet, no cleavers recovered at this site, and such tools are common elements at other LFA sites.

Artefact distribution and geomorphology

Geomorphological conditions at each of the localities appear to play a key role in the ability of each landform to preserve, expose, and render visible Palaeolithic artefacts to survey. Localities with unfavourable conditions, such as the highly erosive slope of a steep jebel (L0026) or an active, sediment-rich wadi bed (L0027) did not yield artefacts of any age; even if artefacts were deposited here in the past, they would no longer be accessible to survey due to their geomorphological setting. In contrast, and as expected from observations in similar environments (Foley & Lahr 2015; Rose et al. 2011), the 'pavement' surface of alluvial terraces and fan remnants proved to be an excellent geomorphological setting for the preservation, exposure, and visibility of lithic artefacts of Palaeolithic age. Some variability was present; on alluvial surfaces where these pavements were less well-developed and where terraces continued to be incised by run-off (e.g. in the alluvial-topped terraces of the Gulf of Aqaba), the lack of Palaeolithic artefacts maybe explained by the less favourable conditions for the preservation and visibility of artefacts. Furthermore, even if all of the alluvial terraces had similarly developed surface conditions, it cannot be assumed that all of the artefacts recorded on the current surface were deposited on the terrace surfaces themselves (Knight & Zerboni 2018). As has been suggested through the variable patinations of the hand axes at L0034, it is possible that artefacts were deposited during alluvial deposition, later becoming exposed and mixed with any material deposited on the surface through deflation. Future work including detailed mapping and absolute dating of terraces coupled with test excavations, will be necessary to provide a framework for understanding the relative age depths of the observed surface assemblages.

Although the observed relationships between landforms and artefact visibility requires systematic testing, our work, alongside that in similar environments, underlines the key role geomorphology plays in shaping lithic artefact distributions and therefore must be integrated into survey strategy, recording, and interpretation (Fanning et al. 2009; Holdaway & Fanning 2014; Inglis et al. 2019).

Hominin activity in the landscape

Given the short period of survey, the dynamism of the region's landscape, and the strong geomorphological controls on artefact distribution, interpretations of hominin landscape use and dispersals from the preliminary observations must remain broad in scale, but still hold important implications for understanding dispersals. Three observations can be made:

1. Palaeolithic artefacts were found in low number throughout the entire study region, documenting the past occupation of the region by hominin populations. This region can therefore no longer be ignored when examining hominin dispersals from Africa into Arabia and beyond.
2. Artefacts were found both along the coastal plain as well as further inland in enclosed basins, suggesting that populations were moving into the hills or into the Arabian interior from the coastal plain (or vice versa) using the basins along the route. This is not surprising since such basins might trap water and attract animals for hunting. As well as preserving artefacts on top of the alluvial terraces, sedimentation in the basins might also have buried Palaeolithic archaeology; this possibility requires future investigation with targeted survey and excavation.
3. No artefacts were found in direct association with marine deposits, and therefore there remains no direct link between immediate shorelines and hominin artefact deposition, such as exists in the Mediterranean (Galili et al. 2018). Yet unlike the southern Red Sea, where the shoreline has shifted laterally tens of kilometres over glacial cycles, the steep offshore topography of the northern Red Sea and Gulf of Aqaba means that even the small numbers of Palaeolithic artefacts observed in the present-day coastal region during this preliminary survey would never have been deposited far from the shoreline, raising the potential that the populations that deposited these artefacts may have been exploiting coastal resources as well as terrestrial ones as they dispersed out of Africa.

Conclusions

The 2018 reconnaissance survey described above has proved the potential of the north-west of Saudi Arabia to inform on ESA, MSA, and later activity in the region, and begins to place the important Palaeolithic record of this region in its cultural context. Its observations make a strong case for the expansion of work in this region to record the rich archaeology potentially associated with the first hominin dispersals out of Africa, but one which, like all others, must be understood in its dynamic geomorphological context.

Acknowledgements

We thank HRH Prince Sultan bin Salman bin Abdul Aziz, President of the Saudi Commission for Tourism and Antiquities (SCTH), KSA, Prof. Ali Al-Ghabban, Mr Jamal Omar, and Dr Abdullah Al Zahrani for granting fieldwork permission and for their interest in and support of our work. The members of the 2018 field team were: Prof. Anthony Sinclair (University of Liverpool), Dr Robyn Inglis (University of York, Macquarie University) Dr Abdullah Alsharekh (King Saud University), Dr Dhaifullah Al Otaibi (National Museum, Riyadh, SCTH), Mr Christopher Scott (UoL), Mr Saud Al Huwaiti (SCTH Al Bad'), and Mr Abdulillah Timani (SCTH Tabuk).

Funding for the field season was generously provided by the SCTH, with participation from Robyn Inglis, Anthony Sinclair, and Christopher Scott supported by the Gerald Averay Wainwright Fund for Near Eastern Archaeology at the University of Oxford, and the Department of Archaeology, Classics and Egyptology at the University of Liverpool. Robyn Inglis also gratefully acknowledges funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Actions grant agreement No. 660343, 'SURFACE: Human-Landscape-Interactions and Global Dispersals: The Surface Record of Palaeolithic Arabia'.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 187–192

Variation in the Dadanitic inscriptions: the case of RḌY

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Summary
In the first millennium BC Dadān was an important oasis town on the incense trading route with a flourishing writing tradition in a local script, called Dadanitic. Dadān (modern-day al-ʿUlā) was situated in the north-west of the Arabian Peninsula. The Dadanitic corpus is the only Ancient North Arabian corpus to boast a substantial number of monumental inscriptions. Despite the official character of these inscriptions, they also contain variation in language, orthography, and technical execution. This paper will focus on the variation in the spelling of the verb from the root √RḌY before enclitic pronouns. It will argue that this particular variation attests a phonological change in the Dadanitic language after it started being written. This has important implications for the orthography and our general understanding of variation in this corpus of inscriptions.

Keywords: epigraphy, Dadanitic, orthography, phonology, language change

Introduction

Dadanitic is the name of the script used to carve inscriptions in and around the ancient oasis of Dadān (modern-day al-ʿUlā), located in the north-west of the Arabian Peninsula. Although the exact dating of the inscriptions is difficult, since none of them mention known historical events, it is commonly assumed that they were produced between the sixth and first centuries BC (see Rohmer & Charloux 2015 for a recent overview of the arguments for this dating). The Dadanitic corpus is characterized by the formulaic nature of the inscriptions, generally following a tripartite division also common to other varieties of Ancient North Arabian (e.g. Safaitic, see Al-Jallad 2015: 6). The longer inscriptions generally start with the name of the author (*superscriptio*), followed by a narrative section (*narratio*), and end with a blessing formula for the author of the inscription (*invocatio*) (Sima 1999: 49 after Knauf 1980) (see Fig. 1).

Despite the highly formulaic nature of the inscriptions, there is also a lot of variation present in the Dadanitic corpus (e.g. Sima 1999: 95). One of these points of variation can be found in the blessing formula of the inscriptions, notably, in the spelling of the verb based on the root √RḌY. As in the example in Figure 1, this verb always occurs with an enclitic personal pronoun attached to it. It is most commonly attested as in AH 141 *rḍ-h*, but it also occurs with the final root consonant represented as *rḍy-h* (Fig. 2).

This variation is mentioned in several previous studies, but none of them discuss the causes behind this variation (Drewes 1985: 168–170; Farès-Drappeau 2005: 70). Sima seems to suggest a chronological development when he says that, although most inscriptions show the spelling *rḍ-h* some *retain* the *rḍy-h* form. He does not discuss this any further, however, apart from calling it an orthographic phenomenon (1999: 106). While I agree with Sima that this variation represents a chronological development, the reasons behind this development and its trajectory deserve closer attention as they have important implications for the development of the orthography and phonology of Dadanitic.

Morphology

Based on the consistent use of RḌY as a transitive verb, with an enclitic pronoun as its direct object, the verb cannot be interpreted as a G-stem verb *raḍiya*, which has a stative meaning ‘to be pleased, content, satisfied’ (compare Classical Arabic for example). Therefore, this form should be interpreted as a D-stem verb *raḍḍVya* (see also Stiehl 1971: 10; Sima 1999: 106). As all attested forms are used transitively, this means that the variation in spelling cannot be due to a different development of triphthongs /-iya-/ and /-aya-/ in this case.

AH 141			
superscriptio	(line 1)	*gzʾ/bn/ʾbgr*	*gzʾ son of ʾbgr*
narratio	(line 2–5)	*ʾẓll/l-ḏġbt//bʿd/ml-h//b-tqmm{/}w b-n//ʾl*	performed the *ẓll* for *ḏġbt* on behalf of his property at *tqmm* and at *nʾl*(?)
invocatio	(line 5–6)	*f-rḍ-h/w//s¹ʿd-h/w-ʾṯb-h*	so may he favour him and aid him and reward him

Figure 1. *A Dadanitic inscription with a typical formulaic structure.*

	Masculine	Feminine	Total
Defective spelling	*rḍ* (123)	*rḍt* (2)	125
Plene spelling	*rḍy* (29)	*rḍyt* (1)	30
Total	**152**	**3**	**155**

Figure 2. *Attested spellings of √RḌY.*

Alternatively, the difference in spelling could be interpreted as a difference in morphological form: *rḍy-h* representing the optative use of the suffix conjugation /raḍḍaya-hu/ 'may he favour him' and *rḍ-h* the imperative /raḍḍī-hu/ 'favour him'.[1] However, since the two forms are always used in the same formula, with the same meaning, this cannot be confirmed from the context. In addition, both third feminine singular of the suffix conjugation (SC) *rḍt-h*[2] and *rḍyt-h* are attested as well (see Fig. 2). These forms can only represent variant spellings of the same morphological form and since they are based on the same stem formation, the difference in spelling cannot be explained as a difference in vowel quality.

JSLih 036/2 ---- *{ʿ}zy/ f rḍt-h/{h}*----[3]
'… *ʿzy* so may she favour him/her…'

AH 288/4 *f rḍyt-h/w ʾẖrt-h* ----
'so may she favour him/her and his/her posterity…'

Phonology

III-weak verbs

Since the morphological form of the verb cannot explain the difference in spelling, the reasons behind variation should probably be sought in the realm of phonology and orthography. If we compare the spelling of RḌY to other verbs with a glide as their final consonant, it becomes clear their spelling is more consistent. The final root consonant of final weak verbs is always represented in Dadanitic in the third masculine singular forms in word-final position and in the third masculine plural SC, but it is lost in third feminine singular verbs SC (Fig 3). Unfortunately, there are no attestations of III-weak verbs with enclitic pronouns, apart from RḌY.

bny	he built	(e.g. AH 208; JaL 006; JSLih 045)
bnyw	they built	(e.g. Müller D.H. 1889: 63–64, no. 8; U 008; AH 200)
wdyw	they placed	(JSLih 077)
ʾfyw	they offered	(U 037)
bnt	she built	(Al-ʿUḏayb 043)
ʾft	she offered	(U 005)

Figure 3. *Attested suffixing forms of III-weak verbs.*

This goes for final *-y* and final *-w* verbs alike. Compare third masculine singular *ʾgw* (e.g. AH 065; AH 157; U 032), but third feminine singular *ʾgt* (AH 006; AH 079; U 126).

The consistent representation of final weak consonants in the third masculine plural SC verbs, as opposed to the third feminine singular SC verbs in which the third root consonant *y* is rarely[4] represented, could suggest a different phonological environment in each. This could confirm the vocalic nature of the third masculine plural suffix /-ū/ and suggest that while /ayū/ and /awū/ were maintained,

[1] I would like to thank Ahmad Al-Jallad (personal communication) for suggesting this interpretation of the difference between rḍ and rḍy.
[2] The form *rḍt* is also attested in Tall al-Kaṯīb, no. 1, but the context seems to be slightly different than in other inscriptions (there is no enclitic pronoun on *rḍt*). In combination with the fragmentary nature of the inscription it is unclear how this should be interpreted and whether the form really represents a verb here.
[3] All inscriptions referenced in this work can be found in the online OCIANA database where they can be found with their transcriptions, translations and available photographs. http://krcfm.orient.ox.ac.uk/fmi/webd/ocian.

[4] There is one attestation of *rḍyt* (AH 288).

/ayat/# collapsed to /ayt/, /ēt/, /āt/, or /at/.

bny (e.g. AH 208; AH 234; JaL 006)	but *bnt* (Al-ʿUḏayb 043)
ʾfy (e.h. U 004; U 031; U 035)	but *ʾft* (AH 051; U 005)

However, taking into consideration the *rḍy-h(m)* forms, it becomes clear that the final glide does not only go unrepresented when it is followed by a closed syllable. Even if we assume that final short vowels were lost, this would only create a final closed syllable at the end of forms with a masculine singular enclitic pronoun /raḍḍaya-hu/ > /raḍḍaya-h/. In forms with a plural enclitic pronoun it would not: /raḍḍaya-hum/. Both forms, with and without the final glide present, are attested with both singular and plural enclitic pronouns.

AH 001 *ʾẓ//llw/ẓll/h-nq/l-//ḏġbt/f* ***rḍ-hm***
'they performed the *ẓll* ceremony of the *nq* for *ḏġbt* so **may he favour them**'

AH 235 *ʾẓlw/h-ẓ{l}[l]----//---- l- ḏġbt/f* ***rḍy[-hm]***
----//---- [w] [s¹][ʿ]d-hm/w ʾḫrt-hm
'they performed the *ẓll* ceremony for *ḏġbt* so **may he favour {them}** and aid them and their posterity'

U 058 *ʾẓll/h-ẓll//{b-}khl/l-ḏġ//bt/bʿd/{n}ḫl-h//w dṯʾ-h b-bdr//f* ***r{ḍ}-h*** *w ʾḫrt-h*
'he performed the *ẓll* ceremony {at} *khl* for *ḏġbt* on behalf of his palm trees and his crops of the season of the later rains at bdr so **may he favour him** and his posterity'

JSLih 061 *ʾdq/l-l//h/{h}-ṣlmn//{f}* ***rḍy-h/*** *w//{s¹}ʿd-h*
'he dedicated the two(?) statues to *lh* so **may he favour him** and aid him'

It is unclear what the vocalization of the feminine enclitic pronoun would have been. Since it is never written with a -*h* to represent a long final -ā (**-*hh* for -hā) it probably did not end in a long vowel (Drewes 1985: 170). Both spellings of RḌY are also attested with the feminine singular enclitic pronoun.

U 056 *ʾẓllt l-//ḏġbt b-{k}hl bʿd//{d}ṯʾ-h/f* ***rḍ-h***
'she performed the *ẓll* for *ḏġbt* at *khl* on behalf of her crops of the season of the later rains so **may he favour her**'

AH 088 *fʿlt//h-ẓll/f* ***rḍy-h//*** *w ʾḫrt-h*
'she made the *ẓll* so **may he favour her** and her posterity'

II-weak verbs

The lack of a clear conditioning environment for the difference between the collapse of the triphthong in feminine singular verbs and before an enclitic pronoun suggests that we may have to consider a general collapse of the triphthong. In this case, variation in orthographic representation of the glide depending on its position in relation to word boundaries may explain the difference between the consistent representation of the *y* in word-final position and its common disappearance before an enclitic pronoun. Indeed, if we consider the medial weak verbs with a glide for their second root consonant, it seems that triphthongs in this position had collapsed as well. In the one attested II-*w* verb *kn* 'he was', the medial glide is never represented, suggesting the presence of a medial long vowel /kāna/ or /kōna/.[5]

U 108 *{b}rd/s¹lm//ḏġbt/ʾẓ//ll/l-ḏġbt//b-khl/bʿd//ḏ-***kn***/l-h/b-y//r*
'*brd s¹lmḏġbt* performed the *ẓll* for *ḏġbt* at *khl* on behalf of that which was his at *yr*'

There may be two examples of the verb *byt* 'to spend the night' (AH 291 and Graf Abū al-Ḍibāʿ 1). Both these examples are attested in short graffiti. If *byt* is a verb in these inscriptions, it likely represents a D-stem /bayyata/, since it is a denominal verb. In this case the medial *y* does not represent a triphthong /aya/.

AH 291 *nʿm//ʿklʾ//w* ***byt***
'*nʿm ʿklʾ* and **he spent the night**'
OR
'*nʿm ʿklʾ* and ***byt***'

[5] Compare the Safaitic inscriptions in which both spellings with and without a medial glide are attested, e.g. *bt* and *byt* 'he spent the night'; *mt* and *myt* 'he died'. The presence of *y* instead of etymological *w* in *myt* could suggest the sound changes áwi/u > ā and awí/ú > i (Al-Jallad 2015: 120). This interpretation depends on when the triphthong in medial weak verbs collapsed. See Huehnergard (2005: n. 75) who considers the triphthong to have collapsed at the Proto-Semitic stage, but Suchard (2016) for a reconstruction of Proto-North-West-Semitic with the triphthong maintained.

Graf Abū al-Ḍibāʿ 1 ---*ʾgr/w {h}{n}ʾl*//***byt*/*b-lwh/ḍlḍ***
' …*ʾgr* and *hnʾl* **spent the night** (sing.) at *lwh ḍlḍ*'
OR
'---*ʾgr* and *{h}{n}ʾl* ***byt*** are at *lwh ḍlḍ*'

Each inscription may better be interpreted by reading *byt* as a personal name instead of as a verb.[6] While it is part of the basic formula of Safaitic inscriptions to begin the verbal phrase following the genealogy at the beginning of an inscription with the conjunction *w*-, this is not part of the common structure of the Dadanitic inscriptions where the verb usually follows the personal names directly. However, there are several examples in the Dadanitic inscriptions where multiple persons are mentioned at the beginning of an inscription, separated by the conjunction *w*-.

JSLih 121 *yʿd/bn ṣqw*//***w*** *ʾbs¹lm/bn ṭly*
'*yʿd* son of *ṣqw* **and** *ʾbs¹lm* son of *ṭly*'[7]

In Graf Abū al-Ḍibāʿ 1 it is problematic to read *byt* as a verb, as it seems to follow at least two personal names and we would expect a plural form *bytw*.

Orthography — final -*y* as a *mater lectionis*

Thus, it seems that the triphthongs /VyV/ and /VwV/ had collapsed in Dadanitic. The fact that *y* is only consistently represented in word-final position suggests it developed into a *mater lectionis*, representing word-final -ī or -ē. In word-internal position, however, the long vowel that remained after the collapse was left unrepresented, such as before enclitic pronouns and the feminine suffix forms. This confirms the existence of a mater -*y*, alongside -*w* and -*h* (Drewes 1985: 167–168). Until now, the evidence for the use of -*y* for -ī or -ē in Dadanitic was considered less clear-cut than for -*w* and -*h* (Macdonald 2008: 186).

If this is the case, *rḍ-h* represents a developed phonological form of the SC, while *rḍy-h* shows us that the triphthong was still intact when this spelling was introduced: /raḍḍaya-hu/. The form *rḍ-h* suggests a pronunciation /raḍḍē-h/. For this form to develop, the final triphthong had to have collapsed, possibly after an initial loss of final short vowels. This would leave us with a form /raḍḍē/ or /raḍḍī/ for the third masculine singular of the SC, in which case the etymological -*y* would come to represent /ē/ or /ī/. This became represented with a *mater lectionis* in word-final position (as in verbs like *bny*), but not in word-internal position.

This suggests that we are witnessing a historical development in the corpus, where the *rḍyt* and *rḍy-h* forms represent older forms or archaic spellings, indicating a period in which the final triphthong had not yet collapsed, while the *rḍt* and *rḍ-h* spellings represent the form after the collapse of the triphthong. This means that all other attestations of III-y feminine verbs (e.g. *ʾft* (U 005; AH 015) are only attested in the more progressive spelling. Since the *rḍ-h* forms seem to have been the norm (224 attestations, with only thirty attestations with *plene* spelling), and *ʾft* only occurs twice, it is not surprising that these two attestations conform to the more common spelling convention.

The fact that there is no variation attested in the spelling of word-final triphthongs suggests that at the time when the triphthongs collapsed word-final -*y* came to be used as a *mater lectionis* for -ē or -ī, and not -ā which would have been represented by -*h* (Drewes 1985: 170). Given the high frequency of *rḍ-h* spellings, most of the final -*y*s on third masculine singular SC verbs were probably intended to represent -ē (e.g. *bny* and *ʾfy* as /banē/ or /banī/ and /ʾōfē/ or /ʾōfī/), as Drewes already suggested (1985: 170). However, since over 10% of the attested forms of √RḌY preserve the *plene* spelling of the final root consonant, it is not unlikely that some of the word-final -*y*s in other verbs were also intended to represent a triphthong at the time of writing. The consistency in the writing of the etymologically correct root consonant in the verb[8] suggests that the collapse /awa/ and /aya/ had different outcomes, probably /awa/ > /ū/ or /ō/ and /aya/ > /ī/ or /ē/.

[6] *byt* is not attested as a personal name in other Dadanitic inscriptions, but clearly occurs as such in two Safaitic inscriptions (AAEK 74 and RWQ 45).

[7] Note that the *w* at the beginning of the second line is placed a little away from both lines and is written at a height more or less between both lines (the trace of the inscription is available on the OCIANA website, http://krcfm.orient.ox.ac.uk/fmi/webd/ociana, accessed 3/11/2017).

[8] Except for one attestation of *ʾgy*, for *ʾgw* (JSLih 177).

**rḍy* /raḍḍaya/	*rḍy-h* /raḍḍayahu/	→	**rḍy* /raḍḍ(ē/ī)/	*rḍ-h* /raḍḍ(ē/ī)h/
	rḍy-hm /raḍḍayahum/			*rḍ-hm* /raḍḍ(ē/ī)hum/
**rḍyt* /raḍḍayat/	*rḍyt-h* /raḍḍayathu/	→	*rḍt* /raḍḍ(ē/ī)t/	*rḍt-h* /raḍḍ(ē/ī)th(u)/
	**rḍyt-hm* /raḍḍayathum/			**rḍt-hm* /raḍḍ(ē/ī)thum/
**rḍyw* /raḍḍayū/	**rḍy-h* /raḍḍayūhu/	→	**rḍyw* /raḍḍayū/	**rḍy-h* /raḍḍayūh/
	**rḍy-hm* /raḍḍayūhum/			**rḍy-hm* /raḍḍayūhum/

Figure 4. *Development of the spelling and pronunciation of III-y verbs.*

Conclusions

The variation in spelling of the verb from the root RḌY before enclitic personal pronouns, in combination with evidence from other weak verbs, suggests that triphthongs collapsed in Dadanitic in II-weak and III-weak verbs. In addition to this, the variation in spelling of RḌY suggests the triphthong -aya(-) only collapsed after the Dadanitic writing tradition developed.

The difference between most commonly used spelling *rḍ-h* as opposed to invariable representation of final glides in III-weak verbs in word-final position suggests *-y* came to be used as a *mater lectionis* to represent -ē or -ī after the collapse of the triphthong.

This clearly shows that the Dadanitic language continued to develop after it first started to be written, and the *rḍy-h* spelling represents an archaic linguistic layer within the corpus. This does not prove that all the inscriptions containing *rḍy-h* forms are older than those containing *rḍ-h* spellings. The archaic forms may have been preserved in spelling for some time, possibly representing a more formal linguistic register.

Acknowledgements

I would like to thank Marijn van Putten for all our discussions about the development of *matres lectionis* and the phonology of Dadanitic, and for reading and commenting on a first draft of this paper. Simone Mauri and Benjamin Suchard also provided helpful comments on a first draft. I would also like to thank Ahmad Al-Jallad for his guidance during my research on Dadanitic. I am indebted to everyone involved with the OCIANA database, for making the Dadanitic inscriptions (and other ANA corpora) easily accessible and searchable. All errors are of course my own.

Sigla

AAEK	Safaitic inscriptions in al-Manaser 2008.
AH	Dadanitic inscriptions in Abū l-Ḥasan 1997.
Al-ʿUḏayb	Dadanitic inscriptions from the al-ʿUḏayb area, published in OCIANA
Graf Abū al-Ḍibāʿ	Inscriptions published in Graf 1983.
JaL	Inscriptions published in Jamme 1968.
JSLih	Inscriptions called Liḥyanite published in Jaussen & Savignac 1909–1912.
Müller D.H. 1889	Inscriptions published in Müller 1889.
RWQ	Safaitic inscriptions published in Al-Rousan 2004.
Tall al-Kaṯīb	Dadanitic inscriptions published in al-Zahrānī 2007.
U	Dadanitic inscriptions from al-ʿUḏayb published in Sima 1999.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 193–198

Modern South Arabian material from the diaries of Eduard Glaser

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Summary
This paper is a brief introduction to a hitherto largely unpublished corpus of nineteenth-century Modern South Arabian records from the diaries of the traveller and scholar Eduard Glaser (1855–1908). Together with the various other materials collected during his four journeys to South Arabia, Glaser also made eighty-nine diary pages of notes on the Modern South Arabian languages, consisting mainly of paradigms, word lists, sample sentences and a few short texts, most of which remain unpublished, with the exception of two short texts. After an introductory discussion of the materials involved, this paper presents one new Jibbali text from Glaser's diaries, which contains a number of widely encountered features among Glaser's records and can therefore be considered representative of the corpus as a whole.

Keywords: Eduard Glaser, Jibbali/Shehri, Mehri, Modern South Arabian Languages, Soqoṭri

Introduction

The legacy of the Austro-Hungarian traveller and scholar Eduard Glaser (1855–1908) is most often viewed in the light of his role as a pioneer of the studies of the Yemeni heartland, and in particular Ancient South Arabian epigraphy. During his four journeys to various regions of modern-day Yemen, Glaser collected a large number of squeezes of Ancient South Arabian inscriptions, a large number of Arabic manuscripts, many of which are still awaiting scholarly edition, and various other items such as original inscriptions. Glaser also kept notes in his diaries, containing a plethora of geographical, general historical, ethnographical, and linguistic material. While the ethnographical material has been largely published (Dostal 1993), in comparison the linguistic material has received less attention. Aside from the various notes on Ancient South Arabian and the Yemeni Arabic material published by Behnstedt (1993) and a few cursory notes on other Afro-Asiatic languages such as Maltese or Somali, the bulk of the — hitherto largely unpublished[1] — linguistic material consists of notes on the Modern South Arabian Languages (MSAL). These records, together with Glaser's other written records kept at the archive of the Austrian Academy of Sciences, are currently being scanned for publication online as part of the second phase of the 'Glaser Collection – Open Access' project, with which the author of this paper is collaborating (http://glaser.acdh.oeaw.ac.at/). Furthermore, the MSAL records are currently being edited by the present author, to provide a standardized transcription of Glaser's MSAL notes as well as an edition based on modern standard descriptions of the respective languages.

Description of the material

The entirety of Glaser's MSAL material is to be found in diaries nos. III and VI,[2] with diary no. III containing a total of sixty-one pages and diary no. VI a total of twenty-eight pages of notes.[3] The German glosses by Glaser were largely written in shorthand ('Gabelsberger' system) or in the German 'Kurrent' script. The majority of the material consists of word lists and paradigms,

[1] With the exception of one short text and a list of numerals by Hommel (1896) and another text by Behnstedt (1993).

[2] The standard of numbering and the usage of the term 'diary' itself is taken from the earliest lists of Glaser's records kept at the Austrian Academy of Sciences. This seems somewhat arbitrary, as the documents referred to as 'diaries' in the lists are not always travel diaries in the conventional sense, but include lists of inscriptions, various epigraphic notes, and other written records by Glaser himself. Furthermore, it should be noted that the numbering of the diaries does not relate to the chronological order of his travels; for instance, diary number I contains records exclusively from his final trip.

[3] TB III + VI, Sammlung Glaser, Archiv der ÖAW, BASIS, Nachlässe, Sammlung Glaser Kt. 1 + 2.

intertwined with a few texts, sentences, and phrases as well as cultural and geographical notes about the regions where the MSAL are spoken. Most of the linguistic material concerns Jibbali and Mehri, but at the end of diary no. VI there are also some notes on Soqoṭri, together with two short texts. Unlike some of the other early texts, such as the folk tales or bible translations collected by Fresnel or the Austrian expedition of 1898–1899, Glaser's textual probes are of a more trivial nature and mainly imitate situations of daily life or describe recent events in the lives of his informants. Although Glaser himself at one point noted his desire to collect as much 'authentic' material as possible, criticizing the MSAL versions of biblical texts provided by other scholars for relying too much on Arabic prototypes (Glaser 1902: 26–27), ultimately his texts betray a somewhat artificial flair at times. Thus, many texts take the form of 'letters', published with parallels in other MSAL, which, in all likelihood, were ultimately produced only for Glaser's benefit.

Glaser himself never visited the MSAL-speaking regions and therefore relied entirely on informants for collecting his data. He consulted his informants on at least two different occasions, during his third (1887–1888, diary VI) and fourth (1892–1894, diary III) visits to South Arabia, in Aden. Of his informants, at least three can be identified by name from notes in his diaries. During his third trip his informant for Jibbali and Mehri was one ʿĪsā b. Maḥaṭ b. Aḥmad, who was only described as a shepherd from Dhofar (Ẓufār) from the tribe of Bayt ʿAbsēn and would seasonally travel around other parts of the southern Arabian Peninsula.[4] During his fourth journey, he had two informants, ʿAwwād Mubārak for Jibbali and Mehri and ʿĀmir b. Jumʿān for Soqoṭri. Both of these were described by Glaser as slaves, and in the case of ʿAwwād, Glaser noted that he was born near al-Shiḥr and only later came to Kharfūt in Dhofar.

In addition to the aforementioned materials, further notes on the MSAL might have existed at one time. Both the published (Höfner 1944) and unpublished inventory lists of the Glaser collection quote diary no. IX as containing 'Samples of the Dialects of Mahra, Dhofar and Soqoṭra (186 pages)' (1944: 78–79). Unfortunately, this diary, which at one time was kept by the German scholar and close friend of Glaser, Fritz Hommel, seems to be lost. According to the various inventories and correspondences kept at the Austrian Academy of Sciences, there seems to have been some kind of agreement between the scholars working with Glaser's material after his death and Hommel, which would have granted Hommel the right to publish Glaser's MSAL material, although he never did. Since all publication projects related to the Glaser collection were halted shortly after the publication of Glaser's report on his expedition to Maʾrib, due to the dire material conditions during and after the First World War, it seems likely that Hommel's attention was drawn away from this endeavour as well. Today, neither diary no. IX nor any significant trace of it could be found in Hommel's *Nachlass*, which is kept at the Bavarian State Library in Munich. However, on the basis of some (somewhat opaque) notes in internal records, it seems likely that diary IX never contained more than the notes from diaries III and VI,[5] and Glaser himself seems to have worked with his MSAL materials after his return from South Arabia, as a number of dated comments (post-dating his return) can be found in his diaries. Furthermore, in at least one of his own publications, Glaser expressed his desire to publish the manuscript of an article which would have included substantial material from his MSAL notes (1902: 11); ultimately and for reasons unknown, he did not publish it. No copy of the aforementioned manuscript could be found in Glaser's materials kept in Vienna.

Transcription and notation

Unlike the authors of most other early accounts of the MSAL, Glaser was trained in a number of Semitic languages and also had a basic awareness of the intricacies of documenting spoken language.[6] Glaser therefore attempted to provide an accurate rendition of the languages he encountered. For this purpose, he

[4] With the sub-tribe of Bayt ʿAbsēn today considered to be part of the larger Barʿamī tribe, his 'full' name might be reconstructed as ʿĪsā b. Maḥaṭ b. Aḥmad of Bayt ʿAbsēn al-Barʿamī.

[5] 'IX enthält Proben der Dialekte von Mahra, Ḍafâr und Soḳoṭrā (186 Bl.) die von Prof. F. Hommel seinerzeit exzerpiert und von D.H. von Müller diesem zur Publikation überlassen worden sind.' (Archiv der ÖAW, BASIS, Südarabische Kommission, Kt. 2 Mp 14 [= Allg. Akt Nr. 835/1916], p. 6.)

[6] As can be seen in his critical, if not polemical, remarks about the Austrian expedition of 1898–1899 and his opinion that the Austrian team did not meet the standards of documenting spoken language (Glaser 1902: 12–16).

devised a somewhat idiosyncratic transcription method of his own, which is largely kept in the reproduction of his notes given below. Where the transcription did not suffice, he would add further notes on the pronunciation of certain sounds, comparing them with sounds in languages (more or less) known to him, such as Arabic, Amharic, or Hungarian, and he would also occasionally make analytic or etymological comment about the forms encountered. A full discussion of Glaser's transcription does not seem appropriate at this point, and only a short summary of the most important sign values will be given.[7] The quantity of vowels is indicated by a circumflex in Glaser's transcription, which is preserved in the transcription below. The quality of vowels is distinguished by at least seven different signs: <a>, <e>, <i>, <o>, <u>, <ä>, and <å>, all of which can be lengthened. A central vowel /ə/ (schwa) seems to be missing in Glaser's transcription. As can be seen in the text, Glaser often hesitated to impose any etymological interpretation on the sound values he perceived and thus various innovative transcriptions can be found at certain points to represent various phonetic realizations of one and the same phoneme. Glaser himself did not elaborate at any point upon his system of transcription although by and large, recurring sign values can be identified and cognates with modern transcriptions can be established. The only sign which perhaps defies identification somewhat is the sign value <s$^{\sigma}$>, that is, <s> with a sigma above, which is tentatively identified as the representation of the labialized Jibbali variant of /š/, on the grounds that this sign occurs only in Jibbali texts in a few indicative positions, most importantly in the form of the preposition *k-* with personal suffixes. On the whole, Glaser relatively rarely uses this sign where one would expect it to appear; for instance, it does not occur in the sibilant morpheme of the Jibbali Š-stems (which is transcribed by plain <s>), or in certain verbs where it would seem to appear lexically, for example in the verb *šerek*, 'to do'. By contrast, it does occur in other places where one would not necessarily expect it to appear, particularly in Arabic loan words, where this sign is used for Arabic /š/, defying the etymological integration of these words.

Textual sample

In the following section, a sample text is presented: first a transcript of Glaser's notes, then a 'normalized' version together with a translation and comments. As mentioned above, the transcript of Glaser's notes given below largely attempts to reproduce his own transcription, which is contrasted with the transcription of the 'normalized' version of the text, for the sake of comparability. The 'normalized' version largely follows Rubin's description of Jibbali (Rubin 2014) although, particularly in the case of vocalization of the forms attested, the author has more often chosen to keep Glaser's original representation.

Transcript of Glaser's notes[8]

III – 21
/17/ lisâlim balʾanbar bâlḫajôt – ḫáṭ min ʾaden, ḫair wa
/18/ ʾâfêt[9] – ez šä zahamtô d^{s}âd ğeiṭš ṣanʾanî, ḫojdum
/19/ a ṭâd ḫawâdje ônr hinî ṭad ḫawâdje iḏ isḥôr min
/20/ ğarrô ǟherô – ânkiš[10] he s$^{\sigma}$î s$^{\sigma}$oğl, her ʾâdjibî ḫawâdje
/21/ daḥôñ serḳ ṭâd bédelî – el djerâ ḫawâdja dahón
/22/ ninkâ – mĝôrun zaḥânkil moğhrub uskôfn têloš
/23/ s$^{\sigma}$î[n?] – mğôra anr nkâ – ḳerêre – daḳḳet t^{s}álliṯ –
/24/ uzaḥân jum ḫížžifet, wağáddek tel ḫúddimš –
/25/ wağadän ag ôt bô kíssan dǟlo – mğôran sḫanóttun
/26/ min ôit bi selân liš ʾáḳimgehâje aud zehâm, mğoren
III – 22
/1/ nfôdjun hê waḫaddimš – uskôfen tǟloš hê ušé wuḫoddimš –
/2/ min his daḳḳet t^{s}âlliṯ ʾåd dakket šét – mğôre jem ğûndôt
/3/ nâʾzenû heãk elğát ʾåd ḳerêre linká – lehellé beğs$^{\sigma}$îs$^{\sigma}$

Transcription

(III – 21)
$_{[17]}$lə-sālim bal ʿanbar bal Xajōt – xaṭ mən ʿAden, xayr wə-

[7] <t^{s}> = /ś/, <d^{s}> = /ẓ́/, <ʾ> = /ʿ/, <dj> = /ğ/, <ğ> = /ġ/, <s$^{\sigma}$> = /š̃/ (see above). Since the graphically exact reproduction of a number of other signs used by Glaser would require the development of special fonts (such as /ṯ/ being transcribed by <t> with three diacritical points on top), these signs were therefore rendered with their 'traditional Arabist' equivalent in the transcript of Glaser's notes below.

[8] The numbering is given according to the following system: diary number – page number: line number. Thus, III – 21:17 refers to diary no. III, page 21, line 17.
[9] Actually å with superfixed ^.
[10] Actually å with superfixed ^.

[18]ʿɔfēt ez šɛ zəḥam tɔ ṭād ġayg ṣanʿanī, xoydum [19]ṭād xawāğe õr híni ṭad xawāğe ð-isxōr mən [20]ġarrɔ ɛ̃hero – õk heš he s̃ī s̃oġl, her ʿáğib xawāğe [21]daḥɔ-ñserk ṭād bedelī l-əğerɛ xawāğa daḥɔ-[22]ninkā mġɔrun zaḥān k-əl-muġrub u-skɔfn teloš [23]s̃ī. mġɔra õr nkā ḳerérɛ daḳḳet śálliṯ. [24]u-zaḥān yum xíllifet, w-aġádk tel xúddimš. [25] w-aġadən ʿaḳ ūt boh késɛn dé-lɔ. mġɔran sxanoṭun [26] mən ūt bə-selān leš ʿaḳ ɛmgehāje ɛd zəḥam. mġɔren (III – 22) [1]nfɔğun he wə-xaddimš u-skɔfn teloš he u-šɛ wə-xodumš [2]mən hés daḳḳet śálliṯ ɛd daḳḳet šɛt. mġɔre yum ġũdət [3]náʿşenu he āk əlġád ʿɔd ḳerérɛ linká – lehellé bəġs̃īs̃

Translation by the author

To Sālim b. ʿAnbar of Khayōt: this letter comes from Aden, may well-being and health [be with you]! This one came to me, a man from Sanaa, servant of a Khawāja and he said to me that there is a Khawāja who has been asking about the Mehri language. I told him that I have work [to do], if the Khawāja wants, we will provide a substitute and we will come for the sake of the Khawāja. Then we came at sunset and we sat with him for a while. Then he said 'Come tomorrow at three!', and we came the next day and I went to his servant and we went into his house, [but] there we found nobody. Then we left the house and waited for him in a coffee shop, until he came. Then (III – 22) we got up — myself and his servant — and we sat down with him — me, and him and his servant — from three until six. Then the night fell and now I want to go, and tomorrow I shall come again. And now, Beġshīsh!

Notes

III – 21

21:17 – *wa-/wə-* – throughout the Jibbali material, the common Semitic conjunction shows the form *w-*, with a rare example of the typical Jibbali labialization being attested in line 21:26 of this text. Presumably this should be interpreted as an Arabic or Mehri form.

21:18 – *dˢâd/ṭād* – curiously, Glaser transcribes this word, which can only be interpreted as *ṭād/ṭad* ('one') with <dˢ> = /ẓ́/ instead of /ṭ/. Since this feature is not widely encountered in other records by Glaser, it should presumably be interpreted as an error in notation.

ğeiṭš/ġayg – the standard form of this word is to be interpreted as *ġayg* ('man'), the palatalization of the final /g/ is a phenomenon known from certain Jibbali dialects, according to Rubin, particularly from central and eastern dialects (Rubin 2014: 26). Divergent transcriptions of word-final /g/ in this word do occur at other points, where Glaser himself notes that the word-final pronunciation of this consonant resembles Hungarian /gy/, that is, a voiced palatal plosive. Moreover, since the alternative realization of /g/ as [dʒ] (according to Rubin mainly in western dialects; see Rubin 2014: 26) could have been easily transcribed by Glaser using <dj> or <ž>, it can be assumed that the underlying sound would have been palatalized here as well, although perhaps not exactly representing the sound value [dʒ].

şanʾanî/şanʿanī – it cannot be determined whether Glaser's transcription of this word is faulty, or whether Glaser's informants adapted the original form of the name Ṣanʿāʾ, therefore Glaser's (adapted) transcription was accepted here.

ẖojdum/xoydum – the standard form of this word should be *xódum* (Johnstone 1981: 298). Interpreting this form as a 'genuine Jibbali' diminutive seems problematic as Jibbali diminutives usually take the forms CéCέC and CéCəCén (Rubin 2014: 87), nor do there seem to be diminutive forms immediately cognate to this form in other MSAL.

21:19 – *ônr/õr* – as elsewhere in Glaser's records, the form of the verb 'to say' is missing its etymological /ʿ/ and nasalization of the etymological /m/ is indicated by the use of the <n>. Interestingly, the same phenomenon occurs with the similarly frequent verbs *nakaʿ* ('to come') and *ʿak* ('to want, love', root **ʿgb*). Throughout Glaser's corpus, there is only one attestation of the preservation of etymological /ʿ/ in an imperative form of the verb *nakaʿ*.[11] It seems questionable whether this should be interpreted as an influence from Mehri, where /ʿ/ might be deleted in these positions, since the vocalism of these words is largely in alignment with the vocalism encountered in Jibbali and /m/ is elided in intervocalic position with nasalization of the vowel, another feature known in Jibbali but not in Mehri.

hinî/hinī – either a variant form to the preposition *her* + 1st pers. sg. suffix *-ni*, which is read elsewhere as *híni* (Bittner 1916: 47; Rubin 2014: 243), or simply a mistake in notation on Glaser's part.

[11] VI – 42:14 *inkaʾ leô – komm her!*

21:20 – *ânkiš/õk heš* – the form of Glaser's original seems somewhat enigmatic at first sight although, when viewed in context, Glaser's own translation and the Mehri parallel of this text,[12] it seems appropriate to interpret this as the 1st pers. sg. form of the verb *ʿõr* – 'to say' with the preposition *her* and a 3rd pers. sg. masc. suffix.
sᵒoğl/šoġl – note the fact that this form makes use of the labialized variant /š̃/, which is also otherwise attested for the substantive (Johnstone 1981: 266).
ʾâdjibî/ʿáğib – most likely the regular Jibbali form of the verb 'to want', 3rd pers. sg. masc. The word-final vowel cannot be explained, and is most likely a (meaningless) epithetic vowel.
21:21 – *daḥôñ/daḥə* – this is an interesting form of the Jibbali future particle *d(a)ḥa(r)-*. Since it reoccurs only a few words later with a word which clearly shows <n>, it is quite likely that the final <n> should be interpreted as the conjugation prefix of the following verb. Thus, the meaning of the verb would also have to change from 1st pers. sg. to 1st pers. pl., since alternations between /l/ and /n/ are not really to be expected at this point. In Glaser's corpus, the Jibbali future particle almost always lacks the word-final /r/, with the single exception occurring in the material solicited by Glaser's first informant.[13] As noted by Rubin (2015: 439–440), one can observe a significant shift between early publications on the MSAL and more modern ones, in terms of the representation of this particle. While older descriptions of Jibbali regularly show /r/ preserved, in most modern Jibbali language records this word-final /r/ is conspicuously missing. The most likely explanation for this phenomenon, as elaborated upon by Rubin (2012: 195; 2015: 439–440), would be to interpret this as a recent (i.e. twentieth-century) language change. Given the sheer quantity of the attestations of the Jibbali future particle in Glaser's material,[14] it seems somewhat unlikely that this is simply a mistake in notation on Glaser's part. If this explanation is to be upheld, Glaser's material might actually attest the hitherto earliest known occurrences of this phenomenon. Furthermore, the quality of the second consonant shifts between /h/ and /ḥ/ in his notations, which need not be interpreted as an error on the part of Glaser's notation, given the fact that such fluctuations are commonly attested in the case of this particle.
serḳ/ñserk – some mistakes in Glaser's perception of these forms seem likely. The verbal form seems to match the verb *šerek*, 'to do', if one assumes that this form is the form attested here (discarding roots such as *šrḳ*- 'to steal' or *srḳ*- 'to masturbate'; see Johnstone 1981: 231), one has to explain the deviations in notation. Since glottalization of /k/ towards /ḳ/ is, to the limits of the author's knowledge, not otherwise attested in Jibbali, it seems most likely that here Glaser actually made a mistake in noting <ḳ>, which should be read as <k>.
21:22 – *dahón ninkâ/daḥə-ninkā* – as in line 21, the final /-n/ of the future particle should presumably be interpreted as the conjugation prefix of the subjunctive form. Moreover, in the next lines the text continues to use 1st pers. pl. forms, which are then recognized by Glaser as such, therefore this line should also be interpreted as a 1st person plural ('we will come'). For the lack of /ʿ/ (root *nkʿ*), see line 21:19.
mĝôrun/mġərun – note the variant forms *mġəra* (21:23), *mġəran* (21:25), *mġəren* (21:26), and *mġəre* (22:2). The final vowel can presumably be interpreted as different realizations of /ə/.
têloš/teloš – one would usually expect the preposition *tel* to change its base when a suffix is attached, resulting in a form *tə̄ləš* (Rubin 2014: 269).
21:23 – *õr nkā ḳerérɛ daḳḳet śállit̠* – note the somewhat untypical use of temporal adverbs and exact time measurements in Jibbali.[15]
21:24 – *ẖížžifet/xíllifet* – the underlying root has to be interpreted as the root *xlf*, well attested in Jibbali (Johnstone 1981: 299), occurring here as an adjective of the feminine substantive *yum*. Glaser's transcription here remains somewhat elusive; neither does he add any comments to this particular form, nor does a representation of the grapheme <ž> for /l/ occur frequently elsewhere. This might, therefore, be best interpreted as an error in notation of some kind on Glaser's part.
21:26 – *bi selân/bə-selān* – note the only occurrence of the typical Jibbali conjunction *b-* 'and' in this text. Glaser

[12] *amårke hô šî ẖádimêt* (III – 49:18–19).
[13] VI – 72:2 *dẖartesā̈f*.
[14] Although many of the attestations are preserved in paradigms rather than in texts or sentences, which might have a negative impact on the reliability of this data. On the other hand, the only attestation of the word-final /r/ (mentioned above) is also attested in a paradigm.
[15] My thanks to Janet Watson for pointing this out.

himself seems not to have recognized this as what it was, since he speculates in a marginal note about the possibility of this being one word with the root *bsl*.

22:2 – *min his/mən hés* – in Rubin's treatise *mən hés* conveys a sense of 'from the time when' or 'since' (Rubin 2014: 370), although, in the case of the texts Rubin's grammar is based on, it is not used with times of the day. Note that the Mehri version of this text also shows a construction with *min his* (*mən hīs*).[16]

Conclusion

The text presented above is a preliminary glimpse on the materials collected by Glaser and further work will provide a full edition of Glaser's material. While being by and large in accordance with other nineteenth-century and modern MSAL corpora, some salient features can already be extracted from this text, such as the variant forms of the Jibbali future particle, the intrusion of Mehri and Arabic forms, the absence of /ᶜ/ in certain frequent words, and the eclectic occurrence of the labialized sibilant /s̃/. It is therefore hoped that Glaser's materials will not only contribute to the study of the history of exploration of this unique language group within Semitic, but also enrich the corpus of (early) MSAL records as a whole.

Acknowledgements

Sincere thanks are due to the Austrian Academy of Sciences and, in particular, to the project leader of the 'Glaser Collection – Open Access' project, Petra Aigner, for permission to work with this material, as well as to George Hatke for his ongoing support and to the Bavarian State Library in Munich for their kind support during my visit in April 2018. Warmest thanks are also due to Aaron Rubin and Janet Watson for providing valuable comments and feedback.

[16] VI – 51:4.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 199–206

The necropolis of Thāj (Eastern Province, Saudi Arabia): an archaeological and anthropological approach (poster)

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Summary

Thāj, a major east Arabian caravan city settled from the 'Hellenistic' to the early Sasanian period, is composed of a large walled city of 40 ha, extensive suburbs, and a necropolis of over 1000 tombs. As part of the Thāj Archaeological Project (SCTH/CNRS/Leiden University), an archaeological study of the necropolis was launched in 2017, with the aim of determining the burial practices, cultural identity, and social organization of the inhabitants of Thāj, and to reconstruct their way of life (diet, health status, etc.). These issues are addressed through a comprehensive approach combining spatial analysis, targeted archaeological excavations, and anthropological analysis. In 2017 a remote survey of the necropolis enabled the identification of more than 1000 tombs, 210 of which were surveyed in the field, as a first step towards the analysis of their typology and spatial distribution. The excavation of a 'white circle' (also called 'ring tumulus'; see Bibby 1973) provided new evidence on burial practices, tomb building techniques, and chronology. Finally, the discovery of several child burials close to the city wall offers new insights into the diversity of funerary treatments at Thāj.

Keywords: eastern Arabia, pre-Islamic period, necropolis, funerary practices, biological anthropology

Introduction

Located 95 km west of the Gulf coast, Thāj is a major east Arabian caravan city settled from the 'Hellenistic' to the Sasanian period (Fig. 1). The site is composed of a large walled city of *c.*40 ha, extensive suburbs covering *c.*12 ha, and a necropolis of over 1000 tombs. It lies at the intersection of two important trade routes, a major trans-Arabian route connecting South Arabia with Babylonia, and an east–west camel track linking the Gulf coast with the Najd (Potts 1990). Explorers mentioned the ruins of Thāj as early as the late nineteenth century, but despite its importance, so far the site has been subject to only limited fieldwork (Bibby 1973; Gazdar, Potts & Livingstone 1984; Potts 1993; al-Hashash et al. 2001; 2002; al-Hashash 2005; 2006). For this reason, a new joint archaeological project was launched in 2016 by CNRS, Leiden University, and the Saudi Commission for Tourism and National Heritage (SCTH) with the aim of carrying out a comprehensive archaeological exploration of the ancient city and its necropolis, including large-scale excavations and a wide array of specialized studies (Rohmer et al. 2018).

Objectives and methods

As part of this project and with the support of the Institut des Déserts et des Steppes, a study of the necropolis was undertaken in 2017. It aims to characterize the burial practices, cultural identity, and social organization of the inhabitants of Thāj, and to reconstruct their way of life (diet, health status, etc.). These topics are addressed through a multidisciplinary approach combining: 1) spatial analysis on a GIS based on aerial images, survey results, and geophysics (Fig. 2); 2) the archaeological excavation of selected tombs; and 3) anthropological analysis of the human remains.

Survey

Using aerial orthophotography of the site, covering *c.*4 km^2 with a ground definition of 2 cm, a remote survey of the necropolis was undertaken, enabling the mapping of over 1000 tombs on a GIS and the identification of two main types of funerary structures (see Fig. 2). Most recorded structures are tumuli (76.8%), 3 to 68 m in diameter, which are mainly concentrated in the south.

Figure 1. *A map of the Arabian Peninsula showing the location of Thāj and the main ancient caravan routes.*

The remaining 23.2% correspond to 'white circles' (shallow ring mounds, 7 to 65 m in diameter, covered with chalky limestone fragments), which are more evenly distributed all around the walled city. In 2017 a foot survey of the necropolis was undertaken during which 210 funerary structures were recorded. The survey enabled the identification of other categories of tombs, such as cairns of various shapes and rectangular cists. The foot survey revealed that the funerary structures are covered with scattered pottery sherds. A targeted

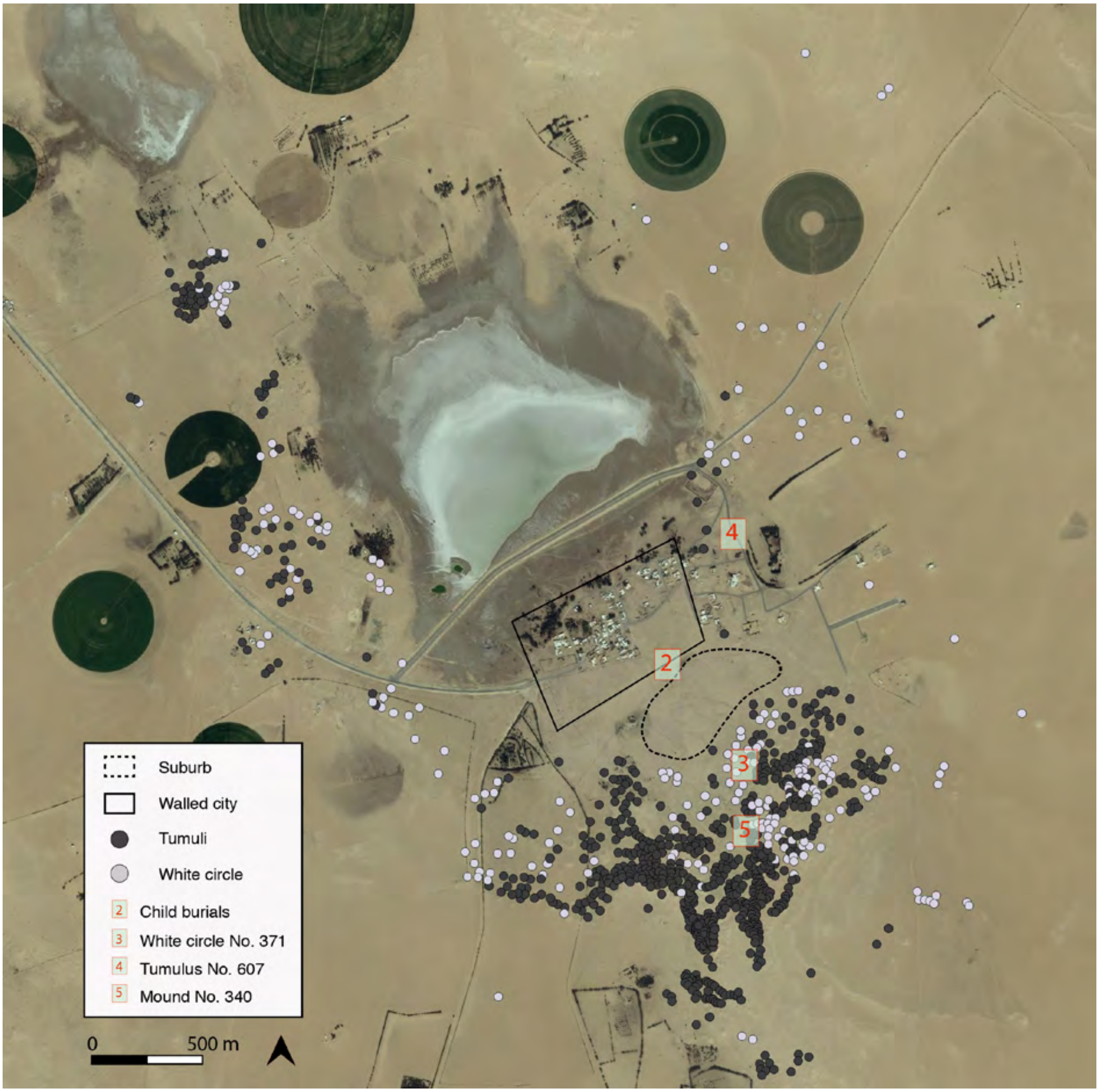

Figure 2. *A map of the Thāj area showing the funerary structures (tumuli and white circles) recorded during the 2017 survey campaign and the excavation areas mentioned in the text (red numbers in white squares).*

sampling of this surface pottery was undertaken, focusing on diagnostic fragments (rims, bases, and decorated fragments), in order to establish a broad chronology of the necropolis. The study of the pottery is still in progress but it is already possible to identify local and imported productions, the latter including notably Hellenistic black-glazed ware of Attic or Levantine origin, dating back to the third–second century BC. Apart from pottery, fragments of granite and alabaster vessels were discovered as well as terracotta female figurines. These observations raise the question of whether the typological diversity of the tombs is related to chronological evolution or to differences in the social status, wealth, and/or cultural identity of the deceased. Further work is planned to gain a better understanding of the spatial distribution of the tombs according to their types and chronological period.

Excavation of funerary structures

— 'White circle' no. 371 (excavation Area 3; Fig. 2)

Located south-east of the ancient city, 'white circle' no. 371 appears on the surface as a whitish ring of chalky limestone fragments, *c.*2 m wide and 25 m in diameter. Three soundings were opened: one near the centre, a second at the eastern edge of the ring where rectangular masonry elements were visible on the ground, and a third at the western edge of the circle (Fig. 3/1). The goals of this first excavation were to: 1) highlight the layout and building technique of the tomb; 2) provide evidence on funerary practices; 3) understand the internal organization of the tomb; and 4) establish its chronology.

Three cists showing a common architectural design were discovered and excavated, although some variability was observed in the building techniques (Fig. 4).

The excavation showed that the three structures had been looted. The preservation of several anatomic connections indicates that the looting took place shortly after the funerals. Furthermore, compared to the other cists of the 'white circle', the dimensions of cist A (Fig. 3/2) are intriguing because it is too small to contain an adult individual in a decubitus position, which was apparently the norm. The anthropological analysis indicates that a mature man, a young woman,

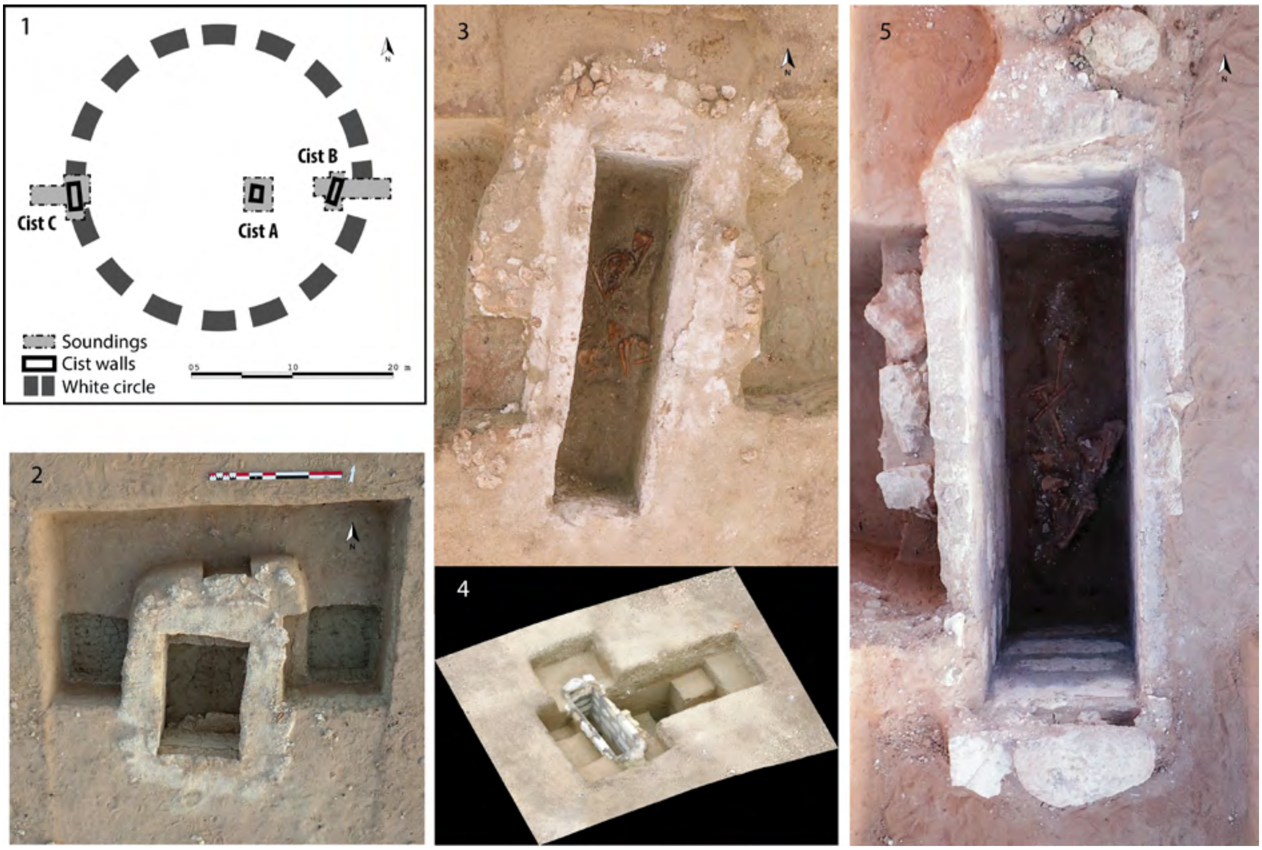

FIGURE 3. 1. *Soundings opened in white circle no. 371 and their respective cists;* **2.** *cist A;* **3.** *cist B;* **4.** *3D model of cist C;* **5.** *cist C.*

Funerary structures	Location	Architecture	Dimensions	Orientation	Human remains	Grave goods	^{14}C dates cal. BC/AD, 2σ
Cist A	Centre	2 courses of cut limestone blocks with pink mortar	L 1.2 x W 0.7 x H 0.7 m, wall thickness 0.8 m	N-S	A few fragments, adult individual	None	209-88 cal. BC (UBA-36874=2135 ± 26; on charcoal)
Cist B	Eastern edge	White limestone formwork covered with a light grey coating	L 2.3 x W 0.6 x H 0.95 m, wall thickness 0.29 to 0.42 m	N-S	Partially articulated bones of a male mature adult, male individual (S. 303)	None	194-46 cal. BC (UBA-36875=2096 ± 30; on charcoal)
Cist C	Western edge	4 courses of cut limestone blocks with grey mortar	L 2.33 x W 0.76 x H 1.33 m, wall thickness 0.21 m	N-S	Partially articulated bones of a young adult, female individual (S. 302) / new-born in a pit (S.301)	8 beads in semi-precious stones; bronze fragment	69-230 cal. AD (UBA-36877=1872 ± 34; on charcoal)

Figure 4. *The main features of the cists in white circle no. 371.*

and an infant had been buried in this funerary complex, showing that all genders and age groups had access to the necropolis. Interestingly, however, the infant was not buried in a cist but in a shallow pit close to cist C, suggesting different treatments according to the age of the deceased. In cist C (Fig. 3/5) the remains of a wooden feature, perhaps a coffin or funerary bed, were found. The latter hypothesis is supported by the discovery of a bronze artefact at the bottom of the cist, which may be the foot of a funerary bed (Fig. 5/8). Moreover, several beads made from semi-precious stones were discovered in cist C, indicating that the young woman had been buried with jewellery. Their quality and variety in material and shape reflect the importance given to the deceased (Fig. 5/1–7). These beads are similar to those found at Tall al-Zāyir, a large funerary mound located to the north-east of Thāj which was excavated by a Saudi team in 1998–1999 (al-Hashash et al. 2001; 2002), and to those found in the impressive burial at ʿAyn Jawān, on the Gulf coast to the north of Tarut (Al Saud 2010), both of which have been tentatively dated to the first–second century AD. These artefacts suggest strong trade connections, which still need to be investigated.

Although the stratigraphy of this 'white circle' is not yet fully understood, at least three phases were identified. Judging by radiocarbon dates from their mortar, cists A and B belong to a second- to first-century BC interval (Phase 1), while cist C was built between the late first and early third century AD (Phase 2). As it covers the looted remains of cist C, the white ring showing on the surface represents a third phase, which has yet to be dated. This does not mean, however, that there was no funerary structure encompassing the cists in Phases 1 and 2; in the east–west sections of soundings B and C, at least two phases of the white circle (layers of white chalky limestone sloping towards the outside) were identified, the lower of which is earlier to or contemporary with cist C. It seems, therefore, that the white circle already existed in Phase 2 (at the latest) and that Phase 3 represents a restoration of this monument, after the looting of cist C and perhaps on the occasion of new burials (yet to be found). Further excavations will be needed to ascertain whether the earliest burials (Phase 1) were already associated with a white circle, and to fully understand the nature of this monument — is it, as Bibby (1973) suggested, a low mound which was eroded or partly dug away or was it designed from the beginning as a ring tumulus? What already seems clear, however, is that there was a relative continuity in burial practices over several centuries, as the deceased from Phases 1 and 2 are all deposited in underground, plaster-coated cists with a north–south orientation.

— Mound no. 340 (excavation Area 5)

In Area 5, located in the southern necropolis (see Fig. 2), the Saudi part of the team excavated another structure whose features are significantly different. Located on a raised area of the site, it is a circular enclosure *c.*12.5 m in diameter, delimited by a wall with regular facings, consisting of two

Figure 5. *Grave-goods discovered in cist C. Top: beads —* **1.** *carnelian;* **2.** *amethyst;* **3.** *amber;* **4.** *garnet;* **5.** *bone;* **6.** *stone;* **7.** *shell or bone; bottom:* **8.** *bronze fragment;* **bottom left:** *bronze fragment in situ.*

courses of cut limestone blocks with a core of smaller blocks. An inner central cist was revealed without any human remains, along with an outer pavement and a fireplace. The date of the structure cannot yet be ascertained, but ^{14}C analysis of charcoal found under the cist testifies to human activity in this area as early as the late fifth to the early fourth century BC.

— Tumulus no. 607 (excavation Area 4)

A test trench was also opened on a large mound, located to the north-east of the ancient city (see Fig. 2), immediately north of the aristocratic tumulus excavated by the Saudi Department of Antiquities in 1998–1999, Tall al-Zāyir (al-Hashash et al. 2001; 2002). This mound is 60 m wide and 8 m high. A preliminary geomagnetic survey suggested the presence of a structure at the centre of this mound. During the 2017 season, the main burial could not be reached but two supplementary intact burials were discovered: an infant (0–1 year old) buried in a pit (oriented north-west–south-east) and an adult in a stone cist (oriented north-west–south-east). There were no grave-goods. Excavations will continue during the next seasons in order to reach the main funerary structure.

— The child burials along the city wall (excavation Area 2)

During the excavation in Area 2, seven child burials were discovered near the city wall of Thāj (see Fig. 2). They were buried in shallow pits, oriented north–south and north-west–south-east. Radiocarbon dating is still in progress. This discovery promises new insights into the diversity of funerary practices at Thāj.

Conclusion

The results obtained during the first field campaign appear very promising. The survey allowed us to record over 1000 tombs and identify several types of funerary structures (tumuli, 'white circles', cairns, isolated cists), although the excavation of mound no. 340, a circular funerary enclosure with various inner installations, shows that this preliminary typology is still far from exhaustive. During the next campaigns, the pedestrian survey will be continued in order to understand the typological diversity of the tombs and their spatial organization.

The excavations of 'white circle' no. 371 (Area 3) yielded new information on the building techniques, internal organization, and chronology of this type of tomb while providing the first clues to the ancient local burial practices. At least three phases were identified, of which the two earlier can be dated respectively to the second to early first century BC (cists A and B) and the late first to early third century AD (cist C). It is still unclear whether the white circle itself existed from the beginning, but it was built at the latest in Phase 2 and restored in Phase 3. In spite of this relatively long period of use, the excavated cist-burials share common features, suggesting a relative continuity in burial practices over the centuries. Synchronically, however, different treatments seem to have been applied to adults and infants. The excavation of Mound 340 (Area 5), Tumulus 607 (Area 4) and the cemetery in Area 2 have yielded other types of burials, but these have yet to be fully studied and dated.

Acknowledgements

The Thāj Archaeological Project is led by the Saudi Commission for Tourism and National Heritage, the French National Centre for Scientific Research (CNRS), and Leiden University (Netherlands). It is supported by the French Ministry of Europe and Foreign Affairs (MEAE), Éveha International, SATORP (a branch of Total Group and Aramco), and the Institut des Déserts et des Steppes.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 207–222

'The numerous islands of Ichthyophagi': Neolithic fisheries of Delma Island, Abu Dhabi Emirate (UAE)

Kevin Lidour & Mark Jonathan Beech

Summary
This paper presents the results of a study of nearly 55,000 fish bones from the Neolithic settlement of Delma Island, Abu Dhabi Emirate (UAE). The analysis has outlined the predominance of small coastal taxa such as seabreams and needlefish in the bone assemblage, indicating the use of non-selective fishing techniques such as small seines or coastal barrier traps. The installation of baited cage traps in deeper reef areas is also suggested by the importance of large groupers. The exploitation of the open sea is likewise documented by the catch of many kawakawas (a regional tuna species) and large sharks. Pelagic schools were probably exploited with purse seines or drift nets since the first shell hooks only emerge from the mid-fifth millennium BC onwards in the northern UAE. Fishing expeditions in open sea, however, require the use of boats at Delma. As Delma (50 km offshore), in the Arabian Gulf, and Masirah Island (20 km offshore), in the Arabian Sea, were already occupied several thousand years ago, Neolithic seafarers from eastern Arabia were thus already capable of long-distance travel. Boating technology is now directly asserted by the discovery of bitumen-coated fragments at as-Sabiyah H3, Kuwait. At Delma, the discovery of Mesopotamian pottery sherds (ʿUbaid wares) and carbonized date stones raises the issue of regular contacts with continental groups. The present archaeo-ichthyological study provides the opportunity to document and discuss the singular features of subsistence strategies in an insular environment during the Neolithic.

Keywords: fishing, Neolithic, eastern Arabia, Arabian Gulf, archaeo-ichthyology

Introduction

During the past thirty years, many zooarchaeological studies have pointed out that Neolithic groups from eastern Arabia are characterized by subsistence economies principally focused on marine resources and small-scale husbandry. Agriculture remained uncertain, however, until the Bronze Age (*c.*3000 BC). In the words of S. Cleuziou (2005), the Arabian Peninsula has followed 'its own path' within the Neolithic phenomenon in the Middle East. While the significance of marine shellfish is regularly outlined for diet and specialized technologies (personal ornaments and tooling) during the Neolithic, only a few studies have been conducted on fish bone assemblages in comparison to the number of settlements and archaeological shell middens documented at this time. Fish, however, constitutes 60–90% of recovered vertebrate remains. In many respects, very little is known about the diversity of fishing grounds, strategies, and techniques engaged by Neolithic fishermen, although they raise key issues for archaeological studies such as subsistence behaviours and strategies, seasonality, and mobility. This paper presents the results of the complete analysis of the fish bones collected during the course of five seasons (1994–1995, 1998, 2014–2015) of excavations at the Neolithic site of Delma (*c.*5300–4700 BC, Fig. 2), Abu Dhabi Emirate, United Arab Emirates.

Site location and archaeological settings

The site (24°30'38"N; 52°18'37"E) is located on Delma Island (Fig. 1/A), which lies about 50 km off the coastline of the Emirate of Abu Dhabi and 30 km off the northern coastline of Sir Bani Yas Island. The central part of the island is the rocky core of a salt-dome reaching about 100 m above sea level. The shoreline of Delma has changed considerably during the past decades with significant infilling of the southern and eastern coasts of the island. Brackish and fresh sources of water are accessible from many artesian aquifers (King 1998). The coastline slope is gentle and composed of mixed assemblages of rocky colluvium

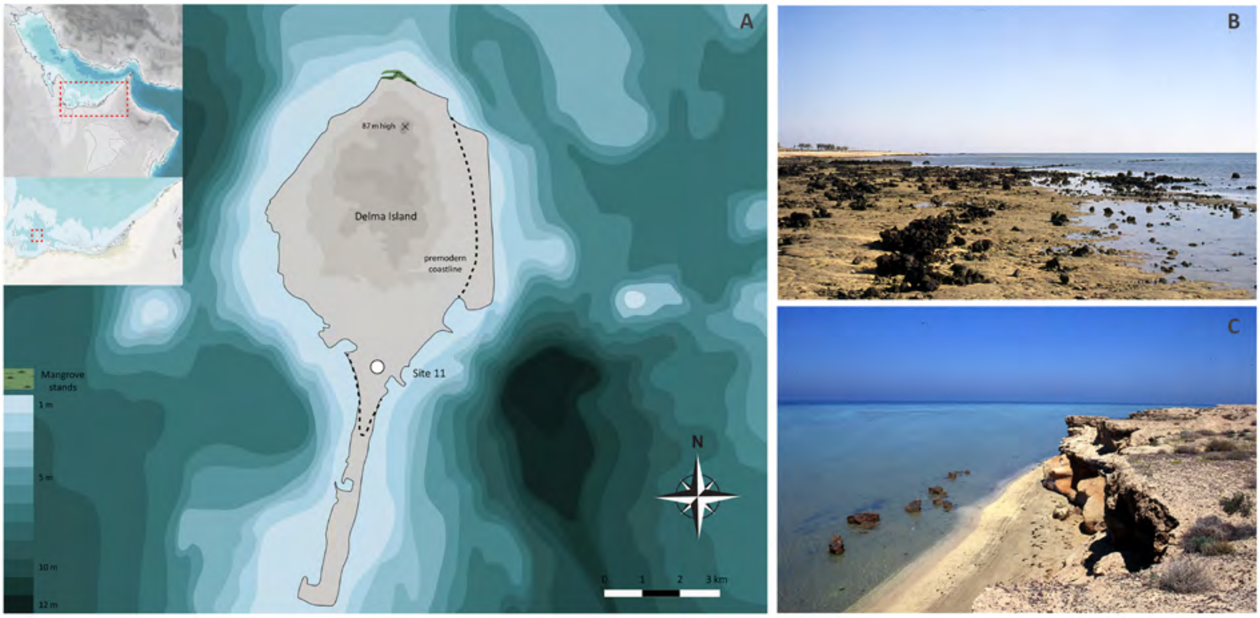


Figure 1. A. *A map of Delma island showing the location of the Neolithic site (© K. Lidour 2018);* **B–C.** *different views of the Delma seashores (© M. Beech).*

Context	Material	Lab code	Radiocarbon age BP	Calibrated radiocarbon date BC (2σ, 95.4% enclosed)
Trench 2, context 1043	ashy sand/charcoal	AA-52544 (GU-10609)	6395 +/- 60	5480-5293 cal. BC (0.968)
Trench 2, context 1027	ashy sand, small bits of charcoal	AA-52545 (GU-10610)	6230 +/- 45	5308-5191 cal. BC (0.541) 5184-5057 cal. BC (0.459)
Trench 2, context 1053	charcoal fragments : humified organic remains	AA-52543 (GU-10608)	6220 +/- 45	5302-5055 cal. BC (1)
Trench 1, context 15	carbonized date stone (*Phoenix dactylifera*)	AA-32032	6165 +/- 55	5230-4962 cal. BC (0.962)
Trench 2, context 1014	carbonized date stone (*Phoenix dactylifera*)	AA-32031	5830 +/- 55	4801-4545 cal. BC (0.992)
Trench 1, context 14	charcoal fragments : humified organic remains	AA-52546 (GU-10611)	5830 +/- 45	4790-4577 cal. BC (0.969)

Figure 2. *Radiocarbon dates from Delma. Calibration for terrestrial material according to Calib Rev 7.0.4 – IntCal13 (Stuiver & Reimer 1993).*

and marine sediments (Fig. 1/B–C). The foreshore is wide and delimited by shallow rocky flats and fringing reefs. Deeper reefs are accessible on the nearshore, especially to the south-east. These environments offer a wide range of habitats for marine life. Stony coral assemblages in the area are mainly composed of *Porites* and *Acropora*. Modern fisheries principally specialize in the catch of groupers (local Arabic: *hāmūr* and *seman*) and grunts (local Arabic: *farsh*) (Environment Agency Abu Dhabi 2015–2016).

The site was discovered during a survey campaign conducted in 1992 by the Abu Dhabi Islands Archaeological Survey (ADIAS) project (King 1998). It is situated on a former children's playground, within the former compound of the Women's Association, in the city centre of Delma town. The Neolithic occupation was first suggested by the occurrence, on the surface, of lithic industries and pottery sherds attributed to Mesopotamian ʿUbaid wares. Systematic sieving of surface collections as well as two test trenches were excavated in 1994–1995 (Flavin & Shepherd 1994). Since 1998 excavations have focused on Trench 1, where a well-preserved circular post-hole structure was found (Beech & Elders 1999; Beech et al. 2016). The archaeological layers continue from the surface up to a depth of 1.70 m, in the deepest part of the sequence.

The successive occupation layers are divided into distinct chronological phases which all belong to the Neolithic period. In both trenches the uppermost part of the stratigraphy is composed of successions of sterile wind-blown sand layers and ashy lenses, which have provided quantities of artefacts and faunal remains (Phases 1–3). The layers from the lower part of the stratigraphy are the most documented, providing structures, fireplaces, and many discarded food remains (Phases 4 and 5). The earliest occupation level (Phase 6) is directly settled on an ancient sandy beach. It is likely that the site was closer to the sea than today. By 6000 BC the marine transgression during the Neolithic is estimated to have been *c.*2 m above the actual modern-day sea level (Sanlaville & Dalongeville 2005).

Material culture

Only a few lithic tools were recovered during the excavations — the knapped assemblage includes arrowheads, drills, and knives; available flint sources are located in the north-western part of the island. Ground-stone artefacts include hammerstones and anvils or burnishing tools made from pebbles. Several unspecified perforated stone discs were also found. Their use as fishing sinkers has been suggested but remains uncertain (Beech 2004: 63). Personal ornaments include disc beads made of marine shell and soft stone, and beads made from perforated gastropods such as *Nerita* sp. and *Engina mendicaria*. Tubular beads in dark stone were also found.

Pottery at the site consists of Mesopotamian ʿUbaid wares with some Arabian coarse ware. Of particular significance is the presence of locally manufactured plaster vessels whose geometric painted decoration appears to imitate the patterns on the ʿUbaid pottery. Plasters vessels were recently also found on Marawah Island at MR11 (Beech et al. 2005). ʿUbaid sherds from Delma correspond to ʿUbaid 2 and 3 productions, dated from the last quarter of the sixth to the mid-fifth millennium BC (Méry et al. 2016).

General overview of the subsistence economies

Terrestrial fauna mostly include domestic caprinids (goat, *Capra* sp.), cattle (*Bos* sp.), and wild game such as gazelle (*Gazella* sp.). The occurrence of gazelle at Delma raises the issue of their arrival during the Pleistocene, when the island was linked to continental Arabia, or of their possible later introduction. A study of the marine shellfish from Delma was previously conducted (Beech & Glover 2005: 102–105) (Fig. 3). This outlined the exploitation of close intertidal (*Lunella coronata*) and subtidal rocky flats (*Pinctada imbricata radiata* and *Hexaplex kuesterianus*). Pearl oyster banks, however, only occur in reef areas. Clams such as *Circenita callipyga*

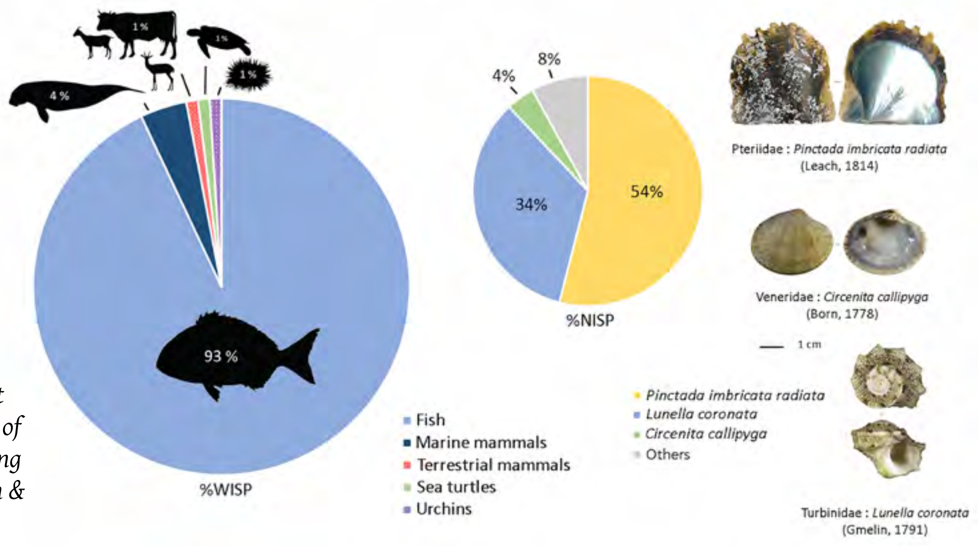


Figure 3. *Pie charts summarizing the different fauna categories in the diet of Delma inhabitants (according to 1994–1995 data and Beech & Glover 2005).*

are found in intertidal coarse sands. Fishing not only includes shellfish, and bony and cartilaginous fish at Delma, but also marine mammals such as dolphins (Delphinidae) and dugongs (*Dugong dugon*). Sea turtles (Cheloniidae) were also frequently recorded. Only a few remains belong to birds (principally to the Socotra cormorant, *Phalacrocorax nigrogularis*).

Two carbonized date stones (*Phoenix dactylifera*), as well as date-stone impressions, were recovered during the excavations (Beech & Shepherd 2001). It is known that the oldest date-palm cultivation centres appear to be located in southern Mesopotamia, from fifth-millennium BC contexts (Tengberg 2012). However, populations of wild date palm have been recently discovered in Oman (Gros-Balthazard et al. 2017). The occurrence of date stones at Delma thus raises the possibility of wild date palms being harvested in eastern Arabia during the Neolithic before their regional domestication. In fact, the date stones from as-Sabiyah H3 (Carter & Crawford 2010) matched the shape of sampled wild seeds from Oman.

Material and methods

All the excavated sediments were systematically dry-sieved using a 4 mm mesh. Additional fine sieving was also conducted with a smaller mesh (1 mm) and clusters of remains, such as connected vertebrae, were photographed, hand collected, and registered with a special number (i.e. Faunal Number #). At Delma, as at several other eastern Arabian sites (e.g. Beech 2004: 174; Mashkour et al. 2016: 199), the archaeological faunal remains are poorly preserved because of high fragmentation and the presence of salt encrustations which often obliterated the diagnostic parts (see Figs 6 & 7).

Anatomical and taxonomic identifications were conducted according to the methods of comparative anatomy, using M. Beech's personal comparative osteological collection of Arabian Gulf fishes. The 1993–1994 material was previously studied and published (Beech 2004: 97–109). The 1998 and 2014–2015 material was studied by one of us (K.L.) during a two-month visit to Abu Dhabi in 2017.

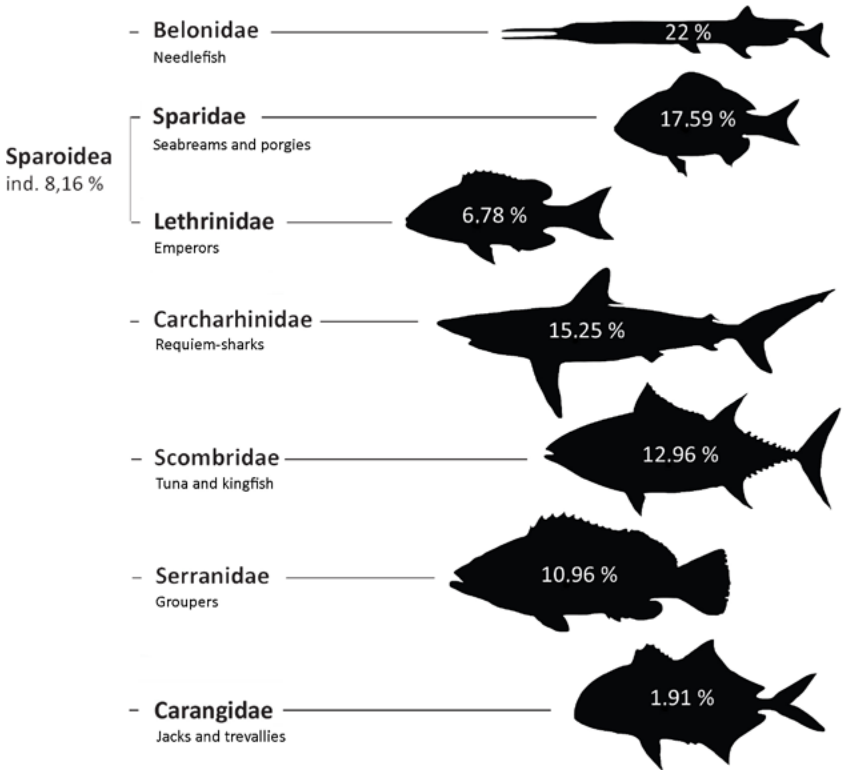
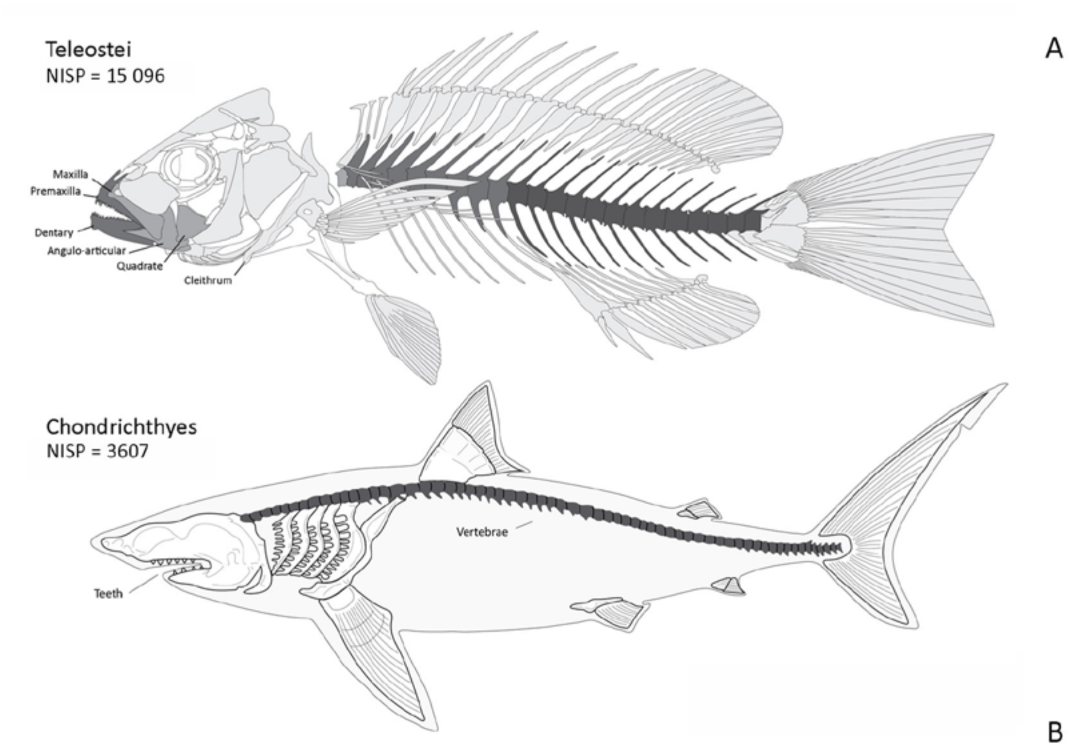


FIGURE 4. *Proportions of the main families identified at Delma. NISP = 17,354; other fish taxa = 4.39 %.*



B

	Teleostei		Belonidae		*Rhabdosargus haffara*		*Epinephelus* spp.		Thunnini	
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%
Vomers	115						82	5.8%	1	
Basioccipitals	104						45	3.2%	2	
Otoliths	123		6		1		29	2.1%		
Palatines	66						5			
Maxillae	196	1.3%			5		78	5.6%	27	1.2%
Premaxillae	1157	7.7%	213	5.6%	272	48.2%	156	11.1%	2	
Dentaries	1093	7.2%	237	6.2%	279	49.5%	204	14.5%	62	2.8%
Angulo-articulars	241	1.6%	1		2		79	5.6%	2	
Quadrates	267	1.8%	2		4		96	6.8%	14	
Hyomandibulars	64						20	1.4%		
Undet. needlefish beak	190	1.3%	190	5.0%						
Opercles	60						14	1.0%	2	
Cleithra	129						27	1.9%	2	
Ceratohyals	19						6			
Precaudal vertebrae	4794	31.8%	2041	53.5%	1		438	31.2%	548	25.2%
Caudal vertebrae	6214	41.2%	1103	28.9%			79	5.6%	1473	67.6%
Others	264	1.7%	20				46	3.3%	43	2.0%
Total NISP	15096		3813		564		1404		2178	

Figure 5. A. *Anatomical representation of the fish bones from Delma (bony fish skeleton modified from Coutureau & Béarez 2012);* **B.** *distribution of anatomical elements for some of the main taxa identified at Delma.*

NISP stands for the 'number of identified specimens', MNI for 'minimum number of individuals', and WISP for 'weight of identified specimens'. MNI quantifications are calculated according to the combination method: the frequency of bones is combined with laterality and size estimations (Chaplin 1971). However, the NISP is commonly preferred because of the significant bias in MNI calculation. We estimated the relative size and fresh weights of fishes after visual comparisons of archaeological bones with the reference collection.

Results

A total of 54,846 fish bones fragments were retrieved and recorded of which 17,354 could be identified to the level of family, genus, or species — the superfamily Sparoidea includes Nemipteridae, Lethrinidae, and Sparidae (see Fig. 9). Remains attributed to fishes clearly represent by far the greatest bulk of the vertebrate assemblage. Indeed, the total weight of fish bones nearly reaches 20 kg while the mammalian assemblage only amounts to a few hundred grams. The identifications could be attributed to different periods of the occupation of the site, which all belong to the Neolithic. A total of six families of cartilaginous fishes and twenty families of bony fishes are represented at Delma including requiem-sharks, hammerhead sharks, sand-tiger sharks, sawfish, stingrays, eagle rays, sea catfish, mullets, silversides, needlefish, flatheads, groupers, jacks and trevallies, snappers, grunts, threadfin breams, emperors, seabreams, goatfish, wrasses, parrotfish, rabbitfish, barracudas, tuna and kingfish, pomfrets, and

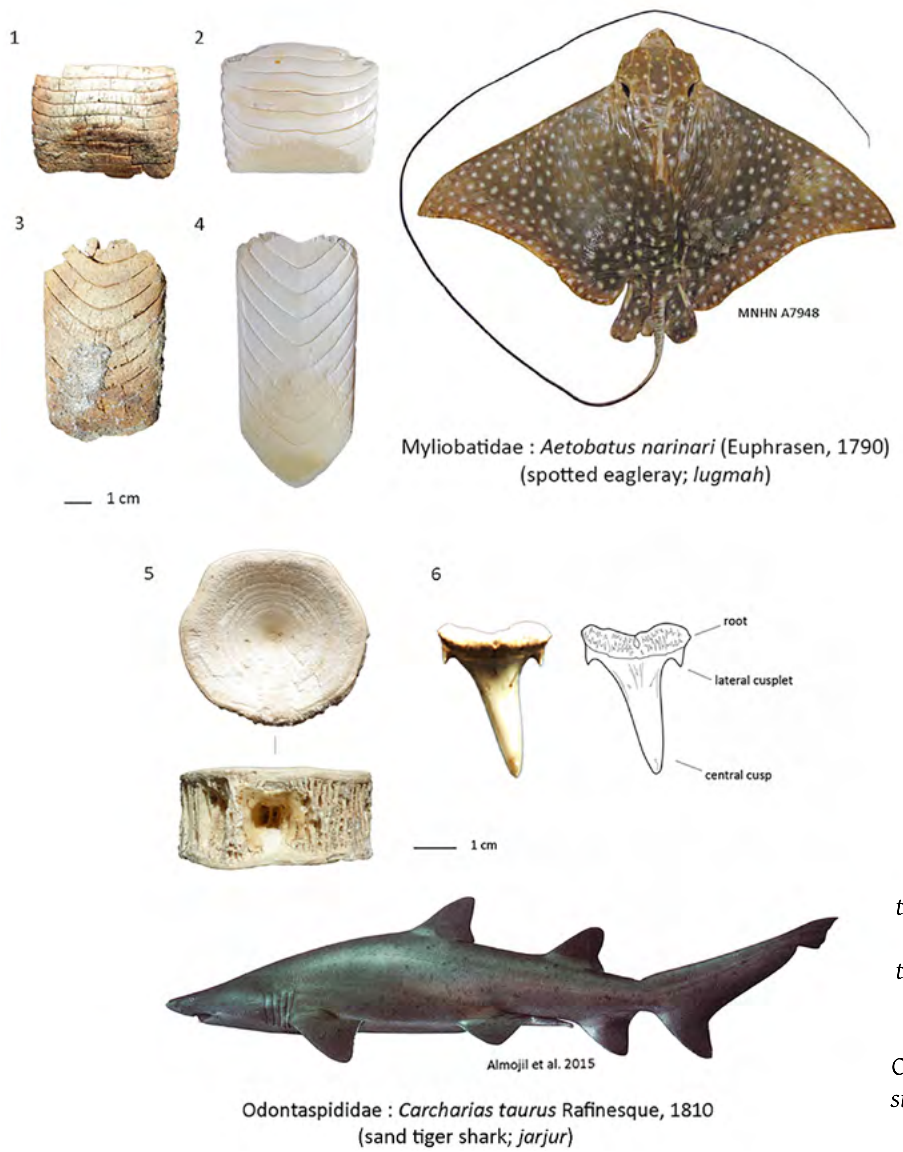


FIGURE 6. *Sample of remains belonging to cartilaginous fish (Chondrichthyes) from Delma compared to analogue bones from the MNHN osteological reference collection, and corresponding live pictures of the species:* **1–2.** *upper tooth plates of the spotted eagle ray,* Aetobatus narinari*;* **3–4.** *lower tooth plates of the spotted eagle ray,* Aetobatus narinari*;* **5.** *vertebral centrum of the sand-tiger shark,* Carcharias taurus*;* **6.** *tooth (lingual side) of sand-tiger shark,* Carcharias taurus.

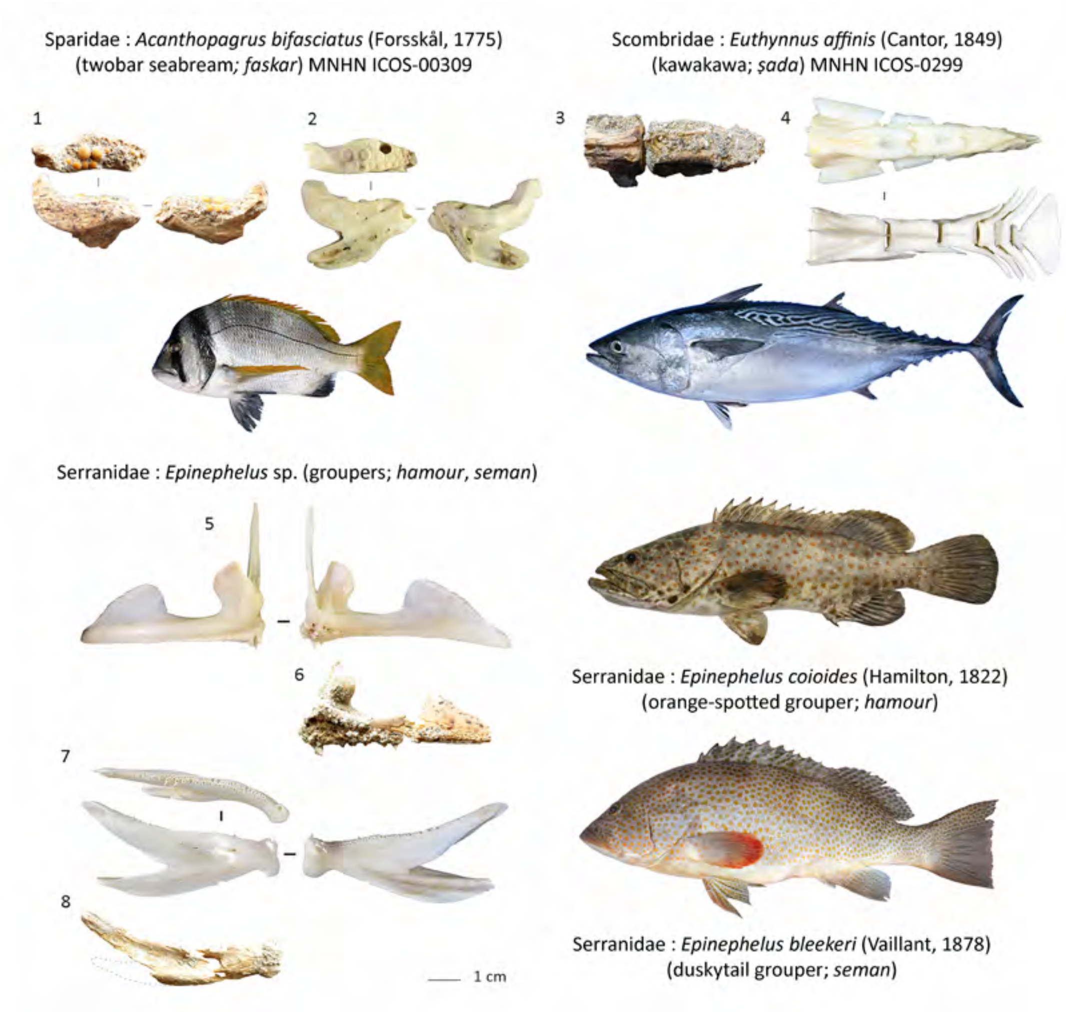


Figure 7. *Sample of remains belonging to bony fish (Teleostei) from Delma compared to analogue bones from the MNHN osteological reference collection, and corresponding live pictures of the species:* **1–2.** *right dentaries of two-bar seabream;* **3–4.** *series of caudal vertebrae of kawakawa,* Euthynnus affinis*;* **5.** *right premaxilla of duskytail grouper,* Epinephelus bleekeri*;* **6.** *right premaxilla of a grouper,* Epinephelus *sp.;* **7.** *right dentary of duskytail grouper,* Epinephelus bleekeri*;* **8.** *right dentary of a grouper,* Epinephelus *sp.*

pufferfish (some remains are illustrated in Figs 6 & 7). This included at least forty genera and forty-six species. Non-fish remains were also retrieved during this study including sea urchins, cuttlefish, and crabs. Sea urchin remains are represented by numerous spines and shell fragments which all belong to the same taxa: rock-boring urchins (*Echinometra* sp.). It is likely that rock-boring urchins also had an important role in the diet of Delma inhabitants.

All major anatomical elements were represented among the fish bone remains (Fig. 5), including cranial, vertebral, and appendicular items. As no butchery marks were observed it is likely that fish were directly brought to the settlement and consumed in a relatively complete form. The hardest elements such as those from the mandibular arch (i.e. dentaries, premaxillae, and maxillae) as well as vertebral centra are the most common anatomical elements recorded. Tunas have strong vertebral centra which are frequently found within archaeo-ichthyological assemblages (Fig. 7/3-4). Their cranial bones are, however, limited because of their weakness. The relative absence of their cranial bones is often misinterpreted as a result of fish beheadings. A few strong cranial elements, such as dentaries and maxillae, were recorded at Delma, however, thanks to the use of fine sieving. Sharks and rays were exclusively represented by vertebrae and dentition pieces such as teeth and tooth plates (Fig. 6). Other parts of their skeleton are cartilaginous and generally did not preserve well.

According to the NISP data, the assemblage is mainly dominated by needlefish (Belonidae, 22%), seabreams and porgies (Sparidae, 18%), requiem-sharks (Carcharhinidae, 16%), tuna and kingfish (Scombridae, 13%), groupers (Serranidae, 11%), and emperors (Lethrinidae, 7%). Jacks and trevallies (Carangidae, 2%) are less frequent. Note that undetermined Sparoidea represent 8% of the NISP (Figs 4 & 9). The whole percentage of Sparoidea thus average 33% of the NISP. Needlefish are almost solely represented by the genus *Tylosurus*. Seabreams are represented by at least three genera and four species of which the Haffara seabream (*Rhabdosargus haffara*) is the most common. Scombrids are represented by at least four genera but kawakawa (*Euthynnus affinis*) is prevalent. Groupers were mostly represented by the genus *Epinephelus*, while a few *Cephalopholis* remains were also recorded. Three distinct species of emperors and at least seven species of jacks or trevallies were recorded.

Discussion

Fishing grounds and techniques

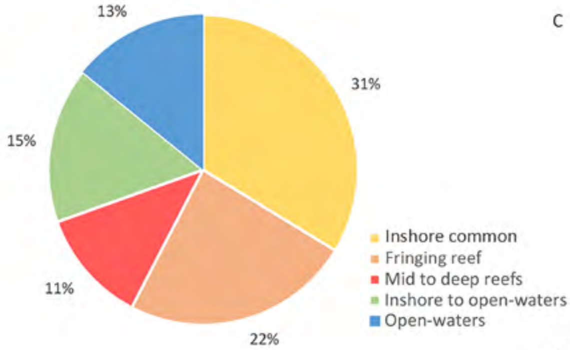
All the fish taxa identified at Delma can be caught in the vicinity of the island. Fishing was essentially carried out in the close shallow waters surrounding the site (Fig. 8/C). Schools of small needlefish (100–200 g) are encountered over sandbars and fringing reefs — they usually swim just beneath the surface. They can be caught with small seines according to a traditional technique called *idfarah* (Arabic) which is similar to *djarifa* (Shimaore) documented in the Comoro Islands (Claro 1994; Jamon et al. 2010). Most of the seabreams identified at Delma can also potentially be caught this way, in particular small Haffara seabreams (200–300 g) which inhabit mainly soft bottoms and around coral reefs (Sommer, Schneider & Poutier 1996); two-bar seabreams (Fig. 7/1-2) occur more frequently in reef areas (Iwatsuki & Heemstra 2011).

Requiem-sharks are relatively common in these coastal environments. Blacktip reef sharks (*Carcharhinus melanopterus*) are encountered in very shallow waters and are regularly caught by inshore fisheries. They can be easily caught in nets, directly harpooned, or shot by an arrow or spear. Large specimens and some species can also swim in open waters to hunt, like the oceanic whitetip shark (*Carcharhinus longimanus*). Pelagic sharks, as well as dolphins, dugongs, and sea turtles, are frequently bycatch in drift nets.

Some remains were attributed to a large sand-tiger shark (Odontaspididae: *Carcharias taurus*) (Fig. 6/5–6).[1] Sand-tiger sharks generally occur in reef areas. According to Bass, D'Aubrey and Kistnasamy (1975: pl. 3) their estimated length is about 3 m but only females can reach this size (> 220–230 cm) (Gilmore, Dodrill & Linley 1983). The first record of this species in the UAE was only made in 2012 (Jabado et al. 2013), in the vicinity of Delma Island. The present study, however, demonstrates that sand-tiger sharks already occurred in the Delma area and in the Arabian Gulf 7000 years ago. Hammerhead sharks (Sphyrnidae) and large sawfishes (Pristidae: *Pristis zijsron*) are also commonly encountered around moderate-depth reef areas (Moore 2014; Jabado et al. 2017: 269).

The reef areas exploitation is also emphasized by the marked occurrence of large groupers (mostly between 2 and 3 kg) at Delma (Fig. 7/5-8). Groupers are solitary and territorial fishes which generally live alone or in small groups in caves and crevices found in reefs. They could form large aggregations during the spawning season as observed for the Nassau grouper (*Epinephelus striatus*) in the western Atlantic (Colin 1992) and the camouflage grouper (*Epinephelus polyphekadion*) in the Pacific Ocean (Rhodes, Taylor & McIlwain 2011). Groupers are thus very exposed and vulnerable during this period. They always constitute a great part of the modern landings from Delma where they are quasi-exclusively caught in cage traps, called *gargūr* (pl. *garagir*) (Fig. 8/A,C). Data from Kuwait Bay indicated that cuttlefish are the best bait used for their catch in cage traps (Chen et al. 2012). Other fishes caught in this way include spangled emperors (*Lethrinus nebulosus*), king-soldier breams (*Argyrops spinifer*), grunts (Haemulidae), and rabbitfish (Siganidae). *Garagir* are traditional dome-shaped traps

[1] According to a comparison work based on Kozuch & Fitzgerald 1989.



D

%WISP	*Gargūr*	*Hadaq*	*Ghazal*
	Cage traps	Lines	Gill net
Serranidae	40-48%	17-23%	-
Carangidae	4-9%	22-26%	25%
Haemulidae	14-17%	2%	-
Lethrinidae	13-23%	22-37%	1%
Sparidae	3-5%	-	-
Scombridae	-	24-30%	74%
Portunidae	4-18%	-	-

FIGURE 8. A. *A small group of orange-spotted groupers,* Epinephelus coioides (hamour) *near a crevice (courtesy Abu Dhabi Marine Conservation Group);* **B.** *example of a tuna bust-up off the Ivory Coast (creative Commons BY-NC-ND 4.0 © 2013 Wm Adams);* **C.** *pie chart summarizing the different fishing grounds exploited at Delma;* **D.** *fishing techniques traditionally used in the Emirate of Abu Dhabi and the main types of fish caught (Environment Agency Abu Dhabi 2015–2016).*

anciently built with palm leaves and fronds. While not mentioned by classical authors, they might have been in use for a long time. The etymology of *gargūr* is from the Old Akkadian *gigurru*(*m*) which means 'basket' and which itself comes from Sumerian (Black, George & Postgate 2000: 92). Some terms of the basic material culture have a Semitic, not Arabic, origin within regional dialects of eastern Arabia — in particular the vocabulary linked with farming and fishing. These could have been passed from Sumero-Akkadian, considering the strong contacts with Mesopotamia during the Bronze Age and the Iron Age or, more recently from Aramaic during the Sasanid period (Holes 2015: 12–18), suggesting the antiquity of the *gargūr* fish trap (2015: 14).

Lines of stones in the intertidal zone are known along the west coast of Delma Island. Previous work on these has interpreted them as the remains of ancient coastal barrier fish traps (Beech 2003), or in the case of Marawah Island, as ancient boat mooring sites (Beech & al-Shaiba 2004: 9). The dating of these features is, however, difficult although they probably belong to the Islamic period. However, simple fish traps were probably among the first techniques used by prehistoric fishermen in the area (Cleuziou & Tosi 2007: 53). Many variants exist such as *hadrah*, *meskar*, and *sakkar*. The commonest one is the *hadrah* type which consists of lines of semi-permanent intertidal fences vertically fixed and supported by stones projecting out perpendicular to the shoreline. The V shape opened to the coastline forms a funnel that encloses fish at the falling tide. Classical authors, like Diodorus (2003: 22), already attest the presence of tidal traps in eastern Arabia a few decades before our era. The antiquity of coastal barrier traps is also suggested by the etymology. The terms *meskar* and *sakkar* are constructed on the same Akkadian triconsonantic stem *sekēru*(*m*), which means 'to shut off, block up' (Black, George & Postgate 2000: 320; Holes 2015: 14). Tidal traps are non-selective and able to catch a wide spectrum of fish taxa encountered in the shallow inshore waters, including seabream, needlefish, and small trevallies (Abou-Seedo 1992; al-Baz et al. 2007; al-Baz, al-Husaini & Bishop 2013). Cuttlefish and pelagic crabs are also frequently caught this way (McEwan, Bell & Dvornak 2001).

While single individuals can sometimes be caught from the seashore, schools of large scombrids only occur in open waters (Fig. 8/C). Kawakawas, frigate tunas (*Auxis* sp.), and tuna (*Thunnus* sp.) tend to form multi-species schools (Collette & Nauen 1983). They feed on schools of other small pelagic fishes such as sardines (Clupeidae) and silversides (Atherinidae), which are planktivorous and thus mostly swim just beneath the surface (Fischer & Bianchi 1984). Estimated fresh weights of kawakawas from Delma are mostly between 3 and 4 kg. Epi-pelagic schools do not necessarily occur far from the shore and can be found a few hundred metres offshore, but it is necessary to use boats to catch them.

Boating technology is well attested during the Neolithic since bitumen-coated fragments were found at as-Sabiyah H3, Kuwait (Carter & Crawford 2010). Schools of scombrids are easily visible because they break the surface of the sea and attract marine birds (Fig. 8/B). Traditional techniques to fish on epi-pelagic schools are purse seines, drift nets (similar to the local *ghazal* technique), and luring (e.g. trolling and baiting with attraction food) (Fig. 8/D). As shell fish-hooks and miniature sinkers are not attested before the mid-fifth millennium BC within the Neolithic fishing kit in the Arabian Gulf (Méry, Charpentier & Beech 2008; Méry 2015), the use of hook and line techniques could not be assumed at Delma. Net fishing techniques are thus presumed. Several perforated stone discs were discovered during the excavations at Delma but their possible use as net sinkers is still unclear. Similar artefacts were found at as-Sabiyah H3 (Carter & Crawford 2010: fig. 9.14–15) and at Dosariyah, Saudi Arabia (Drechsler 2018: pl. 11.22.d). It can be assumed that other fish taxa could be caught in open waters, such as large jacks (*Caranx* spp.), trevallies (*Carangoides* spp., *Gnathanodon speciosus*), queenfish (*Scomberoides commersonnianus*), torpedo scads (*Megalaspis cordyla*), king-soldier breams, and eaglerays (Myliobatidae: *Aetobatus narinari*, see Fig. 6/1–4) (Stehmann 1981; Last & Steven 1994).

Food habits

About 8% of the fish bones studied were burnt (carbonization or calcination). Fire marks are concentrated on less fleshy parts of the skeleton such as the opercle series, spines, and the external tips of the jaw pieces. This distribution indicates that whole fish were probably grilled on coals.

A few remains were attributed to the stellate puffer (*Arothron stellatus*). Pufferfish are relatively uncommon in the area and mostly occur in patch reefs and outer slopes of reefs (Lieske & Myers 1994) — they can be caught in cage traps. They are identified at several other archaeological sites from the Arabian Gulf (Marawah MR14 and MR16, Balghelam BG12) (Beech 2004: tables 104, 114, 119) including the Neolithic settlement of Umm al-Quwain UAQ2, UAE (Mashkour et al. 2016). It is noteworthy that pufferfish are usually reported as poisonous to eat (Masuda et al. 1984). Tetrodontoxin present in the internal organs leads to muscular paralysis, including of the diaphragm, and can cause death from respiratory failure in a few hours (Clark et al. 1999). These ichthyotoxins are essentially concentrated in the skin and gut (the liver in particular), implying that the flesh can be consumed if correctly prepared. The toxicity rate, however, varies considerably from region to region (Magarlamov, Melnikova & Chernyshev 2017) and it is not clear if the pufferfish from Delma are poisonous or not. It is likely they are not because pufferfish remains recovered among other fish bones from the Delma site had not received any special treatment.

Seasonality

Seasonality and mobility issues have been widely discussed in the last few years. While the pattern was essentially oriented towards semi-nomadism according to ethnographic works (Scholz 1980; Lancaster & Lancaster 1995), new results have shown that some Neolithic sites could have been inhabited throughout the year, benefitting from highly productive marine environments such as mangroves (Biagi & Nisbet 2006; Cavulli & Scaruffi 2013; Mashkour et al. 2016). In this regard, archaeo-ichthyological investigations have also suggested that fishing was not solely carried out during a limited part of the year (Desse 1988; Driesch & Manhart 2000; Beech 2004: 201–207; Wilkens 2005; Lidour, Vorenger & Béarez 2018) but at least from autumn to late spring (Mashkour et al. 2016: fig. 10). While marine waters are more productive during the winter season because of cooler seawater temperatures (Van Neer

& Gautier 1993), fishing continues to be carried out at other times of the year in small fish-rich grounds such as lagoons, mangroves, and reef areas. The majority of fish identified at Delma therefore could have been caught all year round (e.g. seabream, needlefish, sharks, groupers, and emperors). According to modern environmental parameters, schools of scombrids can, however, only be exploited during the winter season in the Arabian Gulf. However, because of significant climate change since the Neolithic, the seasonal patterns of subsistence and mobility should be reconsidered.

Comparisons

The Neolithic fisheries from the Arabian Gulf are essentially characterized by the exploitation of shallow and coastal environments. The main taxa identified belong to small seabream, whose proportion is generally situated between 30 and 90% of the NISP (Desse 1988; Driesch & Manhart 2000; Beech 2004; 2010; Mashkour et al. 2016). Emperors also represent a great part of the spectrum of Umm al-Quwain UAQ2 (*c.*36%). Sparoid fishes occur abundantly over soft bottoms and seagrass bed areas close to the shore. They can also be encountered in small lagoons and possibly reef areas. Many silverside (*Atherinomorus lacunosus*) otoliths were recorded from Khor FB and Khor P (Qatar) by J. Desse (1988). These little fish form large schools along sandy shorelines and near reef margins (Ivantsoff & Crowley 1999). Sardines (Clupeidae: cf. *Nematalosa nasus*) constitute a major group at the al-Markh J19 fisheries: this species also forms schools in coastal areas and could be found very close to the shoreline (Rainboth 1996). All these taxa can be caught with simple and non-selective techniques such as tidal barrier traps (al-Baz, al-Husaini & Bishop 2013), fixed nets, and small seines. Sea catfish (Ariidae), which are numerous at as-Sabiyah (*c.*7%), were probably caught with baited cage traps such as the traditional *gargūr* — according to modern landings data (Chen et al. 2012; Environment Agency Abu Dhabi 2015–2016). High proportions of large trevallies (*c.*38%) were recently observed at Akab in the Umm al-Quwain lagoon, where singular fishing techniques have possibly been identified (Lidour, Vorenger & Béarez 2018; Lidour et al. 2019). Techniques such as firing arrows, spearing, and harpooning are possible but remain uncertain.

Fishing in open sea is suggested by the occurrence of pelagic fishes such as kawakawas, tunas, or kingfishes at several of these sites. Large sharks, jacks, trevallies, and king-soldier breams were also frequently consistent with fishing carried out in deeper waters. However, so far, high proportions of scombrids within Neolithic contexts have only been reported at sites situated in the Sultanate of Oman (e.g. RH5, RH6, RH10, and KM1) (Uerpmann & Uerpmann 2003; Wilkens 2005). The fishing of pelagic fishes along the Ja'alan and the Arabian Sea coasts is facilitated by greater depths close to the shoreline. Recent studies from Akab (Lidour et al. 2019), Dosariyah (Uerpmann & Uerpmann 2018) and, now, Delma, have revealed large quantities of kawakawa and tuna remains. Techniques such as net fishing in the open sea and luring could have been utilized. It is certain that fishing expeditions in open sea were frequently carried out during the Neolithic in the Arabian Gulf to exploit scombrid schools — at least hundreds of metres from the settlement sites and involving the use of boats. Delma is actually one of the oldest sites where this kind of fishing has been documented in eastern Arabia and definitively changes our perception of fishing activities in the Arabian Gulf during the Neolithic.

Comparative assemblages are lacking in the vicinity of Delma. The closest sites are situated in Sir Bani Yas Island, *c.*30 km from Delma and dated to the early Islamic period (Sir Bani Yas SBY2, SBY4, SBY7, and SBY9) (Beech 2004: 109–121). The surrounding environments of Sir Bani Yas are quite similar to those from Delma, with sandy shorelines and extensive reef areas. Deeper waters are, however, far from the coast and thus more difficult to access. The proportion of scombrids is thus very reduced at these sites (only 2% at SBY9) but seabream, emperors, groupers, and requiem-sharks were frequently identified, which seems to indicate the perseverance of certain techniques such as barrier traps and cage traps. Only a few remains were attributed to needlefish. This suggests that unprofitable techniques such as small seine fishing did not continue within more specialized activities oriented towards a market logic as opposed to the subsistence economy of small Neolithic communities.

Conclusion

The inhabitants of Delma were involved in a variety of subsistence economies specialized in the exploitation of marine resources: marine mammals, sea turtles, shellfish, urchins, pelagic crabs, and fish were caught and consumed. The present study has shown that fishing was essentially carried out in shallow coastal environments such as sandbars and fringing reefs, using non-selective techniques such as fixed nets, small seines, and tidal barrier traps. The exploitation of deeper reefs is suggested by the occurrence of large groupers, which were probably caught with baited cage traps. Seafaring expeditions in open sea were regularly conducted in order to exploit the pelagic schools and, additionally, to catch large sharks and dolphins. The main techniques involved were probably purse seine or drift nets since shell fish-hooks were not documented before the mid-fifth millennium in the northern UAE.

As the occupation of offshore islands such as Delma implies a mastery of seafaring technology, the latter could have also fostered open-sea fishing. However, this does not seem to be a specificity of this site in the Arabian Gulf since high quantities of large scombrids were also recently recorded at Akab (*c.*4300–4000 BC) during the Late Neolithic (Lidour et al. 2019) and Dosariyah (*c.*5000–4800 BC) during the Middle Neolithic (Uerpmann & Uerpmann 2018). Further investigations on fish bone assemblages from other periods are necessary in order to gain a better understanding of the evolution of fisheries during the prehistory of the southern Arabian Gulf.

Acknowledgements

We would like to thank Rita Aoun-Abdo (Executive Director, Culture Sector) and Mohammed Amer al-Neyadi (Head of the Historic Environment Department) from the former Abu Dhabi Tourism and Culture Authority (TCA Abu Dhabi), now known as the Department of Culture

Family	Genus	Species	NISP	MNI	WISP (g)
Carcharhinidae	*Carcharhinus*	*Carcharhinus* cf. *plumbeus*	1	1	0.14
		Carcharhinus sp.	331	45	245.5
	ind.		2311	-	930.91
Sphyrnidae	*Sphyrna*	*Sphyrna* sp.	57	11	17.87
Odontaspididae	*Carcharias*	*Carcharias taurus*	5	3	11.601
ind. Lamniformes			128	9	142.45
Pristidae	*Pristis*	*Pristis* sp.	95	14	83.27
Dasyatidae	*Dasyatis*	*Dasyatis* sp.	2	1	1.25
	ind.		1	1	0.2
Myliobatidae	*Aeobatus*	*Aeobatus narinari*	2	1	34.94
	ind.		22	3	10.3
ind. Batoidea			41	-	3.54
ind. Chondrichthyes			638	23	110.32
		Total determinated Chondrichthyes	**2996**	**89**	1481.831
		Total Chondrichthyes	**3634**	**112**	1592.151
Ariidae	*Netuma*	*Netuma bilineata*	7	5	10.54
		Netuma sp.	16	4	3.17
	ind.		12	9	5.88
Mugilidae	ind.		9	2	1.28
Atherinidae	*Atherinomorus*	*Atherinomorus lacunosus*	1	2	0.01
Belonidae	*Tylosurus*	*Tylosurus crocodilus*	304	34	32.11
		Tylosurus sp.	1790	32	143.36
	ind.		1719	41	282.8
Platycephalidae	*Platycephalus*	*Platycephalus indicus*	6	7	1.57
	ind.		2	1	0.19
Serranidae	Cephalopholis	*Cephalopholis* sp.	3	2	0.06
	Epinephelus	*Epinephelus bleekeri*	1	1	0.2
		Epinephelus coioides	20	12	18.8
		Epinephelus cf. *malabaricus*	2	1	0.6
		Epinephelus sp.	1381	194	2274.84
	ind.		492	84	570.12
Carangidae	*Carangoides*	*Carangoides* sp.	68	30	31.35
	Caranx	*Caranx sexfasciatus*	3	4	8.74
		Caranx sp.	27	6	7.73
	Decapterus	*Decapterus* sp.	8	1	0.5
	Gnathanodon	*Gnathanodon speciosus*	100	30	32.09
	Megalaspis	*Megalaspis cordyla*	3	1	1.2
	Scomberoides	*Scomberoides commersonnianus*	120	29	110.98
	Trachinotus	*Trachinotus* sp.	2	1	0.1
	ind.		182	30	143.49
Lutjanidae	*Lutjanus*	*Lutjanus malabaricus*	1	1	0.01
		Lutjanus sp.	6	3	0.36
Haemulidae	*Diagramma*	*Diagramma pictum*	6	5	2.67
	Plectorhinchus	*Plectorhinchus schotaf*	10	1	2.6
		Plectorhinchus sp.	1	1	0.08
	Pomadasys	*Pomadasys* sp.	2	1	0.39
	ind.		10	2	3.23
Nemipteridae	ind.		1	1	0.02
Lethrinidae	*Lethrinus*	*Lethrinus lentjan*	27	22	1.77
		Lethrinus microdon	11	8	2.75
		Lethrinus nebulosus	42	27	3.02
		Lethrinus sp.	1095	204	131.31
Sparidae	*Acanthopagrus*	*Acanthopagrus arabicus/sheim*	35	27	174.8
		Acanthopagrus bifasciatus	9	21	114.94
		Acanthopagrus sp.	212	34	94.33
	Argyrops	*Argyrops spinifer*	14	5	6.57
		Argyrops sp.	8	6	0.58
	Rhabdosargus	*Rhabdosargus haffara*	712	245	252.58
	ind.		2059	87	221.13
ind. Sparoidea			1417	12	134.71
Mullidae	ind.		6	3	0.11
Labridae	ind.		1	1	0.01
Scaridae	*Scarus*	*Scarus ghobban*	2	1	2.48
		Scarus sp.	25	17	8.38
Siganidae	*Siganus*	*Siganus javus*	2	1	0.04
		Siganus sp.	91	17	1.68
Sphyraenidae	*Sphyraena*	*Sphyraena jello*	1	1	0.36
		Sphyraena sp.	15	11	1.5
Scombridae	*Auxis*	*Auxis* sp.	6	4	2.48
	Scomberomorus	*Scomberomorus commerson*	4	2	1.9
	Euthynnus	*Euthynnus affinis*	2001	75	3697.88
	Thunnus	*Thunnus* sp.	6	1	3.59
	ind. Thunnini		216	16	343.67
	ind.		13	5	12.02
Stromateidae	*Pampus*	*Pampus argenteus*	7	2	0.1
ind. Perciformes			844	-	117.04
Tetraodontidae	*Arothron*	*Arothron stellatus*	19	3	45.8
	ind.		4	-	2.25
ind. Teleostei			36011	-	8209.9
		Total determined Teleostei	**14375**	**1436**	8953.8
		Grand Total	**54864**	**1548**	18872.891

FIGURE 9. *Taxonomic list with the number of identified specimens (NISP), minimum number of individuals (MNI), and specimen weight (WISP) in grams.*

and Tourism (DCT), for their support for our work on Delma Island. Our thanks also to Fathy Mohammed Abdulla (cultural landscape ranger, TCA Abu Dhabi) who provided local logistical support on the island and also assisted on the archaeological excavations.

Special thanks to Dr Philippe Béarez (CNRS, UMR 7209 AASPE – Muséum National d'Histoire naturelle, Paris) and Dr Sophie Méry (CNRS, UMR 5666 CREAAH – Université de Rennes 1) for their advice and the supervision of the PhD thesis of one of us (K.L.). We would also like to thank Michele Degli Esposti and Helen Knox for their help in correcting the text.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 223–240

Neolithic settlement pattern and environment evolution along the coast of the northern UAE: the case of Umm al-Quwain UAQ36 vs. UAQ2 and Akab shell-middens

Sophie Méry, Michele Degli Esposti, David Aoustin, Federico Borgi, Claire Gallou, Chantal Leroyer, Kevin Lidour, Susanne Lindauer, Gareth W. Preston & Adrian G. Parker

Summary

New data on the Neolithic occupation of the northern UAE coast were collected during the 2017–2018 excavations at the shell-midden site of UAQ36. Although so far limited to a fifth-millennium occupation, this data can be contextualized within the broader research programme of the French Archaeological Mission in the Emirate of Umm al-Quwain.

When compared to the previously excavated Neolithic sites of UAQ2 (last third of the sixth–beginning of the fourth millennium) and Akab (second third of the fifth–beginning of the fourth millennium), this new data can be used to discuss the nature of the Neolithic occupation along the UAE Gulf coast, which overall attests a good and recurring adaptation of the human communities to the changing surrounding environment.

Keywords: Arabia, Neolithic, shell-midden, palaeoenvironmental exploitation, coastal subsistence

1. Introduction

The surveys and soundings conducted since 2011 in the Emirate of Umm al-Quwain by one of the teams of the French Archaeological Mission to the United Arab Emirates, in collaboration with the Department of Tourism and Archaeology of Umm al-Quwain, led to the identification of seventeen new sites of Neolithic age (Fig. 1). To date, the number of Neolithic sites located within the Umm al-Quwain territory thus amounts to more than twenty,[1] and all are shell-middens. These middens can vary significantly from one to another, from surface deposits to well-stratified layers, and also in terms of their surface size and the volume of shells in the deposit.

The cultural identification of these sites relies on the presence of distinct, diagnostic artefacts (Ubaid potsherds, arrowheads, lithic tools, specific types of ornaments, net sinkers).

Three sites were excavated: Akab, UAQ2, and UAQ36. While they provide different results regarding the modes of occupation along the Gulf coast during the Neolithic period, they are all stratified, spatially organized, and comprise the same types of structures.

With these data in hand, is it possible to specify what types of occupation/habitat one is dealing with? If it is not possible to give clear-cut answers, the comparison between these three sites allows some working hypotheses to be put forward, which can be useful to understand site organization at the regional scale, involving short-lived foraging or shell-processing sites as well as places of longer-term dwelling. A simple foraging or shell-processing site can be defined as an area where a single species of shell or syntrophic species from the same biotope (*sensu* Rivas 1964) was consumed after fishing, resulting in a very limited shell deposit.

2. New data on the fifth-millennium human occupation: the site of UAQ36

UAQ36 is located 1 km north-north-east of the sixth- to fifth-millennium site of UAQ2, near the ancient

[1] Sites UAQ1 and UAQ2 were discovered by C.S. Philipps (2002). Site UAQ269 corresponds to point 69 of Boucharlat et al. (1991). Site UAQ70 corresponds to Ramlah RA6 (Uerpmann & Uerpmann 1996). Both were visited several times by the French team and new diagnostic Neolithic items were discovered. Site Ra3 (1996) is now completely destroyed.

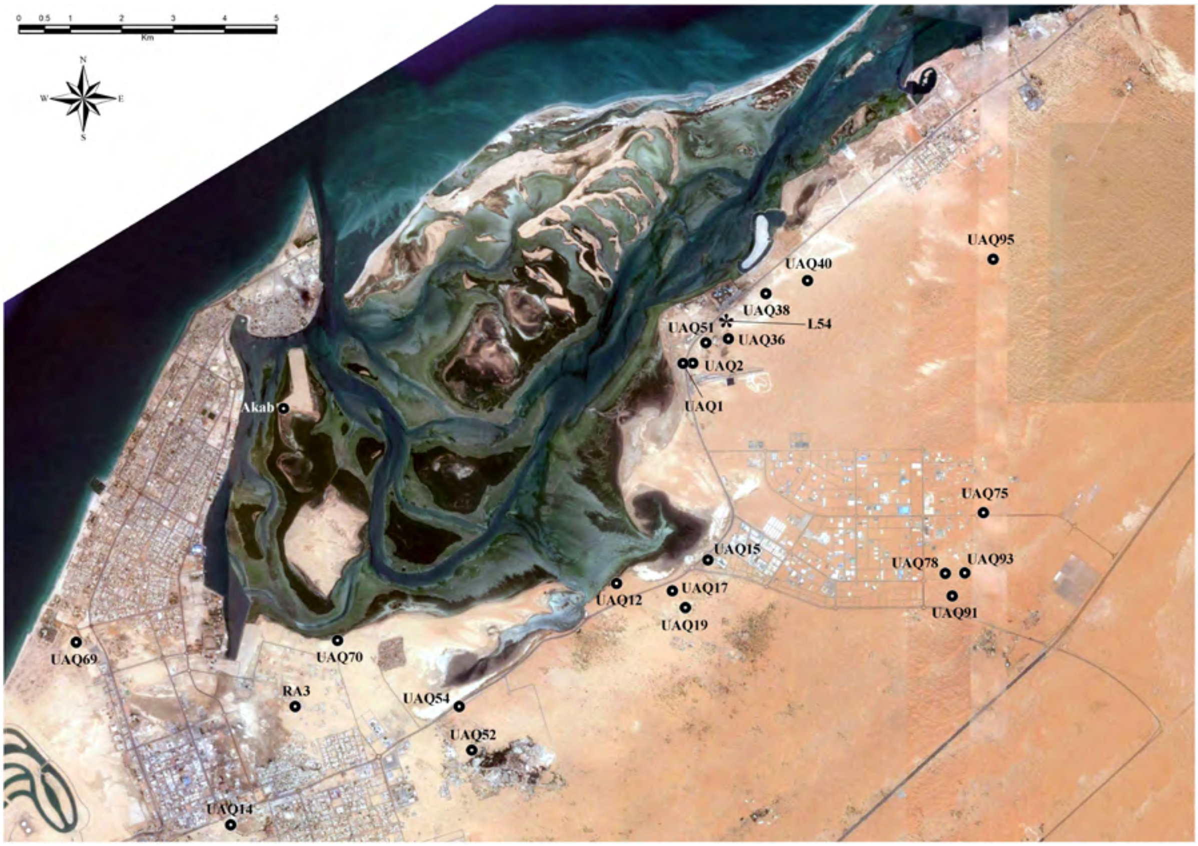


FIGURE 1. *A map of the Neolithic sites, Umm al-Quwain. The location of the drilled core (L54) is indicated with an asterisk in the sabkha at the foot of UAQ36.*

entrance of Umm al-Quwain's large lagoon. It was surveyed in 2011, with limited excavation undertaken in 2013 (unpublished), and more extensive excavation in 2018 (Fig. 2).

In Area I (the top of the dune), a stratigraphic excavation was conducted in Sector 1 (6 m^2). The three main sections of the excavation were studied and drawn (Sections 4, 5, 6; Fig. 3). Aligned with the eastern edge of the excavation, a deep test trench was opened (Trench 1), starting 1.2 m north of the excavation area. The three resulting sections were also studied and drawn (Sections 1, 2, 3; Fig. 3). Two other small test trenches were opened in Area II located on the dune's western slope, where concentrations of shells were observed, one with predominant *Marcia* sp. shells (Trench 2), the other with *Saccostrea cucculata* as the main species (Trench 3). Both trenches revealed the absence of anthropogenically influenced stratigraphy below the surface.

The general stratigraphy in section, one below the topmost accumulation of recent, loose sand (SU 1801), consists of a series of layers which generally comprises alternating seashell-rich layers and cleaner sand lenses.

The earliest occupation, corresponding to SU 1841a, was identified at a depth of *c*.1.8 m from the current dune surface, sitting above a massive aeolian sand accumulation (SU 1841b). SU 1841a appears to be part of an early phase of human activity at the site, together with SU 1839 and SU 1840. Interestingly, SU 1839 is distinguished by a different kind of sand, more greyish and particularly hardened. Another change in the sand characteristics can be seen above SU 1818, where the dominant colour of the sediments turns from a pale orange to a light brown.

Above SU 1839, a thick, clean sand deposit (SU 1838) marks the only possible longer interruption in the anthropogenic stratigraphic sequence, which

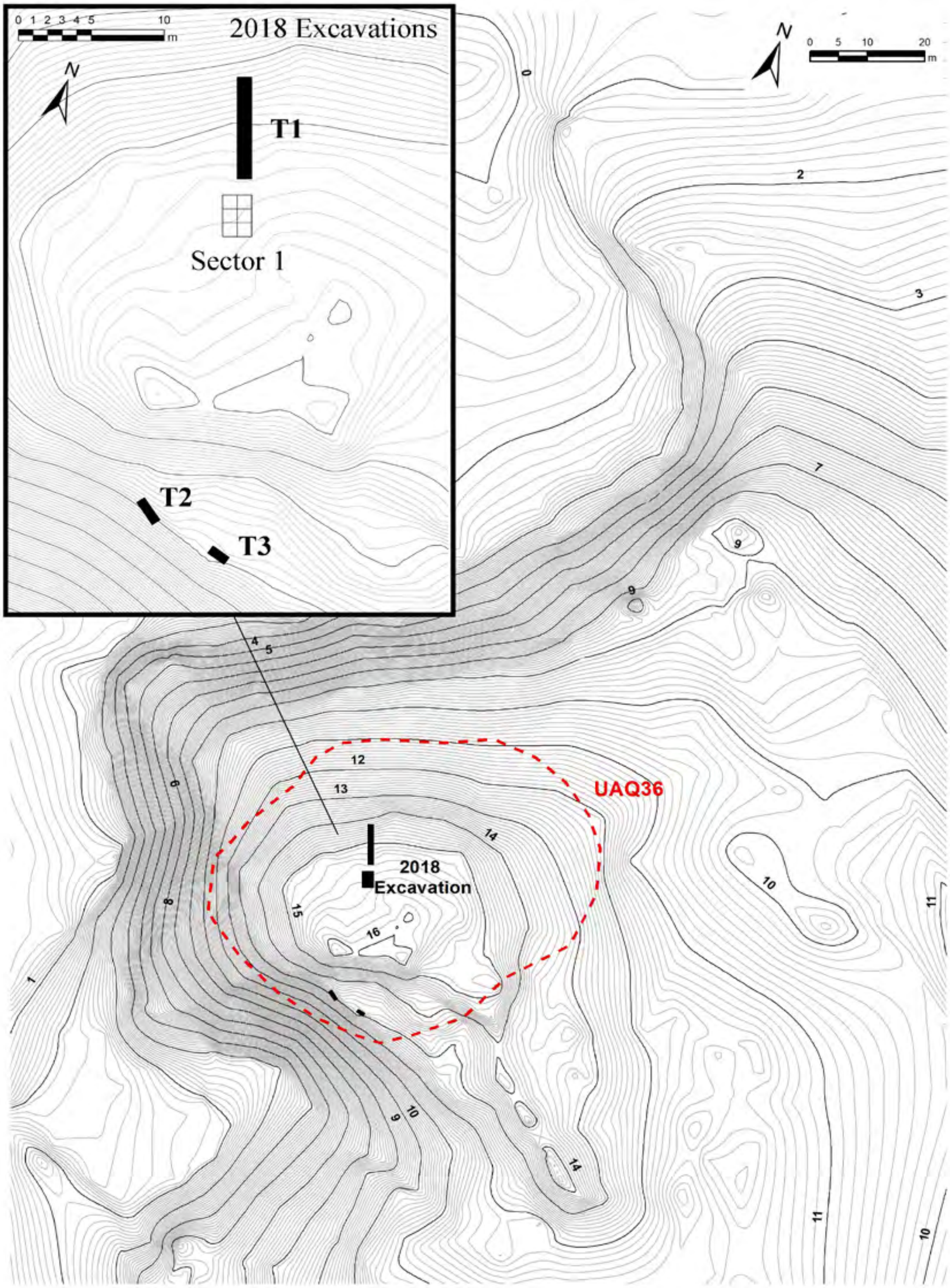


FIGURE 2. *A site map of UAQ36 showing the location of the stratigraphic excavation trench and the test Trenches 1, 2, and 3.*

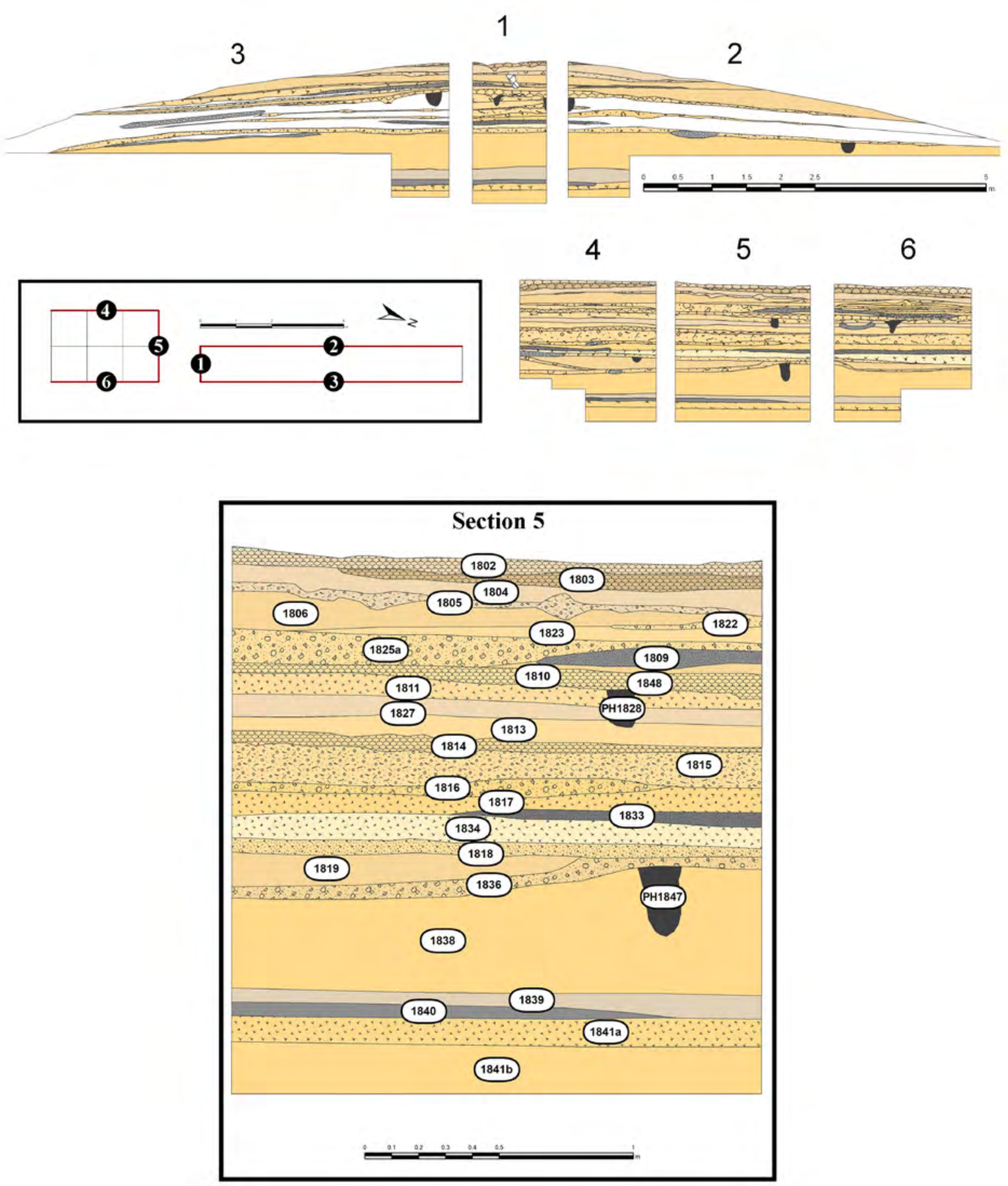


FIGURE 3. *Sections from the UAQ36 Neolithic site. Yellow-orange indicates cleaner sand deposits, nuances introduced to make interfaces more evident. Pattern fills indicate seashell-rich layers, with different seashell density. Greyscale background fills indicate ash-rich layers. Black indicates post holes (PH).*

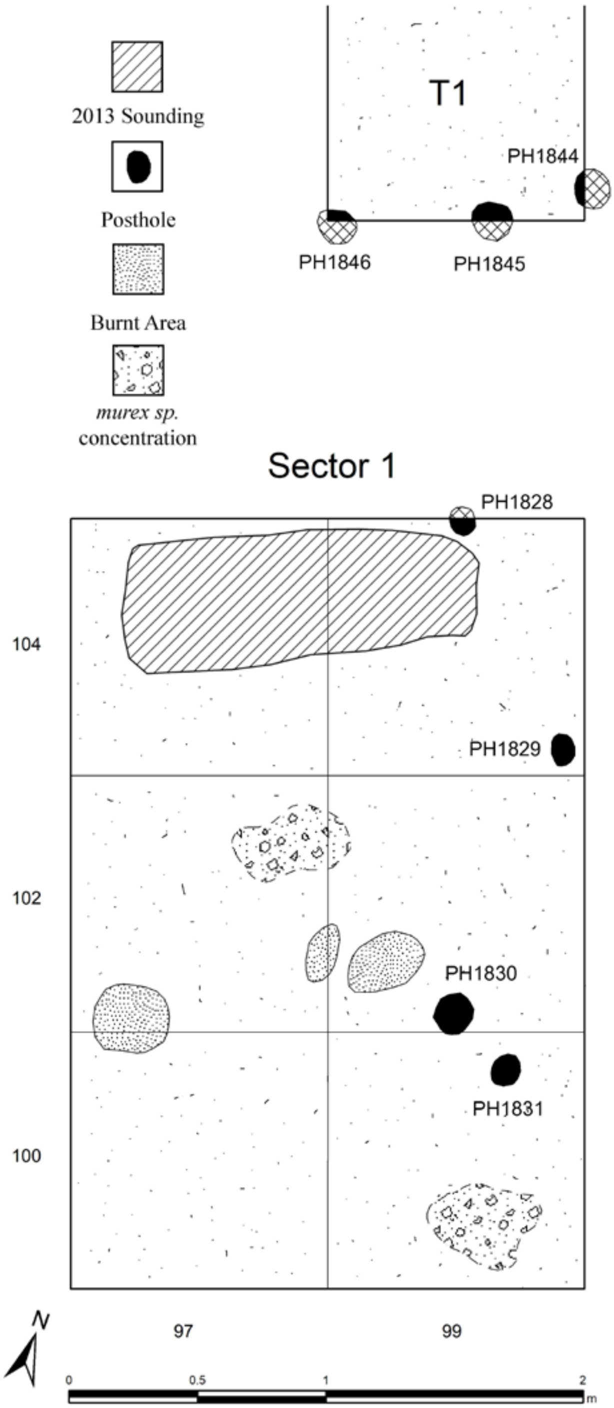


FIGURE 4. *A plan of SU1810, one of the most articulate occupation levels at the UAQ36 Neolithic site.*

otherwise appears to represent continuous occupation. The highly erratic deposition rate of wind-blown sand has to be considered and encourages caution about this observation.

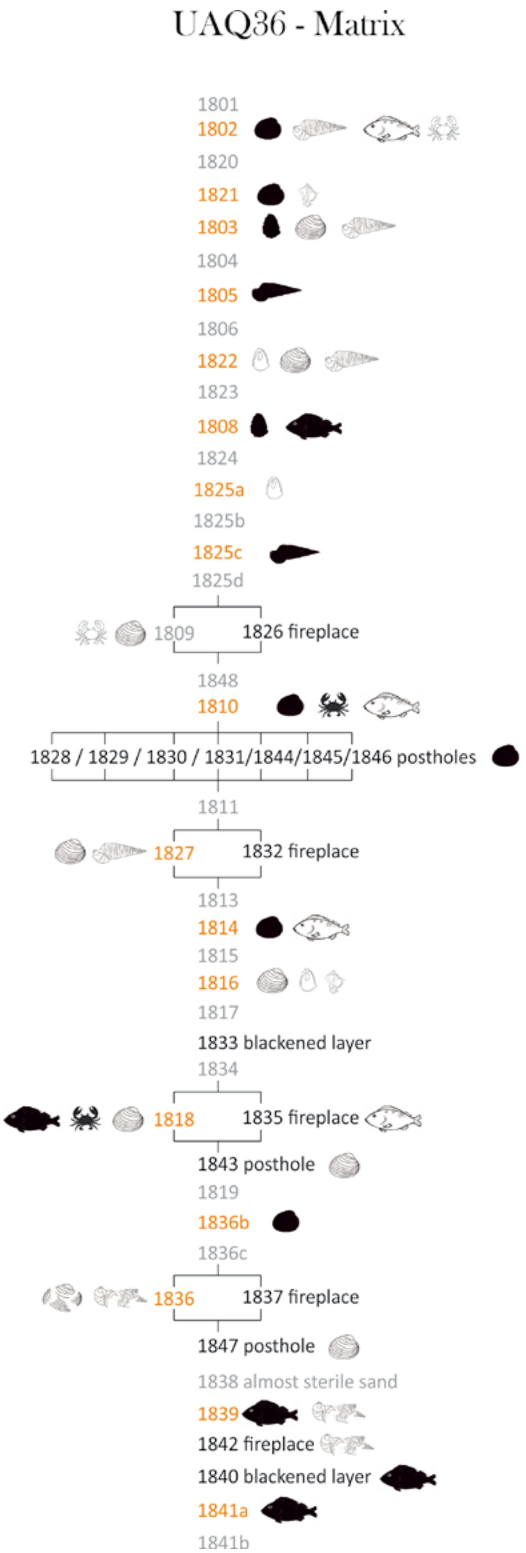
Within the upper part of the sequence, a few layers consisting of denser and more extended accumulations of seashells, with a large quantity of highly fragmented fish also occur (from earlier to more recent: SU 1818, 1816, 1814,1810,1803). The extension of these levels is remarkable, as they could also be traced over a long portion of Trench 1's sections (see below).

A few structural remains were identified, sometimes only visible in the sections (see post holes PH 1828 and PH 1847 in Fig. 3/Section 5). The only exception is the occupation level SU 1810 above the clean sand of SU 1811. Four post holes were identified, cut through SU 1811 and filled with *Marcia* sp. shells, fallen from the overlying layer SU 1810 after the posts' removal (post holes SU 1828, 1829, 1830, 1831). This suggests that some sort of shelter (or other type of architectural structure) was erected during the occupation associated with SU 1810's shell accumulation. Significantly, another three post holes associated with SU 1810 are visible in the sections of Trench 1: SU 1844, SU 1845, and SU 1846. These can thus be associated with those mentioned above in the reconstructed plan of the level (Fig. 4). SU 1810 is further characterized by the presence on its surface of three ash lenses related to domestic burning activity (Fig. 4).

Despite several blackened lenses being present throughout the sequence, only five actual fireplaces were identified. The matrix of the excavation is illustrated in Figure 5.

In Trench 1, the study of the sections enabled the tracing of the northward continuation of the stratigraphic sequence identified in Sector 1, mainly regarding the most consistent layers mentioned above (SU 1818, 1816, 1814, 1810, 1803). The trench extends to the northern edge of the dune, where all ancient layers are interrupted. All layers display roughly horizontal deposition, with no evidence of an ancient dune slope. At least on the northern side, therefore, no dune build-up occurred after the ancient occupation, or it was subsequently eroded.

A first radiocarbon date was obtained in 2011 from a *Marcia* sp. bivalve shell found at the surface of UAQ36. It gave an uncalibrated age of 6135 ± 24 yr BP which,



although out of context, triggered interest in a more detailed investigation of the site. Charcoal collected in 2013 from layer 2b, which corresponds to the bottom of the superficial layer SU 1802, gave an uncalibrated age of 5770 ± 35 yr BP. In 2018 large pieces of charcoal were found within the excavated stratigraphy, which is to date a very rare occurrence in the excavated Neolithic shell-middens of Umm al-Quwain. The earliest occupation reached so far at the site (SU 1840) could thus be dated 5667 ± 24 yr BP (uncalibrated) (Fig. 6).

Preliminary observations of the stratified faunal remains indicate the predominance of very small fish, probably numerous needlefish (Belonidae), mullet (Mugilidae), and seabream (Sparidae). The catches do not generally exceed 100–150 g. Fishing was probably carried out in the surrounding shallow waters of the lagoon. Although a complete detailed study of these remains is necessary, fishing seems to have remained a secondary activity at the site, where lagoon mangrove swamp shells (*Marcia* sp., *Terebralia palustris*, *Saccostrea cuccullata*), and crabs (*Portunus segnis* and *Scylla serrata*) prevail.

Archaeological artefacts from UAQ36's excavated stratigraphy are scarce. One single shell scraper made from a *Callista ericina* valve was found in SU 1810 (Fig. 7/A). The corpus of lithic artefacts consists of twenty items. Despite their low number and their scattered distribution (both spatially and stratigraphically), they can provide interesting information. The largest

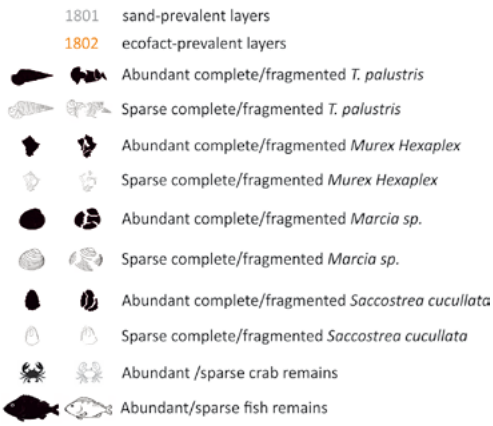


Figure 5. *A matrix of site UAQ36, 2018 excavations, with a schematic indication of ecofact frequency.*

Lab code	*Sample name and material*	*^{14}C age*		*F14C*		*Unmodelled*		*Modelled*		*ΔR*	
		BP	±		±	*cal BC (1 σ)*	*cal BC (2 σ)*	*cal BC (1 σ)*	*cal BC (2 σ)*		±
MAMS 35678	UAQ36 SU 1819/104 charcoal	5574	25	0,5	0,0016	4447-4367	4455-4356	4448-4371	4456-4356		
P 17769	UAQ36 SU 1819/104 M1 *Marcia* sp.	5946	15	0,477	0,0009			4445-4328	4455-4161	68	91
P 17770	UAQ36 SU 1819/104 M2 *Marcia* sp.	5943	17	0,477	0,001			4439-4308	4450-4106	68	91
P 17771	UAQ36 SU 1836 M1 *Marcia* sp.	5980	15	0,475	0,0009			4482-4428	4508-4394	13	36
P 17772	UAQ36 SU1836 M2 *Marcia* sp.	5977	17	0,475	0,001			4482-4427	4507-4395	13	36
MAMS 35679	UAQ36 SU 1840/104 charcoal	5667	24	0,494	0,0015	4520-4463	4545-4456	4514-4461	4541-4456		

Figure 6. *Radiocarbon dates from UAQ36's charcoal samples and* Marcia *sp. shells collected in January 2018 (Curt-Engelhorn-Zentrum Archäometrie gGmbH, Manheim, 2018).*

concentration of lithic items comes from SU 1827, with six pieces, other levels include between one and three pieces only (SU 1802, 1808, 1825, 1809, 1827, 1813, 1818, 1819, 1836, 1839). Fire marks were identified on five pieces (SU 1813, 1819, 1827, 1839), in two cases associated with fireplaces (SU 1819, 1827). The assemblage can be divided into four categories: three cores (Fig. 7/D), six flakes, three tools, among which are two *pièces esquillées* (Fig. 7/C), and eight splinters. The majority derives from debitage (85% of the assemblage, among which 30% are flakes, 15% tools, and 40% splinters). Interestingly, complete operational chains are not represented at UAQ36, but a set of elements (such as a cortical flake) indicative of the various phases of debitage testify that lithic workshops were present *in situ*. No hammer was discovered at UAQ36, but the use of the soft direct percussion is certain.

The presence of cores allows considerations to be made about the technical processes employed during the debitage. No specific or standardized preconceived plan seems to be involved. The state of exhaustion of the pieces is so advanced that one can speak of a real doggedness on the raw material. The frequency of incipient cones and the very basic management of the cutting, only based on surface management, are testimony to the intention of over-exploiting the available material. The technical behaviour can thus be qualified as *expédiante*, or even opportunist. The reuse of certain lithic items, with recutting, and even their new exploitation (in the case of a core) is also attested. This over-exploitation of raw materials is explained by their scarcity in the proximity of the site. Nevertheless, several materials were used: radiolarite, flint, chert, and chalcedony. Over-exploitation of raw materials and *expédiantes* lithic techniques represent further indicators of the status of the site.

Additional finds come from the surface. These include a soft-stone cylinder bead of the 'Akab type' (Fig. 7/B), a type of artefact appearing around 4300 cal. BC at Akab, 10 km from UAQ36 and known in the fourth millennium as well (Charpentier & Méry 2008: 130) (see Fig. 9). Interestingly, this bead is unfinished, as an accidental breakage likely occurred during its manufacture. This clearly shows that this type of bead was also being manufactured at UAQ36 and was, therefore, not exclusively produced at Akab. In Umm al-Quwain, a bead of this type was also recovered at Ramlah RA2 (Uerpmann M 2003: fig. 3), and another one at UAQ69.

The results of the excavations conducted at UAQ36 show that the occupation phases were brief and not very intense, the status of the site thus appearing to be

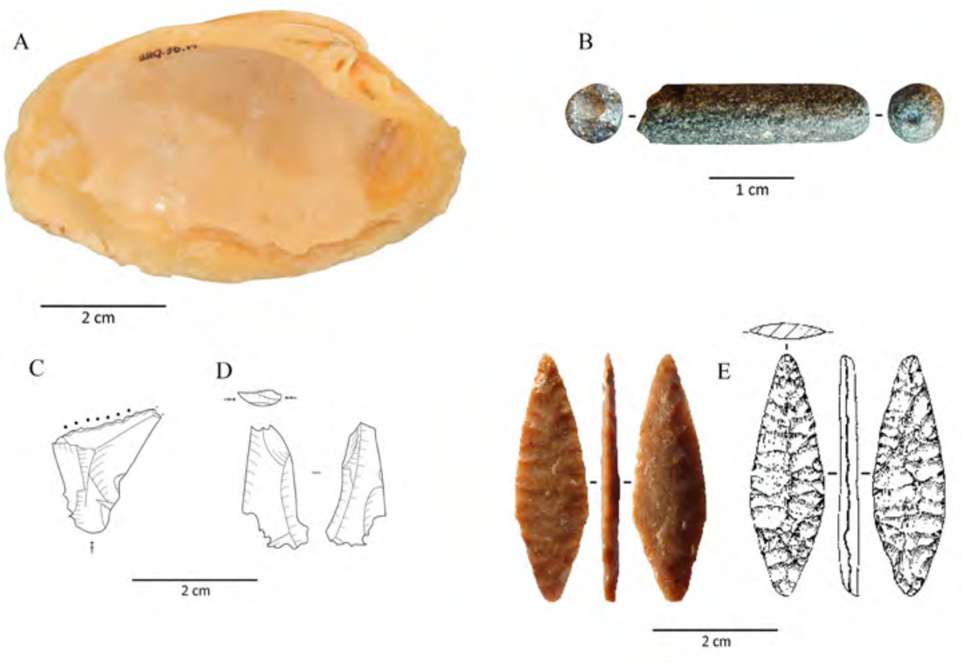


Figure 7. *Artefacts from UAQ36:* **A.** *shell scraper (SU 1810);* **B.** *'Akab' type soft-stone unfinished broken bead (surface);* **C.** pièce esquillée *(SU 1808);* **D.** *core (SU 1818);* **E.** *flint arrowhead (Level 6) (drawings: C. Gallou [C and D] and G. Devilder [E]).*

that of a temporary campsite. The excavation, however, only opened a limited 'window' in the UAQ36 area, and one cannot exclude that longer and more intense occupations took place at or near the site, including deeper in the same stratigraphic sequence.

3. Palaeoenvironmental data

To provide a background against which the discussion can be developed, a brief introduction of the palaeoenvironment is necessary, concerning sea-level change and the Umm al-Quwain lagoon formation/evolution.

During the Last Glacial Maximum (LGM) much of the Gulf was dry. Between 20,000 and 14,000 BP sea level was 120 m lower than at present and the Gulf was free from marine influences (Lambeck 1996; Parker et al. 2018). By 14,000 BP the Straits of Hormuz had opened up as a narrow waterway and by 12,500 BP marine incursion into the central basin of the Arabian Gulf had started. Because of the hypsometry of the Gulf, the rate of horizontal transgression was especially rapid (Lambeck 1996; Parker et al. 2018). Between 12,000 and 6000 BP, the sea transgressed more than 1000 km into the Gulf, at times inundating more than 1 km/yr. Since the end of the LGM, the mean sea level in the Arabian Gulf constantly rose until 6000 BC, when it reached its maximum at +2/+3 m above current sea level (Lambeck 1996; Sanlaville & Dalongeville 2005; Berger et al. 2013; Parker et al. 2018). After this event of maximum transgression, sea level gradually lowered, reaching present-day levels around 3000 BP.

For the development and morphological modification of the UAQ lagoon over the last 6000 years, the reference work of R. Dalongeville provides details of the evolution of the sand spit bordering it (Boucharlat et al. 1991; Dalongeville, Prieur & Bernier 1998; Sanlaville & Dalongeville 2005; Bernier et al. 1995).

During the late glacial, lines of parallel mega-dunes, oriented south-west–north-east, with wide interdunal depressions were emplaced (Atkinson et al. 2012; Preston et al. 2015). At UAQ36 the core of the mega linear dune was dated between 15,000 and 10,000 BP (Atkinson et al. 2012) and the same dune ridge at UAQ2 between 16,000 and 10,000 BP.

With the progressive rise of the sea level, these interdunal depressions were flooded with a +3 m maximum transgression reached at around 6000 cal. BP so that the rapid rise in sea level together with the dominant north-west Shamal wind and the south-west–north-east dominant longshore drift, resulted in the formation of the khors and lagoons along the whole coast of the UAE; the Umm al-Quwain lagoon is the largest of them (Bernier et al. 1995; Goudie, Parker & Al-Farraj 2000).

The ongoing palynological study of a core drilled in the sabkha at the foot of UAQ36 (see Fig. 1, L54) indicates, despite the small number of samples analysed so far, an evolution of the flora that highlights deep environmental changes between the mid-seventh and mid-fifth millennia BC.

In fact, a steppe environment, radiocarbon dated on samples from this core between 6395 and 6215 cal. BC and between 5464 and 5221 cal. BC, predates or coincides with the first levels of human activity at the site of UAQ2 (Fig. 8). The presence of *Terebralia palustris* shells in UAQ2 Levels 15 to 9 is indicative of the presence of mangrove development (Glover 1998; Tengberg 2005) during the second part of the sixth millennium BC.

In this environment, Poaceae at first dominate. This supports the palynological and phytolith data from Awāfī, where grassland developed during the same period (Parker et al. 2004). Later at UAQ36, Chenopodiaceae developed, indicating possible increased saline conditions. *Plantago* and *Artemisia* arrived thereafter, followed by Asteraceae and *Centaurea*. Rare spores of ferns are attested, and ligneous taxa (*Avicennia*) are scarcely developed. Non-polliniferous microfossils mainly include fungal remains. The dominant microfossils (HdV-172 and HdV-200) indicate dry or ubiquitous substrate. These data overall suggest a continental dry steppe vegetation, probably with a restricted wet zone nearby (Aoustin & Leroyer 2018).

Towards 4442–4261 cal. BC, a clear modification of the pollen record provides evidence of the extension of *Avicennia* (grey mangrove), accompanied by *Rhizophora* (red mangrove). Chenopodiaceae also increase, mainly at the expense of Poaceae, as Cyperaceae remain stable. Other herbaceous taxa (*Artemisia*, Asteraceae, *Centaurea*, *Herniaria*/*Paronychia*) also increase, although more moderately. Dinoflagellate cysts and marine foraminifera (HdV-700) are also present. All these data illustrate the development of a mangrove swamp along a lagoon which is well fed by marine and freshwater inputs.

This development of the mangrove swamp at UAQ thus seems slightly earlier than data acquired from sites in the Sultanate of Oman, where it was attributed to an increase in tropical influences around 4000–3700 cal. BC (Lézine et al. 2002; 2010). Interestingly, *Rhizophora* is present in Umm al-Quwain together with *Avicennia* in the UAQ36 core at 155 cm. Today the mangrove at Umm al-Quwain no longer contains this species (Sainz Ollero & Garcia Anton 1999). Charcoal from both these two mangrove taxa was also identified by Tengberg (2005) from Bronze and Iron ages contexts at Tell Abraq, and from late pre-Islamic graves at ed-Dur — sites that border the southern part of the UAQ lagoon. According to Lézine et al. (2010: 422), *Rhizophora* species grow under more humid conditions than *Avicennia* and today this species only occurs in the southernmost part of Arabia (southern Red Sea) which is touched by the Indian Ocean monsoon. The sustainability of *Rhizophora* trees in the UAQ lagoon until, at least, the late pre-Islamic period[2] suggests that rainfall was always important in the region.

At the same time, the fact that the mean latitudinal position of the summer ITCZ and the associated monsoon rains had retreated south from the Arabian Gulf region from *c.*4000 BC (Fleitmann et al. 2007; Macumber 2011; Parker et al. 2006) suggests that stronger westerly winter rainfall favoured the persistence of short-lived lacustrine conditions at the Waḥalah and Awāfī palaeolake sites (Emirate of Ra's al-Khaimah) after that date (Preston et al. 2015), possibly enhanced by a local orographic effect on precipitation gradients due to the proximity of the Al Hajar Mountains (2015: 4). These conditions possibly allowed consistent freshwater inputs from fluvial and groundwater systems for coastal mangroves to persist even within a regional process of aridification in eastern Arabia.

4. Discussion

4.1. Human occupation in the second part of the sixth millennium BC at UAQ2

To date, the stratified coastal site at UAQ2 attests to the oldest Neolithic occupation identified in the northern part of the United Arab Emirates. The archaeological layers developed on the 8 m-high surviving segment of a Pleistocene mega-dune. The stratigraphic sequence

[2] *Rhizophora* stands are reported until the thirteenth century AD further north, in the Ra's al-Khaimah mangrove, according to data from Kush, Periods IV–VII (Tengberg 2005: 42).

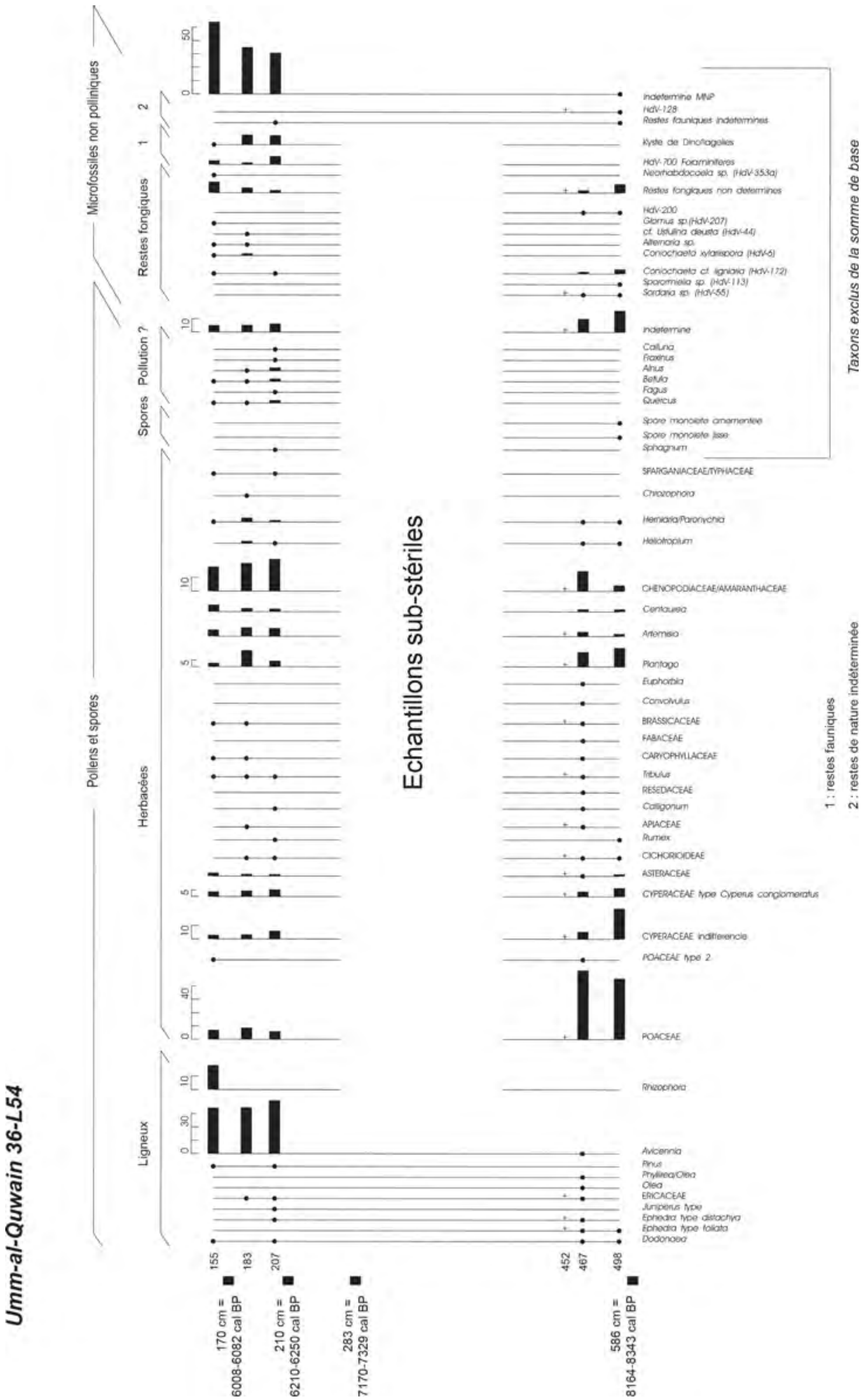


FIGURE 8. *A palynological diagram, UAQ36/L54 core.*

Lab code	*Dated material*	*Depth from g.l. (cm)*	*^{14}C age*	*cal. BC (1 σ)*
SacA-51571	wood (indet.)	117	2855 +/- 30	1115-928
SacA-51572	wood (indet.)	170	5365 +/- 30	4328-4059
SacA-51573	wood (indet.)	210	5485 +/- 30	4442-4261
SacA-51574	wood (indet.)	283	6340 +/- 35	5464-5221
SacA-51575	wood (indet.)	586	7405 +/- 40	6395-6215

Figure 9. *Radiocarbon dates, UAQ36/L54 core. Ground level (g.l.) for the sabkha is considered to stand at 0 m. a.s.l. (radiocarbon data calibrated with IntCal13 using OxCal 4.3.2).*

has a depth of 2.20 m and comprises seventeen distinct archaeological levels. The lowermost, Level 17, consists of a single layer of sparse edible shells (*Marcia* sp.), which attests to a first, probably occasional, human occupation of the site. Above it, Level 16 was almost sterile. Conversely, Levels 15 to 9, radiocarbon dated from 5500/5300 to 5000/4800 cal. BC (*Marcia* sp. shell samples) correspond to the densest human occupations at UAQ2. The two tombs excavated in 2012 (Méry et al. 2016: fig. 4) were dug in Level 14. Based on the descriptions of C. Phillips (2002), it is possible that some of the graves excavated in the early 1990s were contemporaneous with our Level 11.

From then on, human communities show a high degree of adaptation to the close, as well as to the more distant, environment, and exploited a wide variety of resources. The main four shell species they collected were *Marcia* sp., *Hexaplex Kusterianus*, *Saccostrea Cucculata*, and *Terebralia palustris*. The knowledge of the lagoon and, probably, of the open sea as well, was sufficiently elaborate to be recognized as part of a long, prior tradition. Overall, twenty-nine different fish families or taxa were caught by the fishermen. The majority was caught in the lagoon, such as emperors (Lethrinidae) and seabreams (Sparidae), but king soldier bream (*Argyrops spinifer*) and little tunas (*Euthynnus affinis*) suggest possible fishing in open waters (Mashkour et al. 2016: 204). Of the necessary equipment, only stone net sinkers were recovered at UAQ2 in Levels 15 to 9.

UAQ2 dwellers also exploited terrestrial food sources available around their camp, as indicated by the evidence of diversified hunting. Medium to large herbivores (*Gazella* and *Oryx*), carnivores (*Vulpes* and *Felis*), and birds (Aves) are well represented, especially in Levels 11 and 12. The study of Levels 15 to 9 shows that UAQ2's communities also herded caprinids (*Capra* and *Ovis*), two thirds of which are goats, and cattle (*Bos*). Medium-sized dogs (*Canis*) were also part of the diet according to M. Mashkour (Mashkour et al. 2016).

Compared to UAQ36, at UAQ2 it is in the levels of the second half of the sixth millennium that the occupational surfaces and connected layers are best preserved and are richest in organic matter. They can be interpreted as a succession of residential levels which always combine, although in different ways, the same basic features: fireplaces, fireplace clearing refuse, food waste concentrations, waste from tool or ornament production, and post holes (Méry et al. 2016: fig. 7B).

In Levels 15 to 9 the material culture is represented in an unparalleled variety for the Neolithic period in the northern UAE. Moreover, craft making is attested *in situ*, whether lithic debitage or retouch or shell-bead (*Spondylus* sp.) production. Among the tools, some are very well made, which is the case for polished axes made from different types of rock (haematite, granodiorite). Stone files were also found. Dozens of tools made from hard animal material were discovered, such as bone points (from caprinid long bones; Méry et al. 2016: fig. 2/A), shell scrapers/knives (*Callista* sp., Méry et al. 2016: fig. 2/E), and possible shell containers (*Acrosterigma* sp. and *Anadara* sp.). The shell and stone ornament artefacts are very varied, mostly attesting to simple *chaînes opératoires*. However, a perfectly polished carnelian sphere (Méry & Charpentier 2013: fig. 4) and a few tubular pearls with single perforation testify to more elaborate practices, but it is not possible to establish whether these objects were locally made or were the result of regional exchange.

The study of UAQ2's lithic assemblage from Levels 15 to 9 (466 items in total) provides useful elements to characterize the oldest phases of occupation. The largest concentration of items comes from Level 11 (131 items), the smallest from Level 15 (two items). In addition to flakes and splinters, which number in the hundreds, the stratified assemblage includes a dozen or so cores and some eighty tools, including arrowheads, scrapers, side scrapers, borers, and *pièces esquillées* (see Méry et al. 2016). The variety of tools is thus more evident than at UAQ36 where, moreover, no arrowhead or scraper has been found so far.

Only one hammering tool (also used as an abrader) was found at UAQ2, but the frequency of the elements resulting from different phases of the knapping indicates very frequent *in situ* activities. The type of percussion is more varied than at UAQ36 (soft direct, hard direct, pressure). The clastic raw materials used at UAQ2 are also more varied, with beige or grey radiolarite, black flint, chalice, chalcedony, agate, carnelian, chrysoprase, phtanite, and sandstone-quartzite. As at UAQ36, they seem to have been collected in the form of blocks or small plates on primary deposits (some items have cortex).

Unlike UAQ36, some *chaînes opératoires* for lithic tools can be fully reconstructed at UAQ2 (such as the bladelet *chaîne opératoire*), but not those for the arrowheads (Méry et al. 2016: figs 2/C–D and 8/A) and scrapers (2016: fig. 2/B), for which only the ultimate retouching is visible, with corresponding retouch splinters.

The knapping is much better organized than at UAQ36, but the lack of local deposit of raw material also leads to a maximal reuse of lithic cores and products. Only arrowheads and scrapers seem not to have been reused. Although it is not possible to give details, due to the lack of elements corresponding to the first phases of the operational chain, arrowheads and scrapers always show a predetermined and standardized debitage. Combined with the use of pressure retouching techniques on these two categories of tools, this shows the knappers' high technical level, and their probable specialization (in the sense of a technical activity that is not carried out by everyone; Averbouh et al. 2006: 326–327).

4.2. The fifth millennium BC as a period of environmental and cultural change

4.2.1. Umm al-Quwain UAQ2 — Levels 8–4

As mentioned above, archaeological materials from UAQ36's excavated levels are scarce. This is even more evident when compared with the nearby site of UAQ2. However, at UAQ2 finds were numerous in the sixth-millennium levels (Levels 15 to 9), but rarer in the fifth-millennium ones (8 to 4). Levels 8 and 6 correspond to thick sandy accumulations which seem to have developed quickly, during a phase of possible climatic deterioration. The soils are not well discernible, but ashy areas and several accumulations, either of small burned stones or grindstone fragments, indicate several anthropogenic occupations. These levels are not very dense in artefacts. The lithic assemblage (twenty cores and 100 tools) do not essentially differ from the earlier ones. One can, however, note the rarity of arrowhead types previously attested, and the appearance of a new type in Level 6 (Fig. 7/E). Scrapers do not change, but they are less numerous. The largest concentration of lithic pieces comes from Level 8, with 275 items; the smallest from Level 6, with 138 items.

In 2012, the discovery of the portion of a skeleton in Level 8 confirmed that the UAQ2 necropolis was still in use at the time.

Levels 4 and 5 show a remarkable density of edible shells, including well-laid seashell 'beds' and pockets and lenses as well. Within this complex accumulation, one can occasionally distinguish small single species concentrations (e.g. broken and burned *Terebralia palustris*), probably resulting from a single episode (i.e. their consumption).

Marine shells are the predominant component of these accumulations, with the same four main species as in the previous levels (*Marcia* sp., *Hexaplex kuesterianus*, *Saccostrea cuccullata*, *Terebralia palustris*). In the absence of clearly perceptible hiatuses between the shell 'beds', and knowing the taphonomic phenomena of compaction and deflation inherent to this type of deposits, it is difficult to choose between the hypothesis of continuous accumulations or that of a series of successive deposits linked with episodes of more or less prolonged human frequentation over an annual cycle. However, the thin sandy lenses which sometimes occur make the hypothesis of cyclic — or even seasonal — deposits more likely.

Level 5, in an area fairly dense in shells, hosted the remains of a probably circular structure (only half excavated), with traces of several rearrangements of the posts (Méry et al. 2016: fig. 11). This shows that architectural structures could be installed in dense shell accumulation areas and that the differentiation between residential areas and zones of consumption and waste disposal was not necessarily marked on the site. It is in Level 5, in connection with this circular structure, that a new tool and a new type of ornament appear, namely the mother-of-pearl fish hook and the black stone earring. These two categories of objects are well-known markers of the Late Neolithic in Oman (Charpentier & Méry 1997; Usai 2018).

As for the lithic assemblage, one observes in Levels 4 and 5 the absence of the most elaborate tools (arrowheads and scrapers), and a new reduction in the number of pieces (110 pieces only), among which 23% are tools (mostly *pièces esquillées*, and a few borers). The tools are less standardized than in the previous levels, yet they are still slightly more elaborate than on UAQ36. No human bone was found in Levels 4 and 5.

In conclusion, the sequence of the fifth-millennium BC levels at UAQ2 is marked by clear differences compared to the most ancient ones. A possible phase of deteriorating climate and perhaps higher pressure on the natural resources (Levels 8–6) did not prevent human installations on the site, although they look more tenuous when compared to earlier periods. One may also observe a growth in the proportion of sea bream (*Sparidae*) indicating that fishing was limited to the shallow areas of the lagoon (Mashkour et al. 2016).

4.2.2. Akab

The settlement site of Akab is smaller than UAQ2, and the sites are only partially contemporaneous, with overlapping occupation from the second third to the end of the fifth millennium. Akab only has a preserved level of the second part of the fourth millennium BC (see Charpentier & Méry 2008). Like UAQ2 and UAQ36, the site is located on a segment of a Pleistocene dune. The sandy and greyish archaeological levels mainly contain shells of the same four main species witnessed at UAQ36 and UAQ2, plus fish bones and crabs. Caprinids and dogs were exploited (Beech, Charpentier & Méry 2017). The frequency of the mud crab (*Scylla serrata*) and the mud creeper snail (*Terebralia palustris)* indicates the presence of a mangrove near the site. Under a sterile surface layer, six anthropogenic layers were excavated and the virgin soil reached. No major hiatus (in the form of sterile sand deposits) was identified between the occupational levels; the depth of the anthropogenic layers does not exceed 35 cm.

Remarkably numerous remains of architectural structures were discovered at Akab, with more than 290 post holes (Méry et al. 2009: 699) located at the base of the anthropogenic layers, where these cover the sterile soil. Their density indicates substantial and persistent occupation of the site. Definite structure plans could not be distinguished among these lower post holes. Different post-hole density was observed from one area of the site to the other, indicative of the inner organization of the built-up area. This has a good correspondence with what was observed in the sixth-millennium BC levels at UAQ2.

At the best estimate, the duration of every 'residential episode' at the site seems to have been significant, and repeated successive occupations occurred. The latter were linked to activities such as *Spondylus* sp. and *Pinctada* sp. beads manufacture, pearl fishing, and the fishing of tunas and large trevallies (Beech, Charpentier & Méry 2017; Lidour et al., in press). Mother-of-pearl fish-hook manufacture on site was directly linked with this activity. Unlike UAQ2 and UAQ36, dugong (*Dugong dugon*) vertebras and broken ribs are present in good numbers (Beech, Charpentier & Méry 2017). Marine turtle (Cheloniidae) bones are rare, while they are not represented at UAQ36.

The number of artefacts is greater in the residential part of Akab than in the fifth-millennium levels at UAQ2. Moreover, *Spondylus* sp. beads at different stages of manufacture and including finished objects, count for more than a quarter of the almost 1850 objects found in stratigraphic context; they were collected from all the levels. This indicates the importance and persistence of this activity at Akab, suggesting a probable form of specialization in the production of this type of ornament (Charpentier & Méry 2008). The lithic material comprises less than 300 items, the only tools are *pièces esquillées* and borers —very few according to V. Charpentier (2008) but well adapted to the shell-bead work. *Pièces esquillées* are present in Levels 6 to 8 at UAQ2.

5. Conclusions

UAQ2, specifically in the earlier phases of its occupation, is the only site among those discussed here that comes close to the wealth and wide variety of remains known from the Neolithic settlements of the Ja'alan and of the Muscat area in Oman, albeit without reaching it. The most varied activities, which can be sometimes complex, specialized, dangerous, or requiring particular capacities (skills, strength, long training, etc.), are practised at UAQ2 in the sixth-millennium cal. BC levels. Currently available data indicate a rather long duration residence time at UAQ2 (Mashkour et al. 2016), at least equivalent to other sites investigated along the coast of the Sultanate of Oman (Biagi & Nisbet 2006), which may correspond to winter and spring occupation. Based on the mode of subsistence and residence of the UAQ2 communities, and on the mentioned evidence of craft activities, one can infer a complex economic and social organization, likely entailing work distribution, given the apparent presence of specialized craftsmen.

At this stage of the palynological study, the presence of a mangrove swamp cannot be fully confirmed for the sixth millennium, but the presence in Levels 15 to 9 of UAQ2 of *Terebralia palustris* — together with *Marcia* sp., *Hexaplex kuesterianus*, and *Saccostrea cuccullata* with imprints of mangrove tree pneumatophores — shows that it existed at the time.

The occupation of Akab, UAQ2, and UAQ36 during all or part of the fifth millennium is strongly indicated by stratigraphic evidence, combined with the study of the material and several radiocarbon dates. Furthermore, the presence in stratified contexts of mother-of-pearl fish hooks, 'Akab type' pearls, and black stone earrings fits well with what is known of the second half of the fifth millennium in eastern Arabia (Cleuziou & Tosi 2007; Méry & Charpentier 2013). According to the first palynological results near UAQ36, a mangrove swamp developed locally at the time.

The logistics of these (and other local) communities, in other words, the set of methods and means connected with the organization of the different activities, was partly inherited from the sixth-millennium predecessors (who, in the case of UAQ2, frequented the same site). As an example, one can mention the raw materials' — hard and clastic rocks — procurement strategy, which entailed the exploitation of different and variously located sources, such as beaches, wadis, and primary geological deposits.

In particular, it seems that the three sites discussed here obtained clastic materials at Jebel Ma'taradh, located 30 to 40 km from the coast. This deposit is the only one known to date that contains true chalcedony, and also agate (including zoned agate), carnelian, and more or less finely grained black flint (Charpentier et al. 2017). All these types of rock are found in the form of finished products in the archaeological sites of the UAE. Conversely, on and near the geological deposits only primary products and very few tools from various periods were found. Small Neolithic bifacial pieces, as well as bladelets and laminar flakes, are of the same type found at UAQ2 and Akab and at other coastal sites along the Gulf coast of the UAE (Charpentier et al. 2017).

The site of UAQ2, the only one among those discussed here that seems to have been occupied from the second part of the sixth to the beginning of the fourth millennium BC, testifies to significant economic and social changes from Level 8 onward. Perhaps in conjunction with the beginning of an environmental deterioration (aridification), subsistence strategies, dwelling patterns, and technical activities change, a trend that appears to be even more marked from Level 5 onwards.

About 1 km from UAQ2, starting in the second half of the fifth millennium, UAQ36 was repeatedly occupied, without perceptible discontinuity, but only shows (in the so far excavated layers) evidence of non-intense and short occupations. No contemporaneous grave was discovered. The picture is, therefore, that of a smaller campsite than UAQ2 or Akab, even though diversified hunting and herding are attested. The lithic industry, conversely, only reveals an *expédiante* or opportunistic tool production, with no evidence of diversified techniques.

Akab appears as a more active residential site, characterized by more numerous activities, and is more oriented towards open sea exploitation than UAQ2 or UAQ36, as suggested by active pelagic fish catching in the open sea and pearl fishing. The lithic industry, without having the opportunistic character of UAQ36, is consistent with the UAQ2 assemblage of the second half of the fifth millennium.

To summarize, the three Neolithic coastal sites discussed in this work have proved to be stratified and spatially organized. Although they contain the same kind of structures, one can nevertheless distinguish a certain degree of variation in the settlement type, which appears to be directly linked to the degree and nature of the exploitation of natural resources in the surrounding environment.

In light of the accurate, stratigraphic excavation methods, paired with systematic dry-sieving of the removed sediments (with additional test-sieving with 1 mm meshes, or by flotation in the case of UAQ2), the data collected from the excavation of a more or less large portion of these sites can be considered as truly representative of their nature.

In conclusion, and in spite of minor comparative biases between the three excavations — taphonomy; excavation extension; methods of excavation, sampling and recording — we think that the intensity of the human occupation can be validly estimated in the research area discussed here and that this provides valuable insight on the nature of Neolithic coastal sites. This is further encouragement, given the well-known difficulties in achieving reliable dating for the region and the intrinsic difficulties of interpretation in a dune environment where archaeological sites can be quickly buried or severely deflated.

Acknowledgements

Our most warm-hearted thanks go to H.H. Shaykh Saud bin Rashid bin Ahmed bin Rashid bin Ahmed bin Abdullah bin Rashid bin Majid Al Mualla, Member of the Supreme Council of the UAE and Ruler of the Emirate of Umm al-Quwain, for inviting the French Archaeological Mission to the UAE to conduct research in Umm al-Quwain. We gratefully thank H.E. Alyaa Alghafli, Head of the Department of Tourism and Archaeology (DTA) of Umm al-Quwain, Ms Rania Kannouma, Director of the Museum of Umm al-Quwain, and Mr Miqdad Aboelgreed, archaeologist at the DTA of Umm al-Quwain, for their constant and invaluable support to the mission's activities. We are grateful to H.E. Ludovic Pouille, French Ambassador to the UAE, Prof. Nicolas Grimal, President of the Commission des fouilles archéologiques françaises à l'étranger, Ms Sabine Sciortino, Director, Cooperation and Cultural Action advisor, and Mr Christian Velud, Deputy director of the French Institute in the UAE. The excavations and surveys are supported by the DTA of the Emirate of Umm al-Quwain; the Sous-direction des sciences humaines, sociales et de l'Archéologie du Ministère des affaires étrangères, Paris; and ANR Neoarabia, Agence nationale de la recherche, France.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 241–246

Rhodian amphora trade in Arabia (poster)

Bruno Overlaet, Patrick Monsieur, Sabah Jasim & Eisa Yousif

Summary
Pre-Islamic Arabia was an important producer as well as an importer of wines. Among these imports were wines from Rhodes. The Greek island was a major wine producer from the late fourth century BC to the beginning of the second century AD and used characteristic wine amphora. Both handles were stamped with the names of the manufacturers and annually elected priests or civil servants. The advance in the stamps' identification provides unique opportunities to establish their production date and ascribe them to specific ateliers.

The export of Rhodian amphorae to Arabia is documented by finds from sites such as Faylaka, Thāj, and Mleiha, but they remain for the most part insufficiently published. Yet they represent one of the rare occasions when Hellenistic pottery production can be accurately dated. When statistically relevant numbers are identified this can provide an insight into trade route patterns. Amphorae were in essence transport containers but they were not simply discarded. Even though only some bear graffiti, many show repairs and alterations, such as the removal of spikes and even secondary glazing, indicating that they were sometimes regarded as valuable assets.

Rhodian amphorae are promising tools for the study of trade routes of the Hellenistic era. The Rhodian Amphora Trade in Arabia (RATAR) project is an effort to collect the available data on Rhodian amphorae. Mleiha (Sharjah, UAE), at present one of the rare sites where significant numbers have been studied, is presented as a test case. Rhodian amphorae were systematically placed in third- to first-century BC tombs. Although their reuse is attested and their stamps can only provide *post quem* dates for the burials, it is possible to identify distinct chronological area shifts within the graveyard.

Keywords: pre-Islamic Arabia, Rhodes, Mleiha, amphora, amphora stamps

Wine and wine trade in pre-Islamic Arabia

Maraqten (1993) provided an extensive survey of the role of wine in pre-Islamic Arabia. Wine was locally produced from dates, grapes (Yemen had more than eighteen kinds of wine grapes), honey, and cereals; references are found in both Arabian and Western sources. South Arabia was one of the important wine producers (Casson 1989: 65), as was the island of Tylos in the Gulf. The appreciation of wines was highly developed. The Arabs differentiated four colours and drank their wine either pure or thinned with water. They were known to mix it with aromatics such as frankincense and myrrh, or added spices like pepper or sweet basil to create a range of flavours (Maraqten 1993: 102–103). This explains the development of a complex trade in various wines. Southern Arabia exported wine to Barygaza in India (Casson 1989: 81) but also imported wines from Syria, for example. North Arabia topped its own production with imports from Syria, Palestine, and Iraq (Maraqten 1993: 105, 107).

Rhodian wine amphora and trade networks

In Hellenistic times the Greek island of Rhodes was the main economic and naval power in the Mediterranean and the Black Sea region with a huge production and export of wine. For over 300 years, it shipped its wine in locally produced amphorae that can be identified by their fabric and shape and by the stamps on their handles. These amphorae were produced on a semi-industrial scale. Stamps were placed on both handles: one bore the name of an annually elected official preceded by the Greek preposition *epi*, meaning 'under the term of'; the other mentioned the name of the manufacturer. With the exception of the period during which the practice of stamping began, the stamps always bear the name of a month of the Rhodian calendar. A symbol (head

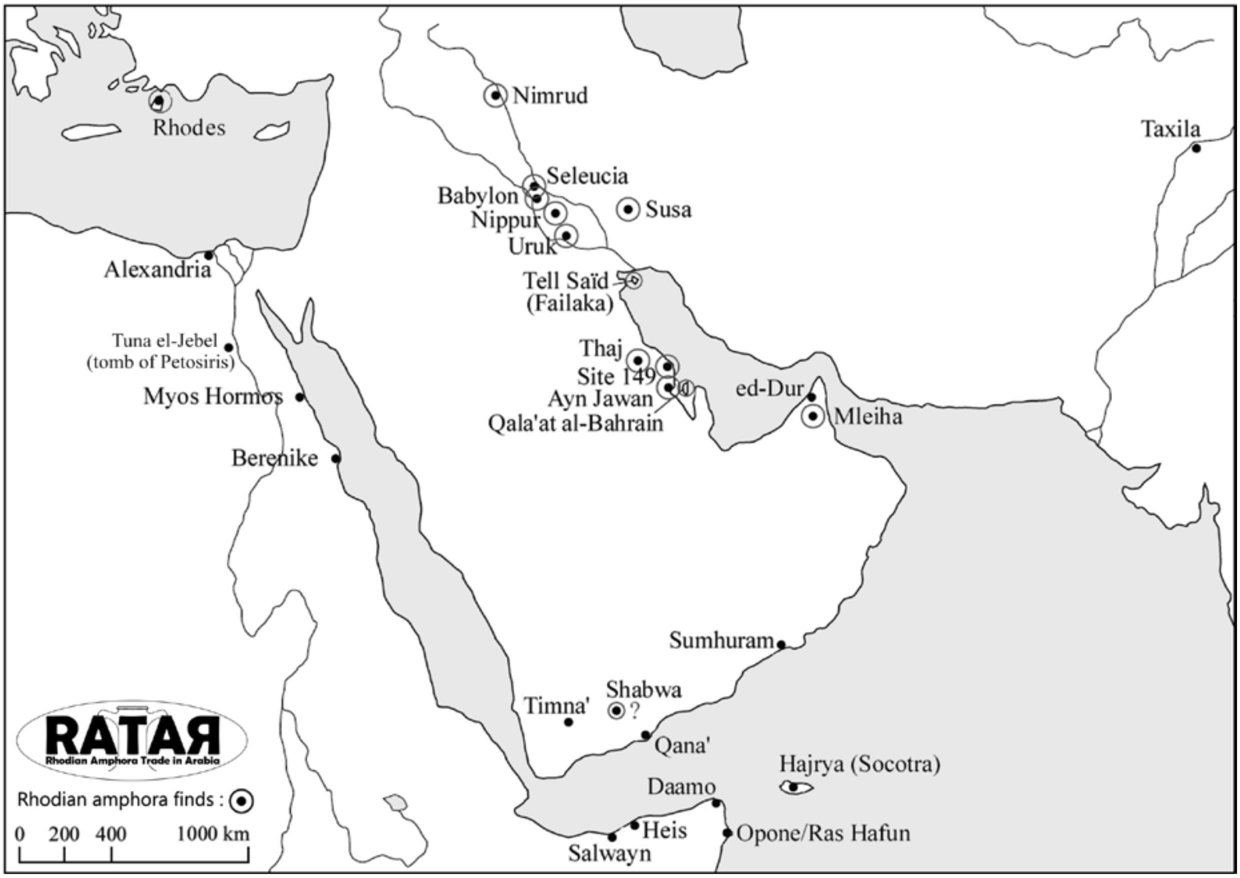

Figure 1. *Sites with Rhodian amphorae to the east of the Euphrates (after Monsieur et al. 2013: fig. 1).*

of Halios, animal, attribute of a god, etc.) also occurs regularly, mostly in connection with the manufacturer's name. Rhodian amphorae were systematically stamped for about 270 years. The practice started around 304 BC and lasted until the sack of Rhodes by Cassius in 43 BC. In the Augustan era, when production was resumed, the practice of stamping was abandoned (Grace & Savvatianou-Petropoulakou 1970; Finkielsztejn 2001; Badoud 2015). The function of stamping on Rhodian Hellenistic amphoras is still a matter of debate.

The discovery of amphora fragments and stamped handles on so many sites reflects the complex network of Rhodian commerce, either directly or indirectly through intermediate traders. The main significance of Rhodian amphora stamps lies in their chronological value. Complex research work combining sequences of eponym groups with dated archaeological sites, style features, and manufacturers can determine the approximate year in which these officials held function. As such, Rhodian amphora stamps are becoming a reliable dating tool for the chronological framework of a wide range of archaeological sites. Their presence on so many sites means that it is possible to establish the trade routes through time and determine their shifts or changes.

Terminus post quem and use and reuse of amphorae

Since Rhodian stamps refer to the *production date* of the amphora, they establish a *terminus post quem* for the archaeological context they are found in. Particularly when discovered at great distances from Rhodes, the discrepancy between the production date and the discard/burial date may be significant. It is not only the transport time that must be considered, amphorae may have been stored or reused over a considerable time. In some cases, they may have been kept as heirlooms.

Depending on the economic context, amphorae could be discarded or reused after they had served their original purpose. One of the most peculiar examples in antiquity is the Monte Testaccio near Rome, an artificial 50 m-high hill of discarded imperial-era olive oil amphoras from Spain and Africa (Rodríguez Almeida 1984). At the Roman necropolis of Adriatic Potentia they were used as grave markers and funeral libation devices (Monsieur 2007). In other circumstances they kept their value by being refilled with wine or used to store other commodities. The late fourth- to early third-century BC Egyptian tomb of Petosiris at Tuna al-Jabal documents what seems to be the reuse of eastern Mediterranean amphorae. Workmen are depicted filling Egyptian and most probably reused Greek-type amphoras with the same, locally produced wine (Cherpion, Corteggiani & Gout 2007).

Arabian wine was commonly transported in wine skins and kept in wine casks, vessels, or even baskets of palm leaves coated with bitumen (Maraqten 1993: 96–97, 99–100). Mediterranean amphorae were more complicated to load on camelback (Gubel 2007–2008: 9–11, fig. 8) as their shape was adapted for mass transport and storage in ship's hulls. In more remote places Rhodian wine and the amphoras themselves seem to have been considered as a status symbol. This may explain the presence of Rhodian wine amphorae among the grave-goods of important burials in Mesopotamia (e.g. at Uruk; Pedde 1993), Iran (Susa; Monsieur, Boucharlat & Haerinck 2011), and Arabia (Fig. 1).

Mleiha, a case study

Mleiha is at present the only site in Arabia where a significant amount of Rhodian amphorae and fragments, including twenty-seven stamps, has been documented. Most of these come from (plundered) tombs; others were found in settlement areas or were surface finds (Monsieur et al. 2013) (Fig. 2).

Whereas the amphorae probably reached Mleiha containing Rhodian wine, it is hard to prove they still

Figure 2. *An aerial view of Mleiha (Google Earth) with the graveyard (shaded) to the east and west of the settlement. The areas discussed in the text are circled in red.*

contained the original wine when they were placed in the tombs. The neck of an early second-century BC amphora from area AV-Z was extensively repaired with drilling holes; in this case, it could not possibly have contained its original wine. This fragment was found near a plundered tomb which had the base of an amphora still *in situ*, set in a square cavity in the burial chamber's floor (Fig. 3). The spike had been carefully chiselled away, possibly in order to place it more easily into the cavity. Another amphora which had its spike removed had been glazed (Fig. 4). The handles are covered with a thick black glaze making it impossible to see whether there are any stamps. The shape, however, points to a date in the early or mid-third century BC (Overlaet 2018: 13–15, fig. 13; Overlaet et al., in press: fig. 4). A sherd from a second black glazed amphora and a green glazed handle from yet another demonstrate that glazed Greek amphorae were appreciated at Mleiha. The glazing means that they would not have contained the original Rhodian wine and were possibly refilled with other wines or fermented drinks. The complete black glazed amphora in Figure 4 was found in Tomb F5, in which a late third-century BC funerary inscription was discovered (Overlaet, Macdonald & Stein 2016). Since all the third- to first-century BC glazed pottery at Mleiha was apparently imported from southern Mesopotamia or Susiana (Haerinck & Overlaet 2016), the amphorae may also have been glazed in this region. The presence of Rhodian amphorae along the Arabian coast (see Fig. 1) seems to suggest that it is the most likely trade route along which they reached Mleiha.

Repairs, glazing, and spike removals are all actions that indicate secondary uses for the Rhodian amphorae at Mleiha and thus suggest a clear time span between production and deposition, although the amphorae can still be used as chronological markers at the site. Stamps and amphora material of specific phases are concentrated in specific areas. Together with variations in tomb types and burial goods, this provides a view of the chronological development of Mleiha's graveyard (Fig. 5). The earliest documented monumental tombs are a group of five tombs in Area F. They date to the late third century BC and are associated with at least two early third-century amphorae. A second-century stamp from the area may point to the presence of a later tomb or to a later reuse, which is confirmed for several of the graves in Area F. The Area C and AV monumental tombs are slightly smaller than those of Area F and are to be dated somewhat later. They are linked to amphorae of Phases III–IV (*c.*198–146 BC). A group of large monumental tombs of Area 7 are linked to amphorae of Phases III–VIIa (*c.*145–43 BC). The handle of one of these is incised with a property mark in the *zabūr* script (Stein 2017). The amphora fragments and

Figure 3. *Mleiha Area AV-Z.* **Left:** *the base of a Rhodian amphora as found placed in a cavity in the grave chamber's floor;* **right:** *details of the removed spike;* **top left:** *an amphora rim found nearby with repair holes and a stamp of the eponym Agemachos (photographs B. Overlaet).*

FIGURE 4. *Mleiha tomb F5.* **Centre:** *a black glazed Rhodian amphora;* **left:** *details of its base with the spur marks around the removed spike;* **right:** *the unglazed triangle on the body (photographs B. Overlaet).*

stamps present a solid base for the chronology of the site covering a time frame from the early third century to the middle of the first century BC.

The Mleiha case study demonstrates the importance of a detailed documentation of Rhodian finds. Research on Rhodian amphorae has advanced significantly in the last decade but the publication of stamps from Arabia lags somewhat behind. The RATAR project wants to bring together information on Rhodian amphorae from the Arabian Peninsula to reconstruct trade and

Phase : Finkielsztejn *Chron. basse*	Date BC	**Mleiha sector** ***graveyard area*** **settlement / surface**	**Eponym** ***graveyard***	**Manufacturer** ***graveyard***
I	*c.* 304–235	AI (c. 270–250) ***F*** *(early 3rd cent.)*		
II	*c.* 234–199	E	Aristeus (c. 233–220) Eukles II (c. 233–220)	Kreon
III	*c.* 198–161	***F*** ***C*** **AV-*Z*, Q *&* P** E W	*Timasagoras (c. 184)* Sodamos (c. 195) Ariston II (c. 167–165) *Agemachos (c. 181–179)* *Ainesidamos II (c.179/177)*	Antigonos Apollonios Aristogeitos Iason I *Damocrates* *Diskos II*
IV	*c.* 160–146	***AV-Q*** surface	*Timourrodos (c. 159/8–154/3)* *Eudamos (c. 150/147)*	--------------------------- IIIb–IVb: *Antimachos* *Aisopos/Nysios*
V	*c.* 145–108	***7*** surface	*Andronikos (c. 132)*	---------------------------
VI	*c.* 107–88/86	surface ***7*** *(c. 107–43)*		Vc–VI : Philostephanos (?) (c. 118–88/86+)
VII a	*c.* 87/85–43			

FIGURE 5. *Chronology of the identified Rhodian stamps from Mleiha with reference to their find location (red italics = graveyard; black = settlement or surface find).*

exchange patterns as well as their function in burial practices during the Hellenistic era.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 247–264

A Friday Mosque founded in the late first century A.H. at al-Yamāmah: origins and evolution of Islamic religious architecture in Najd

Jérémie Schiettecatte, Christian Darles & Pierre Siméon

Summary

Archaeological excavations have only rarely documented the birth and development of Islamic religious architecture in the Ḥijāz and none had in Najd. In this respect, the fieldwork conducted by the Saudi-French archaeological mission in the oasis of al-Kharj (central Arabia, 2011–2017) filled this gap by discovering and excavating the Friday Mosque at al-Yamāmah, ancient Jaww al-Khaḍārim, a major city in the region of al-Yamāmah. The five-year-long project revealed a late Islamic mosque (sixteenth–eighteenth century AD). Soundings and a careful examination of its floor demonstrated that it had been laid over an early Islamic mosque (eighth–tenth century AD), itself built over pre-Islamic dwellings.

The stratigraphic sequence, architectural analysis, material study, and AMS radiocarbon dating at al-Yamāmah clarify the development of early Islamic Najdī religious architecture. This architecture is at the origin of a central Arabian indigenous tradition, which received little influence from outside the Peninsula and remained unchanged until recent times.

Keywords: Najd, early and late Islamic periods, Islamic archaeology, Islamic religious architecture, mosque

Introduction

Al-Kharj oasis is located 70 km south-west of Riyadh, the capital of the Kingdom of Saudi Arabia. The area lies between latitude 23.8° and 24.4° North and longitude 46.9° and 48° East.

Water resources from several of the largest aquifers of the Arabian Peninsula have made this area one of the most attractive regions of central Arabia for sedentary communities.

A seven-year programme led by the joint Saudi-French archaeological Mission[1] aimed at studying the coevolution of man and the environment in this region from the Pleistocene to the modern era. By characterizing the diverse prehistoric, protohistoric, pre-Islamic, and Islamic archaeological remains, we attempted to understand the evolution of the settlement pattern and how people living in harsh climatic conditions developed original subsistence strategies in order to cope with this environment (Chevalier et al., in press; Crassard & Hilbert 2013; Hilbert et al. 2016; Monchot 2014; Monchot, Bailon & Schiettecatte 2014; Schiettecatte et al. 2012; 2013; Schiettecatte, Chabrol & Fouache 2016; Schiettecatte & al-Ghazzi 2016; in press).

This project led us to conduct archaeological excavations on the largest site of the oasis, al-Yamāmah (fifth century BC–eighteenth century AD). In this major ancient urban settlement, the Friday Mosque was identified during the first season and entirely excavated during the following seasons (2011–2016). Its study provided valuable evidence of the characterization of early Islamic regional religious architecture, related to the late Islamic Najdī architecture characterized by Geoffrey King (1978). This paper gives us an opportunity to present the results of this excavation and propose a global framework for the development of this architectural tradition.

The site of al-Yamāmah

Al-Yamāmah is the largest ancient settlement reported in the region of al-Kharj. It is located in the centre of the oasis, west of the confluence of Wādī Ḥanīfah and Wādī Nisāḥ.

[1] The archaeological study of this region began in 2011 thanks to the Joint Cooperative Agreement for Archaeological Surveys in the oasis of al-Kharj, signed by the Saudi Commission for Tourism and National Heritage (SCTH), Riyadh and the Centre National de la Recherche Scientifique (CNRS), Paris. Since then, a team has conducted six field seasons under the direction of Abdalaziz al-Ghazzi (King Saud University, Riyadh) and Jérémie Schiettecatte (CNRS, Paris).

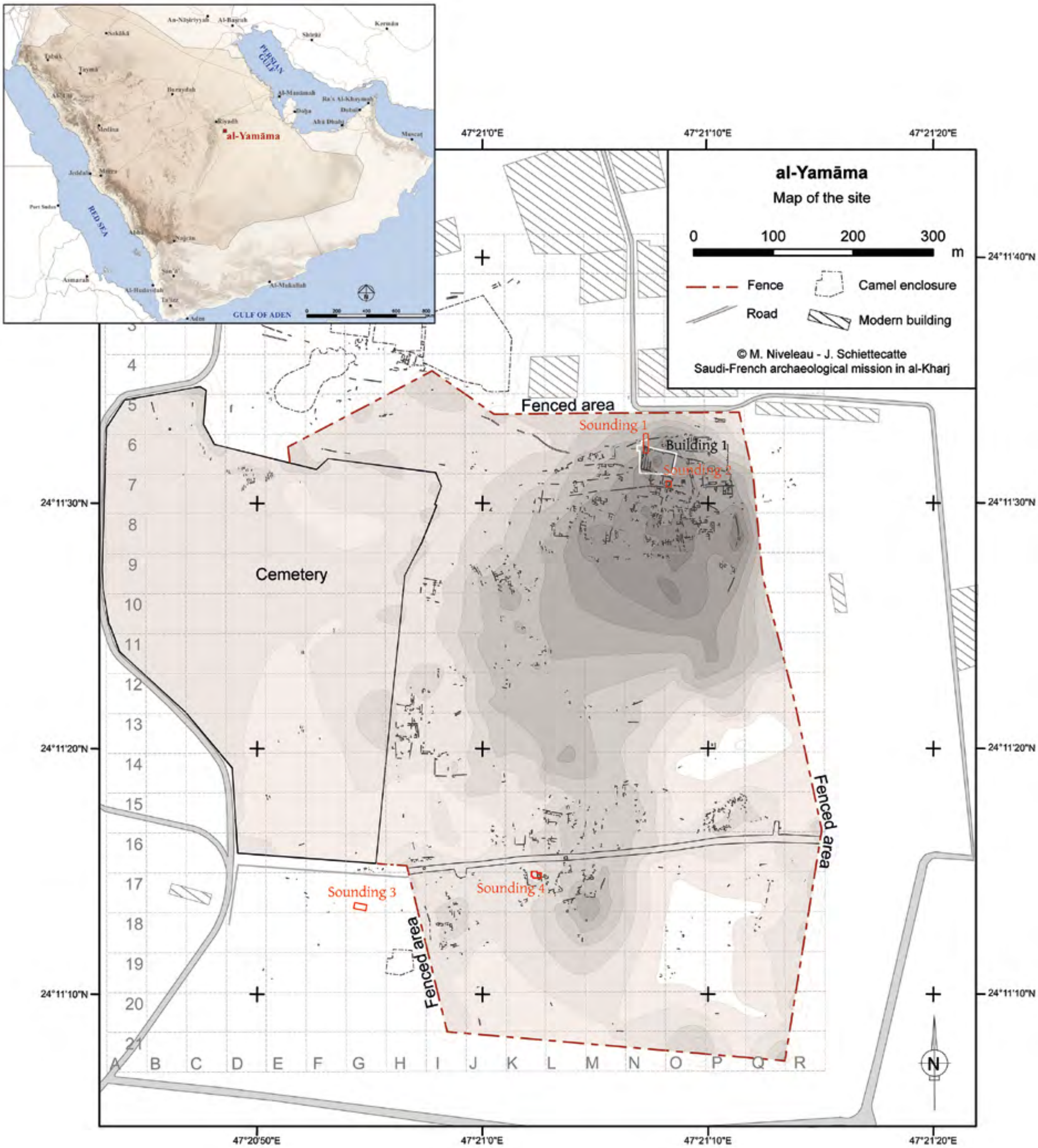

Figure 1. *A topographic map of the site (M. Niveleau and J. Schiettecatte, Saudi-French Archaeological Mission in al-Kharj).*

Its existence was first reported by H.StJ. Philby (1920: 168). Surveyed during the Comprehensive Archaeological Survey Program, the site was given the registration number 207-30 (Zarins et al. 1979: 27, 30). Soundings were carried out in the late 1980s by Abdalaziz al-Ghazzi for his PhD thesis, and a pottery typology was subsequently drawn up (al-Ghazzi 2010).

The archaeological area is located to the north-west of a village named al-Yamāmah, on the edge of palm groves. It is locally named al-Bannāʾ (literally 'the constructions'). The site is identified with the medieval city of Jaww al-Khaḍārim (al-Askar 2002: 16; al-Juhany 2002: 45; Robin & Arbach 2016), which is probably the ancient Jawwān (*Gwn*), from the Sabaic inscriptions.[2] Today, al-Yamāmah is only used as the name of a village in the vicinity of the archaeological site. It is highly likely to be a legacy of the time when the ancient Jaww al-Khaḍārim was nicknamed al-Yamāmah (al-Masʿūdī 1864: 276–288).

The local authorities fenced off most of the archaeological area in the 1980s. However, outcropping structures are visible beyond the fence, to the north-west, east, and south-west, where a pottery workshop was excavated in 2016. The site is more than 75 ha wide.

Al-Yamāmah started to be occupied at a time when local communities settled in the alluvial plain and initiated an oasis-based agricultural economy in *c*. the fifth century BC (Schiettecatte, Chabrol & Fouache 2016). Three periods of occupation were identified: fourth–third century BC, seventh–eleventh century AD, and fifteenth–eighteenth century AD. It is highly likely that the chronological gaps in this sequence correspond to a shift of the settlement elsewhere in the oasis, sometimes — but not systematically — equated to the contraction of the regional settlement pattern. The excavation of pre-Islamic and Islamic dwellings, of an early Islamic pottery workshop, and an early/late Islamic mosque highlights several aspects of daily life, material productions, architectural developments, and settlement process (Schiettecatte & al-Ghazzi 2016; in press[3]). This paper only focuses on the early/late Islamic mosque, respectively Building 3 and Building 1, located in Area N6, to the north of the site.

The late Islamic mosque (Building 1)

During the first excavation season (2011), a deep stratigraphic sounding was undertaken along the slope of the major archaeological mound, in Area N6 (Fig. 1). In its southern part, the north-west corner of a large columned hall was exposed. This construction was labelled Building 1, which soon proved to be a mosque (Figs 2–3).

Plan

The entire building is 41 m long and 29 m wide (Fig. 4). The mosque enclosure is divided between an open courtyard (*ṣaḥn*) to the east and a covered prayer hall to the west. The remains of a portico (*riwāq*) run parallel to the northern wall of the courtyard. There are no traces of the foundations of a minaret or of

Figure 2. *An aerial view of Building 1, the prayer hall and the courtyard at the end of the fourth season, 2015 (Th. Sagory, Saudi-French Archaeological Mission in al-Kharj).*

[2] The place name Jawwān (*Gwn*) is associated with those of Kharjān (*Ḫrgn*) and Yamamatān (*Ymmtn*) in two Sabaic inscriptions: ʿAbadān 1, dated to AD 360 (Robin & Gajda 1994) and ʿIrāfa 1 from the fifth century AD (Gajda 2004).

[3] See also the six extensive field reports available on the website https://halshs.archives-ouvertes.fr/

Figure 3. *A digital elevation model of Building 1 and the surrounding area, and the location of the soundings and trenches (J. Schiettecatte, Saudi-French Archaeological Mission in al-Kharj).*

a staircase to the roof. This absence is not unusual in late Islamic mosques of central and eastern Arabia; see, for example, al-Ghaṭghaṭ, al-Qaṭīf, al-Hufūf, Julfār (King 1978: 469; 1980: 254, 258; 1992: 48).

The prayer hall is a rectangle measuring 29 × 12 m.[4] The sanctuary roof rests on three colonnades running parallel to the qibla wall, each including ten columns.

[4] These are rather large dimensions for late Islamic Friday mosques excavated in the Peninsula. Cf. the eighteenth- to nineteenth-century mosque at al-Ruwayḍah (Qatar): prayer hall 12.5 × 6.5 m (Petersen et al. 2016: 334–335); the eighteenth-century mosque at al-Furayḥah (Qatar): prayer hall *c.*18 × 12 m (Rees, Richter & Walmsley 2011: fig. 4); or the fifteenth- to seventeenth-century mosques at Julfār: prayer hall 20 × 20 m in Mosque 1 and 27 × 17 m in Mosque 2 (King 1992). Although larger, the Julfār mosques had no courtyard.

FIGURE 4. *A plan of Building 1 (light grey), Building 3 (dark grey), and the surrounding area (J. Schiettecatte, Saudi-French Archaeological Mission in al-Kharj).*

To enter the prayer hall, eleven thresholds were built between the columns. Two rows of flat stones were set in a mud mortar. Stones appear to have come from pits P. 185 and P. 186, dug for the reuse of building material from the previous Building 3.

This mosque had two mihrabs contained in the thickness of the wall, a large central one and a smaller one in the southern half of the qibla wall (W. 006). The central mihrab niche is rectangular and does not project onto the exterior surface of the qibla wall. No traces of a built minbar were found next to the mihrab except for a small plaster step in the last stage of occupation. The minbar was probably a movable wooden structure. In the southern end of the western nave, a massive mud-brick stepped podium (St. 089) functioned as a small staircase leading to a doorway in the qibla wall, in the south-west corner of Building 1;[5] it was bricked up during the last stages of occupation. In the southern end of the central nave, two walls added between abutments W. 034 and W. 035 and columns Co. 023 and Co. 024, delimit a large recess, which might have been used for the storage of books, manuscripts, or prayer mats. There was space in each nave for *c.*32–37 worshippers (width *c.*0.7–0.8 m/worshipper). If an extra person was added between each column — in other words, another twenty people — the prayer hall could have hosted about 125 worshippers.

Stratigraphy

The stratigraphic sequence of Building 1 shows four stages of occupation of the mosque (Building 1-I to 1-IV), followed by the collapse and abandonment of the area (Building 1-V) (Fig. 5).

Building 1-I: Building 1 was built above an earlier mosque (Building 3). After they were levelled off, the walls and pillars of Building 3 were used as the foundations for the construction of the new building. Peripheral walls were built above those of the previous mosque. Plaster floor F. 015, laid during the last stage of occupation of Building 3, was cleaned and restored with packed clayish earth. A semi-circular recess (Ni. 049) was dug in the southern part of the qibla wall; it could have been used as a second mihrab or a recessed minbar. The western and central rows of columns were built directly on this plaster floor; the eastern row of columns was built above the pavement of the courtyard of Building 3 (F. 253). A 15–30 cm-thick layer of orange aeolian sand gradually covered the entire surface of the prayer hall (see Fig. 5: Uf 030).

Building 1-II: parallel to the north wall of the courtyard, nine small columns were built above a thick, hard, and uneven surface. They are *c.*0.4 m in diameter and delineate a covered portico (*riwāq*) bordering the northern side of the courtyard. A capital constructed of mud bricks and large flat stones (St. 172) was lying in the sand and associated with the fallen shaft of a small column (Co. 193). Judging by the different fragments of this column and its capital, the minimum height of the small columns in the portico was 1.72 m. The capital has an inverted crowstep profile; it measures 80 × 70 × 36 cm. In the prayer hall, a thin crust of clayish sand (F. 014) had hardened as a result of constant traffic and by the presence of mats. More than twenty footprints were found, as well as the imprints of palm-leaf mats. Floor F. 014 was gradually covered by a *c.*20–30 cm-thick layer of soft brown-orange sand punctuated by thin layers of crusty sand (temporary floors).

Building 1-III: this stage is characterized by the restoration of the mud-brick walls enclosing the two mihrabs (Ni. 160 and Ni. 049) after they collapsed; the bricking-up of the doorway in the south-west corner of the prayer hall; the application of a new mud coating on the qibla wall; and the replacement of two damaged columns with rectangular pillars (W. 032 and W. 067). This phase of occupation is also characterized on the ground by a new floor (see Fig. 5: F. 046), a thin hardened sandy crust, patchily preserved and showing footprints and mat imprints. At this stage, the columns of the portico as well as the walls of dwellings to the south of the courtyard had already collapsed. This stage bears the signs of makeshift repairs in a decayed building.

Building 1-IV: in the eastern row of columns separating the courtyard and the prayer hall, small mud-brick walls, five to six courses high, were built between the columns, except for the central part, thus restricting access to the prayer hall. These flimsy walls were built directly on a

[5] The presence of a second entrance to the mosque in the qibla wall has been observed on several occasions, either to give access to a fortified building, e.g. Sudūs (Najd) (King 1978: 480), or for the personal use of the imam when entering the mosque, e.g. al-Mābiyāt (Ḥijāz) (al-Talhi et al. 1986: 59). See also the mosque at Khaybar (King 1986: 52).

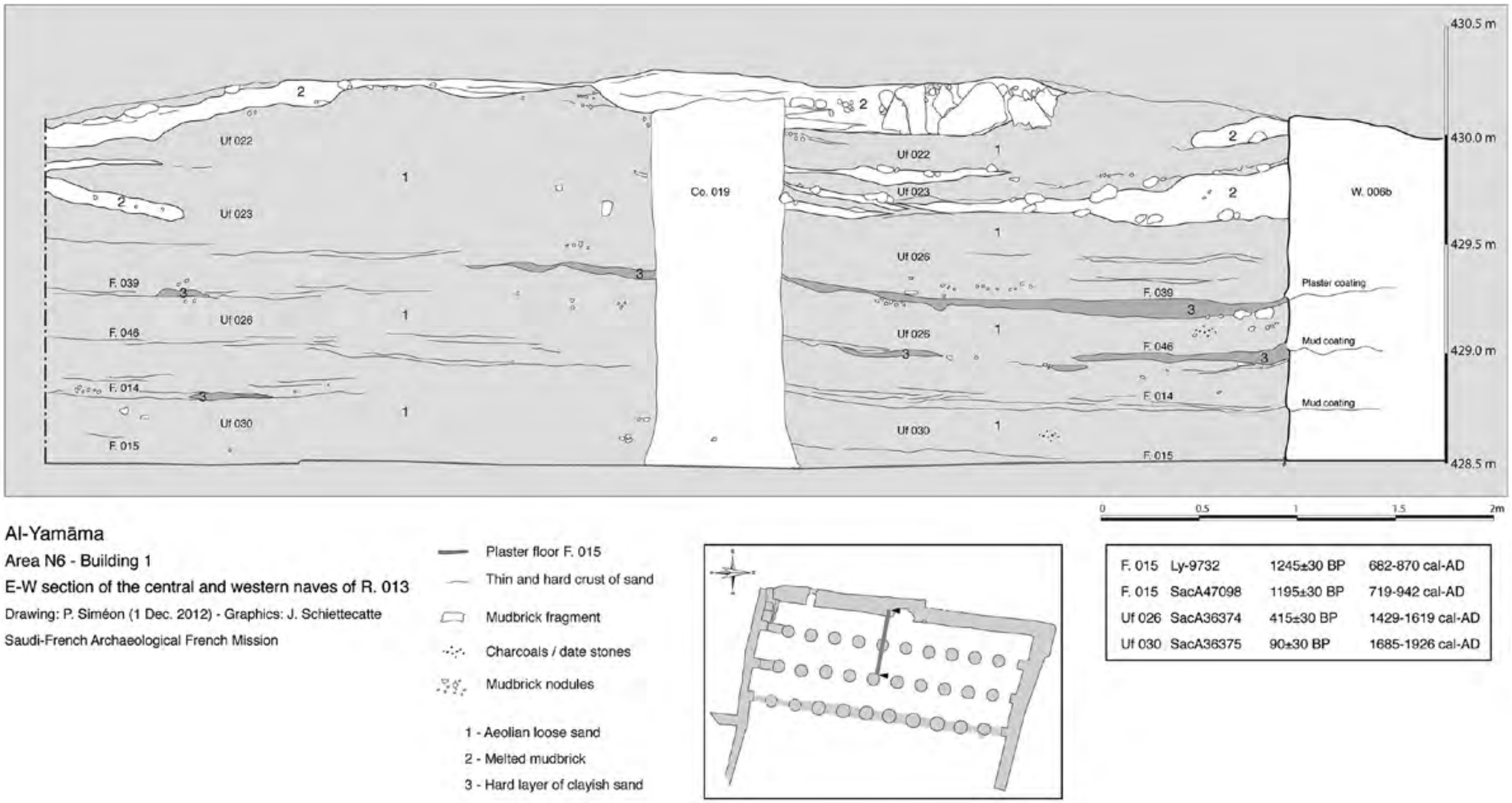

FIGURE 5. *Building 1: stratigraphic section of the western and central naves of the prayer hall, from east to west (drawing: P. Siméon; graphics: J. Schiettecatte, Saudi-French Archaeological Mission in al-Kharj).*

sand accumulation. A white plaster coating was applied on the walls of the mihrab. The final remnants of this occupation level are represented by a crust of hardened sandy clay preserved in patches (see Fig. 5: F. 039). In the southern end of the eastern nave, footprints had left their marks in the mud and the remains of a palm-leaf mat were once again visible in the sand. Above floor F. 039, the sediment was a mix of natural aeolian sand deposit, collapsed mud bricks from the superstructures, and degraded mud bricks resulting from weathering of the collapse.

Chronology: a late Islamic mosque (sixteenth–eighteenth century)

The four architectural phases of Building 1 each date to the late Islamic period. Each one of them is characterized by architectural alterations, a new floor, and a new mud or plaster coating of the inner walls.

Radiocarbon dating (Building 1-I and 1-II): two samples of charcoal from Building 1-I layers and two others from Building 1-II layers were radiocarbon dated (respectively SacA36372 & SacA36375, and SacA36373 & SacA36374; see Fig. 6). Both Buildings 1-I and 1-II yielded a sample dated to the early fifteenth–early seventeenth century and another to the late seventeenth–early twentieth century. The calibration plateau effect of the three last centuries does not allow a more accurate determination of the chronological range. Moreover, the nature of the analysed charcoals is undetermined and an old wood effect cannot be ruled out. We can thus only consider these results as a *terminus post quem*.

Dating of the artefacts (Buildings 1-II and 1-III): within the time span determined by radiocarbon dating, a few artefacts point to an occupation mostly limited to the late sixteenth–eighteenth century. In Building 1-II, a D-shaped post-medieval gunflint from a flintlock rifle (Y.086.2) belongs to a type of gunflint that was widespread from 1550 onwards (de Lotbiniere 1984: 206).[6] The presence of two lead musket bullets (Y.105.2 and Y.105.4) is consistent with this date. In Building 1-III, Batavian ware was found in the shape of a porcelain cup fragment with underglaze blue painting on the inside and a chocolate glaze on the outside (Y.069.1). This eighteenth-century production from Jingdezhen (province of Jiangxi) is a well-attested import in the Gulf, at al-Zubārah (Carter & Sundblad 2011: 30, 260), al-Ruwayḍah (Petersen et al. 2010: 45; 2016: 343), and al-ʿAyn (Power & Sheehan 2012: 301; Power 2015: 12, 19). The presence of a clay pipe bowl (Y.043.1) is once again consistent with this date.

Reconstitution

Two reconstitutions of the roofing can be proposed. In a first, the columns bore a rough capital and thick roofing beams (Fig. 7/b), as described in a mosque at al-Buraydah (King 1978: 489). In a second reconstitution, the columns were surmounted by rectangular impost blocks on which keel arches supported a flat roof (Fig. 7/a). The reconstitution of keel arches is all the more probable because in the portico, north of the courtyard, the presence of a column along with its crow-stepped capital is strongly indicative of their presence (see Figs 2, 7/c). Most of the historical mosques of Najd use arcades with keel arches, running parallel to the qibla wall and supporting the roof (King 1978: 467). There are close parallels with the mosques of al-Majmaʿah, Jalājil, Malham, Sudūs (King 1986: 135, 138, 143, 146), and al-Dakhiyyah (al-Raseeni et al. 2001: fig. 111). Although there is no evidence of the roof itself, it is highly likely that it was made in the traditional Najdī way, with *Tamarix* beams, palm thatch, a layer of mud, and plaster.

The early Islamic mosque (Building 3)

Plan and stratigraphy

A closer look at plaster floor F. 015, at the base of Building 1, showed that it had been laid before the construction of the columns and that this floor abutted levelled mud-brick structures belonging to a former construction. All these levelled structures (see Fig. 4: dark grey areas; Fig. 8) constitute a former mosque, Building 3. The visible remains of the surrounding walls (north and south) and the remains of the plaster coating of the qibla wall on the ground indicate that Building 3 was

[6] D-shaped in plan and wedge-shaped in cross section, these gunflints usually correspond to seventeenth- to eighteenth-century productions and the present artefact is comparable to similar gunflints found in seventeenth- to eighteenth-century wrecks: *La Belle* (1684) (www.thestoryoftexas.com/la-belle/the-exhibit/artifacts; accessed 5/12/2017); HMS *Dartmouth* (1690) (de Lotbiniere 1984: fig. 2a); and *Doddington* (1755) (1984: fig. 2c).

AMS Lab #	Location	Nature	Radiocarbon age (^{14}C yrs BP)	Calibrated date Two Sigma Ranges Start–end (relative area)
SacA36375	Area N6 – Uf 030 Building 1-I Late Islamic mosque	Wood charcoal	90 ± 30	cal AD 1685–1732 (0.27) cal AD 1808–1928 (0.73)
SacA36373	Area N6 – Uf 016 Building 1-II Late Islamic mosque	Wood charcoal	130 ± 30	cal AD 1675–1777 (0.40) cal AD 1799–1893 (0.44) cal AD 1905–1941 (0.16)
SacA36372	Area N6 – Uf 013 Building 1-I Late Islamic mosque	Wood charcoal	405 ± 30	cal AD 1434–1521 (0.84) cal AD 1576–1584 (0.01) cal AD 1590–1622 (0.15)
SacA36374	Area N6 – Uf 026 Building 1-II Late Islamic mosque	Wood charcoal	415 ± 30	cal AD 1429–1518 (0.90) cal AD 1594–1618 (0.10)
SacA47098	Area N6 – Floor F. 015 Building 3-III Early Islamic mosque	Charcoal (*Phoenix dactylifera* – trunk)	1195 ± 30	cal AD 719–741 (0.04) cal AD 766–896 (0.94) cal AD 927–942 (0.02)
Ly-9732	Area N6 – Floor F. 015 Building 3-III Early Islamic mosque	Charcoal (*Phoenix dactylifera* – trunk)	1245 ± 30	cal AD 680–779 (0.72) cal AD 788–873 (0.28)
SacA47097	Area N6 – Floor F. 192 Building 3-I Early Islamic mosque	Wood charcoal (*Tamarix* sp. - branch)	1290 ± 30	cal AD 665–769 (1)
SacA49975	Area N6 – Uf 156 Trench B Building 9	Wood charcoal (*Acacia tortilis*)	2220 ± 30	cal BC 374–203 (1)
SacA42321	Area N6 – Uf 148 Trench D Building 5	Carbonized date stone (*Phoenix dactylifera*)	2295 ± 30	cal BC 405–355 (0.79) cal BC 289–233 (0.21)

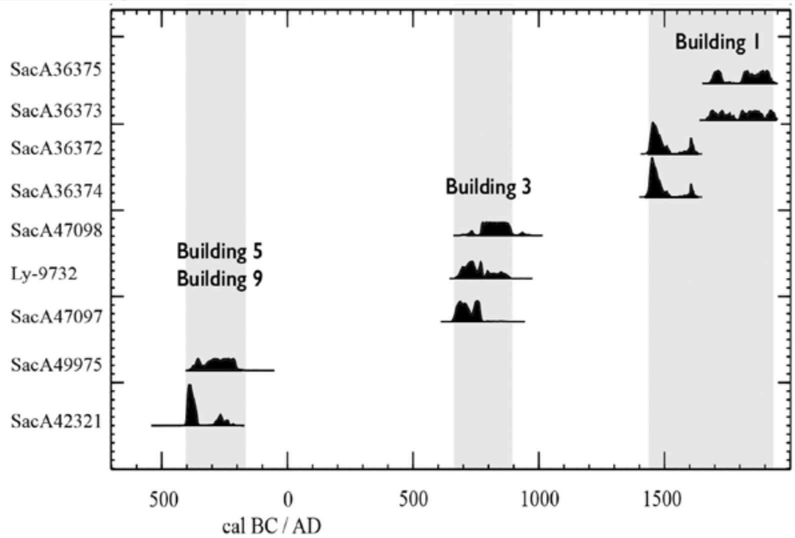

FIGURE 6. *Area N6, Buildings 1 and 3 and Trenches B and D: AMS dating on charcoals. Calibration program: Stuiver M., Reimer P.J. & Reimer R.W. 2017 CALIB 7.1 (www program, available at http://calib.org, accessed 11/22/2017). Calibrated with IntCal13 curve (Reimer et al. 2013).*

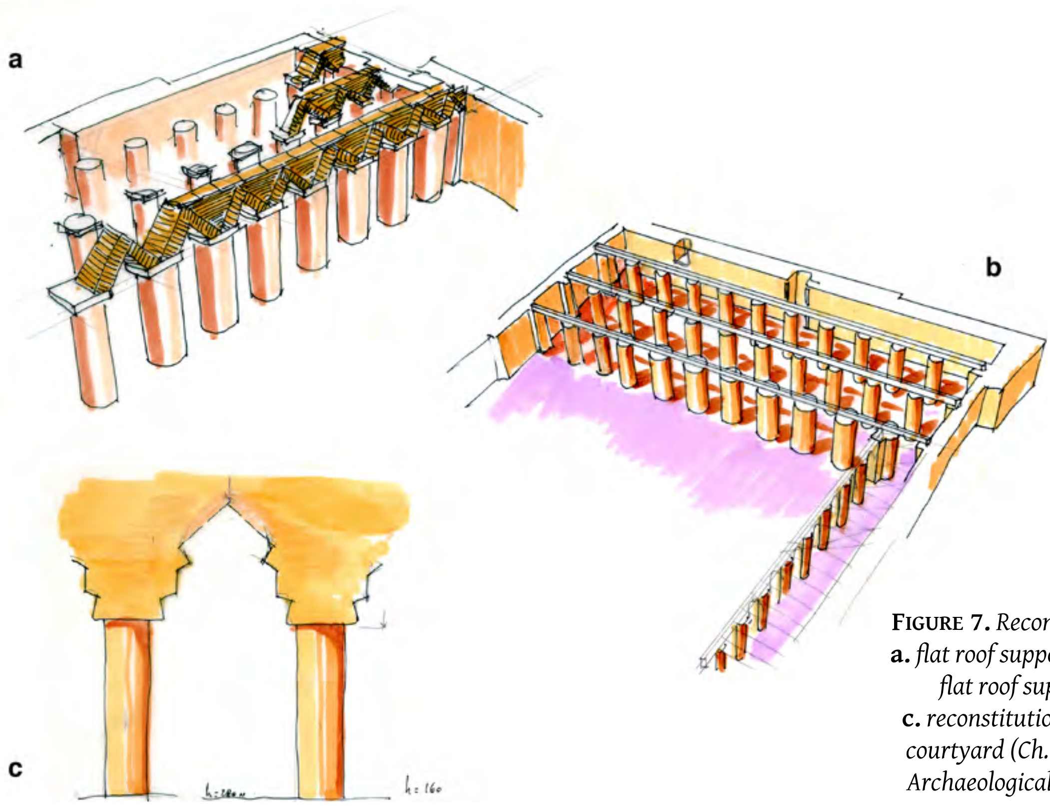

Figure 7. *Reconstitution of Building 1:* **a.** *flat roof supported by keel arches;* **b.** *flat roof supported by beams;* **c.** *reconstitution of the portico in the courtyard (Ch. Darles, Saudi-French Archaeological Mission in al-Kharj).*

almost as long and as wide as Building 1. Building 3 had only two naves separated by wall W. 188 in the southern half and by three pillars (W. 091–093) in the northern half (see Fig. 8). The prayer hall measured 29 × 11 m.

Two soundings were opened within the prayer hall in order to gain a clearer understanding of Building 3 and other previous occupations: Trench A in the southern end of the central nave, and Trench B in the northern end of the western and central naves (see Fig. 3). Three pits dug in F. 015 (P. 185–187) were emptied, which also enhanced the picture of previous occupations (Fig. 9). The purpose of these pits was the reuse of materials from Building 3 during the construction of Building 1.

Our soundings showed that:

- Building 3 had three successive occupations, each characterized by a distinct plaster floor. They are, in chronological order, F. 192 (Building 3-I), F. 182 (Building 3-II), and F. 015 (Building 3-III) (see Fig. 9).
- In Building 3-II, the spaces between pillars W. 091, 092, 093, and St. 216 were closed by a wooden screen whose anchorage system was a grooved plastered trench (St. 288) dug in floor F. 182 (see Fig. 8: left; Fig. 10/c). When F. 015 was laid above F. 182 and St. 288, this wooden screen was removed. This device can be interpreted as a *maqṣūrah*, a screen delineating an enclosed area in a mosque reserved for the use of the ruling elite, and well known in the mosques of al-Baṣrah, al-Kūfah, Damascus, and al-Fusṭāṭ (Bloom & Blair 2009: 461–462: 'Maqṣūra'; Pedersen et al. 2012).
- In Building 3-III, plaster floor F. 015 and the plaster coating on the walls are visible in the mihrab. They show an early Islamic mihrab with a similar shape to the late Islamic one. The latter was simply a direct continuation of the early Islamic mihrab. Moreover, floors F. 192 and F. 182 are visible below F. 015 within the mihrab, which means that Building 3-I and Building 3-II already had a mihrab whose shape cannot be determined.
- In Building 3-III, the plaster coating on the walls shows traces of yellow and dark red paint.

Figure 8. *A plan of the early Islamic mosque: Building 3-II (left) and Building 3-III (right) (J. Schiettecatte, Saudi-French Archaeological Mission in al-Kharj).*

- On plaster floor F. 015, twenty-eight engraved game boards were visible (see distribution on Fig. 8, right). Three distinct games were identified: the alquerque or *qirkat*, the game of 'fourteen' (a kind of mancala game), and chess. This plaster floor was in use in both Building 1 (late Islamic) and Building 3 (early Islamic). However, since the game boards are often covered by the columns of Building 1, we can assume that they were carved during the occupation of Building 3.

Chronology

Since Building 3 was levelled, sherds and artefacts were rare and none of them provided chronological information. The occupation of Building 3 was only dated by ^{14}C analysis of wood charcoals sampled in the plaster of the floors (see Fig. 6).

Building 3-I: the first floor of Building 3 (F. 192) was dated to cal. AD 665–759 (SacA47097: 1290 ± 30). The

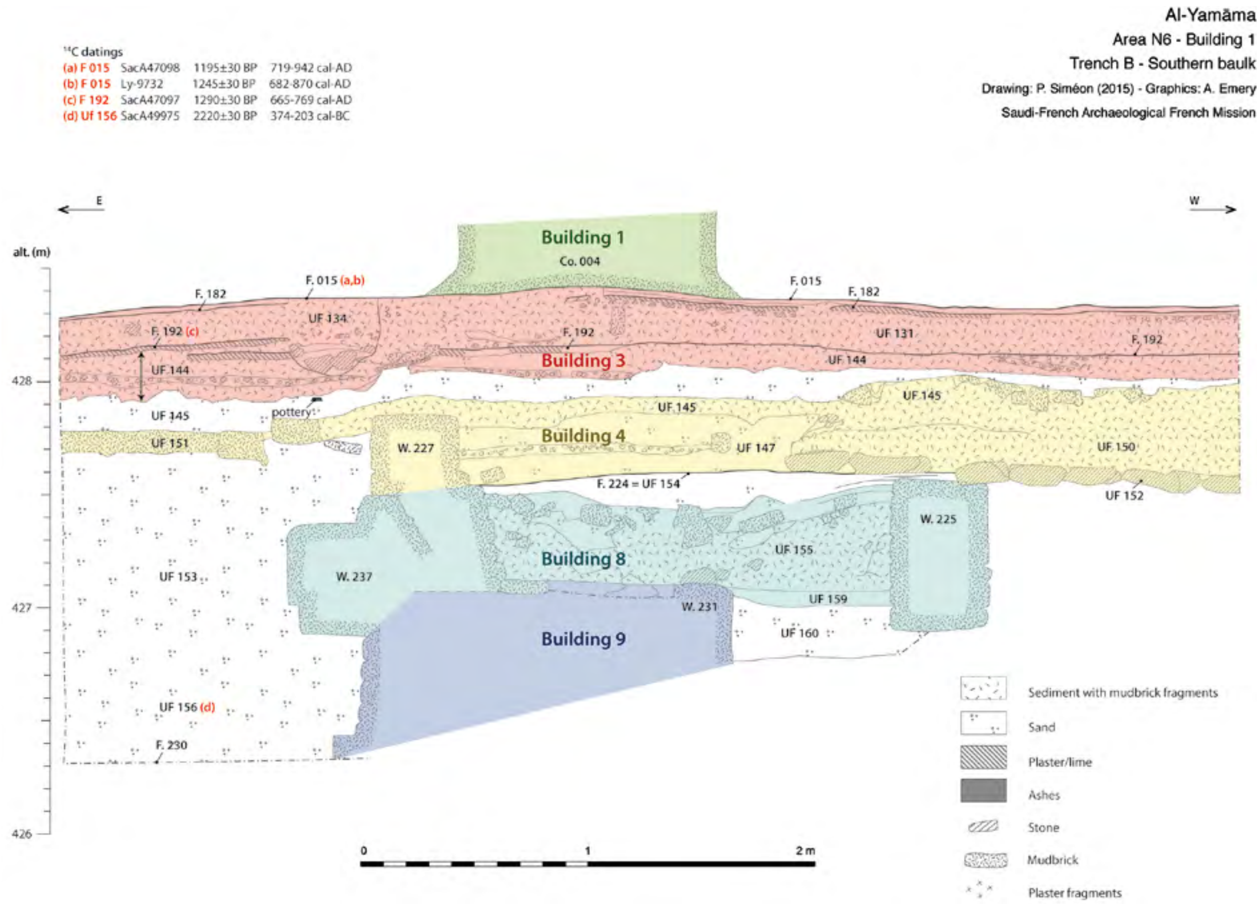

Figure 9. *Trench B: southern section drawing with the main architectural phases highlighted (drawing: P. Siméon; graphics: A. Emery, Saudi-French Archaeological Mission in al-Kharj).*

sample was the carbonized fragment of a small branch of *Tamarix*; an old wood effect is highly unlikely and the dating is considered to be reliable. Considering the presence of a central mihrab in Building 3-I (see above), the construction should rather be dated to the second half of the radiocarbon date range, that is, the first half of the eighth century AD, at a time when projecting niche mihrabs appeared and spread in Islamic religious architecture (Fehérvári 1993).

Building 3-II: it was not possible to date the second floor (F. 182) as the charcoal sampled from it was insufficient to provide a result.

Building 3-III: the third floor (F. 015) was dated thanks to two fragments of date-palm trunk. The first was dated to cal. AD 680–873 (Ly-9732: 1245 ± 30), the second to cal. AD 719–942 (SacA47098: 1195 ± 30) with a high probability for cal. AD 766–896 (94%). Building 3, therefore, was confidently built during the Umayyad period and went through two major phases of restoration. The latter possibly took place after the ʿAlawī leaders of the Banū al-Ukhayḍir established themselves as rulers in al-Yamāmah, from AD 866 onwards, and made Jaww al-Khaḍārim their residence (al-Askar 2002: 139–140; al-Juhany 2002: 45–50). Two centuries later, *c.* AD 1051, Nāṣir-i Khusraw described the inhabitants of al-Yamāmah as ʿAlids, belonging to the sect of the Zaydīs (Nāṣir-i Khusraw 1881: 224). Except for the disappearance of the *maqṣūrah*, these changes of obedience had no visible impact on the local religious architecture.

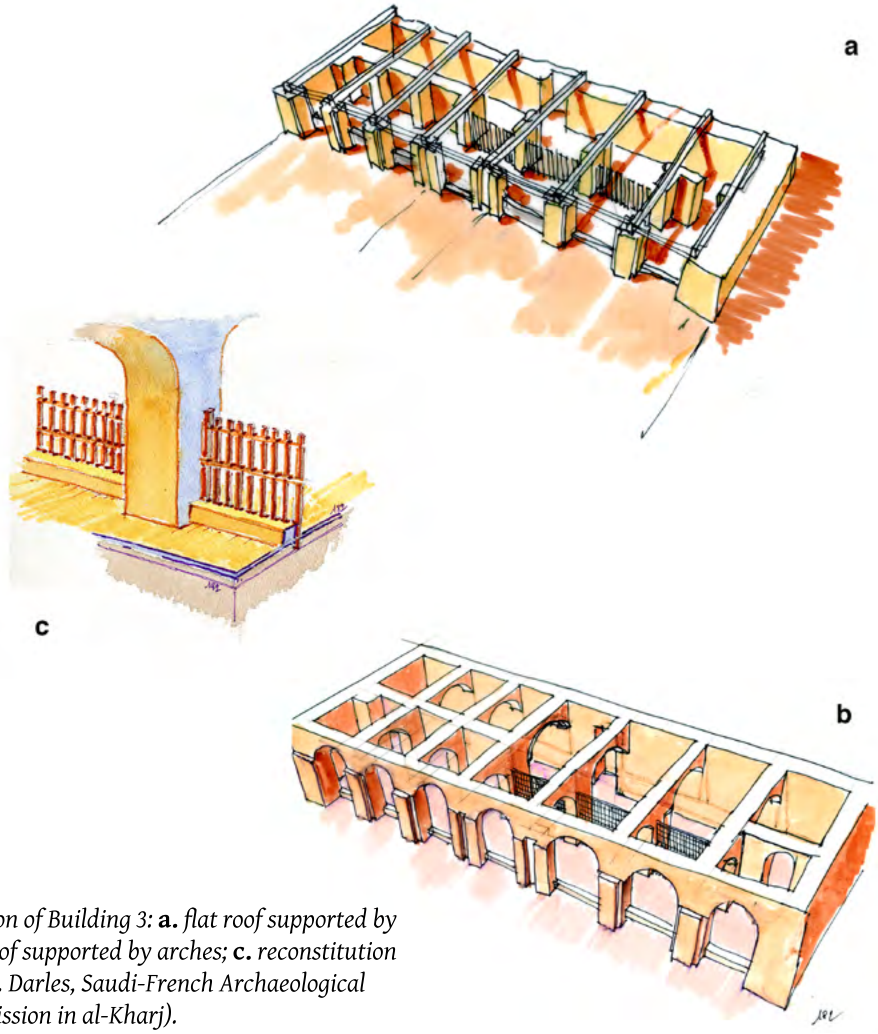

Figure 10. *Reconstitution of Building 3:* **a.** *flat roof supported by wooden beams;* **b.** *flat roof supported by arches;* **c.** *reconstitution of the* maqṣūrah *(Ch. Darles, Saudi-French Archaeological Mission in al-Kharj).*

Reconstitution

A first hypothesis shows a level roof resting directly on walls and piers (see Fig. 10/a). An alternative hypothesis is suggested by the presence of four cruciform pillars east of the prayer hall (W. 201, 203, 121, and 214); their pilasters may have been supporting brick arches (see Fig. 10/b). However, if this is structurally conceivable, we should bear in mind that so far 'the round-headed or the pointed structural arch is unknown in the local architecture, and where it exists in Saudi Arabian territory, seems to owe its presence to external influence' (King 1978: 494).[7]

A previous occupation below the early Islamic mosque

In the different trenches opened in and around the mosque, almost everywhere below the Islamic layers, an aeolian sand accumulation, up to 1 m thick, shows an absence of continuity with the previous occupation. Only Trench B (see Fig. 3: location; Fig. 9: section), in the prayer hall, showed a succession of architectural phases (Buildings 4, 8, and 9) below the early Islamic mosque (Building 3). Pottery sherds from these previous

[7] A ceiling supported by an arcade is an architectural tradition which spread in the southern part of the Peninsula (Oman, Yemen), e.g. the mosque of Qalhāt (Rougeulle, Creissen & Bernard 2012: 347), and the numerous examples published by P. Costa at Bahlāʾ, al-Shawādhnah, Nizwā, Manaḥ, etc. (Costa 2001).

architectural phases are homogeneous and similar to those generally found in fourth- to second-century BC contexts at al-Yamāmah.[8] There was nothing to indicate a late antique occupation.[9] Four samples were radiocarbon dated in the deepest layers of Trench B (Uf 156 — Building 9) and Trench D (Uf 148 — Building 5). They all indicate the same chronological range in the fourth–third century BC (see Fig 6).

Discussion — origins and development of early Islamic Najdī religious architecture

The early Islamic mosque (Building 3) at al-Yamāmah was built ex nihilo, probably in the early eighth century AD. Its shape was not constrained by a previous building or by the urban fabric. In this respect, it offers a rare insight into early Islamic religious architecture in Najd. This building enriches a growing corpus of excavated early Islamic mosques in the Najd and Ḥijāz including:[10]

- Al-Yamāmah, central Najd: Friday mosque dated to the eighth–eleventh century AD.
- Fayd, northern Najd: Friday mosque dated to the 'early Islamic period' (unpublished).
- Al-Rabadhah, central Ḥijāz: western mosque on site C dated to the ninth–tenth century AD (al-Rāshid 1986: 22).
- Jarash, southern Ḥijāz/ʿAsīr: Friday mosque dated to 'the early Islamic period' (al-Zahrani et al. 2017); the excavation yielded ninth- to tenth-century pottery material.
- Al-Ukhdūd (southern Ḥijāz/northern Yemen): *c.* seventh–ninth century AD (al-Zahrani et al. 2001: 17–18).

Interestingly, with the exception of the small mosque at al-Ukhdūd, all these buildings share features which reveal a common early Islamic architectural tradition in both the Ḥijāz and the Najd (Fig. 11):

- A rectangular prayer hall, *c.*20 to 30 m large (al-Yamāmah: 29 m; al-Rabadhah: 22.75 m; Fayd: 22 m; although the dimensions at Jarash are not given, the building looks similar in size).
- Two to three colonnades running parallel to the qibla wall.
- A prayer hall retaining the characteristics of the *līwān*, stretched along the entire length of the qibla wall and separated from the courtyard by a set of openings.
- The absence of a minaret.
- From the eighth century onwards, a mihrab making a projection on the exterior surface of the qibla wall.
- Few decorations, except for the (painted) plaster coating of the qibla wall.

These features define an early Islamic type of mosque specific to both the Ḥijāz and Najd which, unlike the Syrian, Iraqi, and Omani mosques, shows no influence either from outside the Peninsula or from the pre-Islamic South Arabian religious architecture (Costa 2001: 225–227; Bandyopadhyay & Sibley 2003). They reflect the common standard for Islamic religious architecture which was probably established during the caliphate of ʿUmar ibn al-Khaṭṭāb (Johns 1999).

The early Islamic great mosque of al-Yamāmah probably fell into decay after the end of the eleventh century AD, at a time when there is no evidence at all of any occupation. In the sixteenth century AD — perhaps slightly earlier — the remains of this building were levelled off and served as a base for the construction of the late Islamic mosque. The architecture of the latter shows how limited the architectural skills of the builders were: plaster floor F. 015 of Building 3 was used as a support for the over 1 m-wide columns of Building 1; they had no foundations and were — unnecessarily — excessively large. Nevertheless, the interest lies in the permanence of the previous architectural features. In addition, the sixteenth-century mosque at al-Yamāmah introduces one of the most significant features of nineteenth- to twentieth-century Najdī traditional religious architecture, namely the use of keel arches to support a level roof.

Although the late Islamic mosque at al-Yamāmah does not already show all the features of nineteenth- to twentieth-century Najdī traditional religious

[8] See Sounding 1 (Mouton, Schiettecatte & Charloux 2016), Sounding 4 (Cuny & Schiettecatte, in press), Trench D (Schiettecatte et al. 2016: 53–96).
[9] So far only textual sources mention the late antique (fourth- to sixth-century AD) occupation of the oasis (Robin & Arbach 2016).
[10] The mosque of ʿUmar bin al-Khaṭṭāb at Dūmat al-Jandal is excluded from this section because of the uncertainty surrounding the date of its construction (Charloux 2012: 41–43).

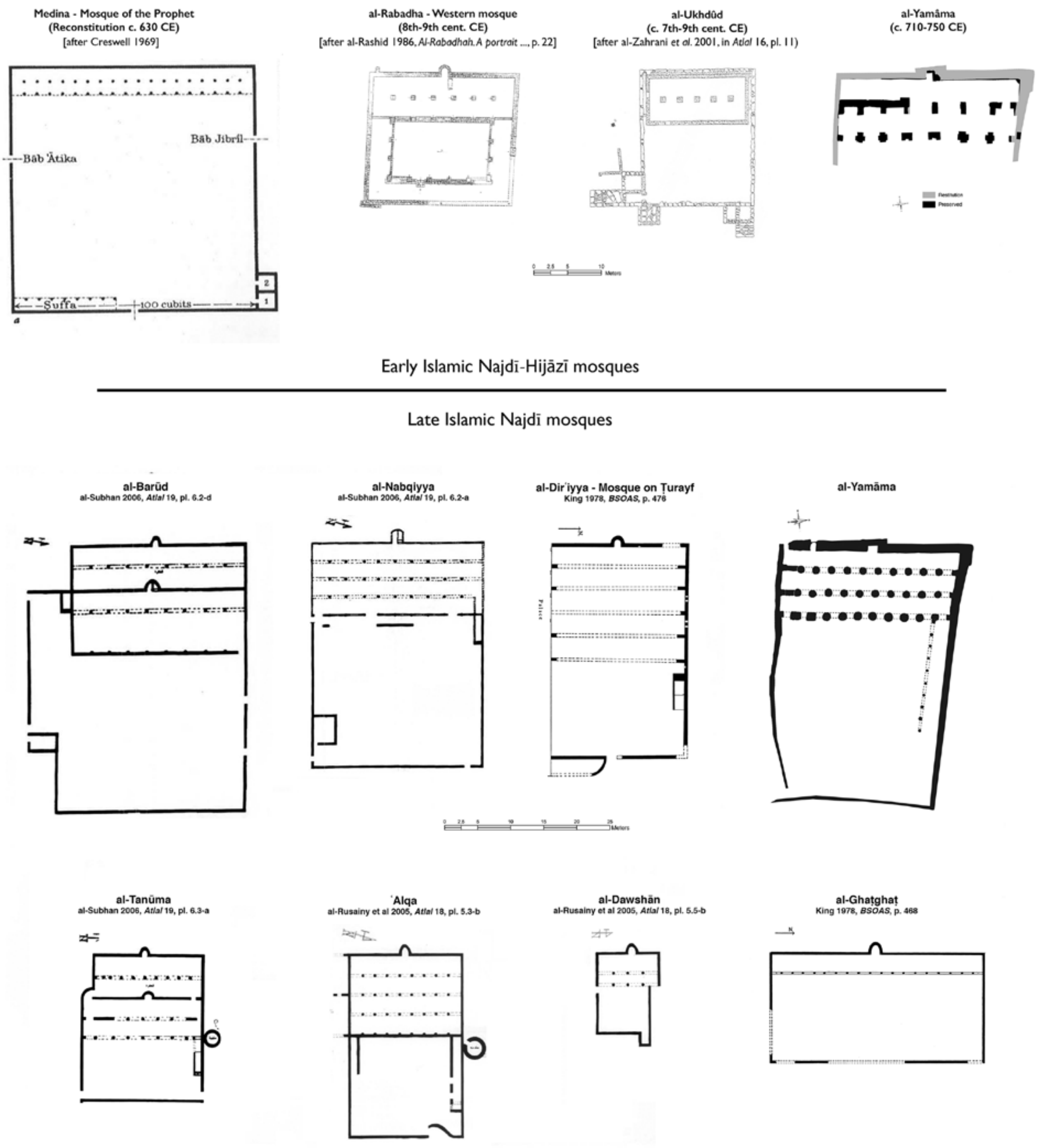

FIGURE 11. *Plans of early Islamic Najdī and Ḥijāzī mosques and late Islamic Najdī mosques (after Creswell 1969; King 1978; al-Rāshid 1986; al-Rusainy et al. 2005; al-Subhan 2006; al-Zahrani et al. 2001).*

architecture[11] — the staircase to the roof of the prayer hall, generally accompanied by rectangular minarets; the minbar; and a protruding mihrab were not identified during excavation — it is the missing link that bridges the gap between early Islamic Najdī and Ḥijāzī religious architecture and nineteenth- to twentieth-century Najdī religious architecture (see Fig. 11).
In this respect, although he had no archaeological data on which he could base his argument, Geoffrey King was perfectly right when he stated that:

> Certain types of Saudi Arabian mosque are related to Islamic architecture traditions which have arisen outside the peninsula whereas other mosques seem to derive from an indigenous Arabian tradition of building. It may well be that these indigenous Arabian mosque traditions preserve very early Islamic forms that perhaps have undergone little evolution over centuries (King 1986: 189).

Acknowledgements

Archaeological excavations at al-Yamāmah were made possible thanks to the financial and technical support of the Saudi Commission for Tourism and National Heritage (SCTH), the French Ministry of Foreign Affairs, the French Embassy in the Kingdom of Saudi Arabia, and the CNRS. Part of this work was carried out under the auspices of the LABEX *Resmed* project (ANR-10-LABX-72) and received financial state aid managed by the Agence Nationale de la Recherche, as part of the programme 'Investissements d'avenir' (ANR-11-IDEX-0004-02).

We are also most grateful to those who put their trust in our work and did their utmost to make fieldwork possible and trouble-free, both in Riyadh and in Paris: HRH Prince Sultan b. Salman b. Abdalaziz, President and Chairman of the Board of Directors of the SCTH, his Excellency Bertrand Besancenot, French Ambassador to the Kingdom of Saudi Arabia, Dr ʿAli al-Ghabban, Vice-President of the SCTH, and Jamal Omar and Dr Abdallah al-Saud, both heads of the Research and Excavation Centre of the SCTH. Many friends and colleagues, too numerous to name, from France, Germany, Pakistan, Saudi Arabia, and Sudan took part in the fieldwork and shared both their experience and their enthusiasm as scholars, students, workmen, drivers, cooks, and jacks-of-all-trades. We thank them all sincerely.

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[11] The traditional mosques of Najd are mainly characterized by a rectangular, flat-roofed sanctuary built against the qibla wall occupying half the mosque enclosure, and an open courtyard filling the rest of the enclosures; one or more colonnades running parallel to the qibla wall; the use of unfired mud brick; a finish in mud or plaster; a decoration confined to the mihrab alone; arcades formed of keel arches running parallel to the qibla wall; and a mihrab protruding beyond the line of the qibla wall (King 1978: 493–494).

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Proceedings of the Seminar for Arabian Studies 49 (2019): 265–274

The Hafit period at Al-Khashbah, Sultanate of Oman: results of four years of excavations and material studies

Conrad Schmidt & Stephanie Döpper

Summary
Al-Khashbah, located approximately 17 km north of the modern city of Sināw, is one of the largest Early Bronze Age sites in the Sultanate of Oman. The University of Tübingen has carried out excavations at the site during the last four years (2015–2018), revealing a significant amount of Hafit-period architecture and finds, including a mud-brick complex (Building I) and a stone tower (Building V). Building I dates to around 2800 cal. BC and has provided evidence of bead and chipped stone workshops. Its layout is comparable to the contemporaneous tower at Hili 8, Phase I. Building V yielded the oldest substantial evidence of copper processing in Oman, dating to the end of the fourth millennium, around 3200 cal. BC. Thus, the archaeological record in Oman can now corroborate archaic texts from Uruk in southern Mesopotamia that mention copper objects from the Gulf. This paper presents the preliminary results of the study of the architecture, metallurgy, lithics, ground-stone tools, and anthracological material from Al-Khashbah. These diverse strands of evidence offer valuable insights into the Hafit-period economy, environment, and lifestyle at Al-Khashbah.

Keywords: Hafit, Al-Khashbah, towers, copper processing, Oman

Introduction

The archaeological research project of the University of Tübingen at Al-Khashbah, Sultanate of Oman, began in 2015. It seeks to investigate changes in the settlement pattern in the region, focusing on the development of complex societies at the end of the fourth and the beginning of the third millennium BC. Al-Khashbah lies about 17 km north of the city of Sināw, in the Wilayat of al-Mudhaiby of the governorate of al-Sharqīyah North in Central Oman. The geography of Al-Khashbah is characterized by a row of shallow limestone outcrops, which cross Wādī Samad from east to west, branching into several arms. Most of the archaeological remains can be found on top or close to these rocky outcrops. Today, sporadic shrubs and acacia tree vegetation dominate the landscape of Al-Khashbah. Not far to the west of the site is another wadi, Wādī ʿIndām, which is one of the biggest wadis in the Sultanate.

An extensive survey of the site in 2015 identified 325 buildings and other structures (Schmidt & Döpper 2017a; 2017b; Döpper & Schmidt 2018). The majority of these date to the Hafit and Umm an-Nar period, followed by a big gap in the occupation of the site. In the seventeenth to nineteenth century Al-Khashbah became an important place for local agriculture, which is attested in particular by wells and *aflāj* in and around the oasis, as well as by small farms with extensive field systems in the vicinity. Most of the archaeological remains of Al-Khashbah date to the Hafit period (3200–2700 BC). These comprise 205 cairn tombs and seven monumental towers made of stone and mud brick. The Hafit tombs are situated almost exclusively on the rocky outcrops, while the contemporary towers were built either in the plain or slightly elevated on the outcrops — the latter always lie directly next to one of the main wadi arms. Excavation during the last four years has resulted in the partial clearance of two monumental buildings, Building I and Building V, which are the focus of this paper.

The late Hafit-period Building I

Building I is situated in Area B, where at least three other Hafit-period towers exist (Fig. 1). As none of these was excavated, it cannot be determined whether all the structures in Area B are contemporaneous and if they belong to the same settlement. Directly to the north of Building I lies Building XI, one of the other Hafit-

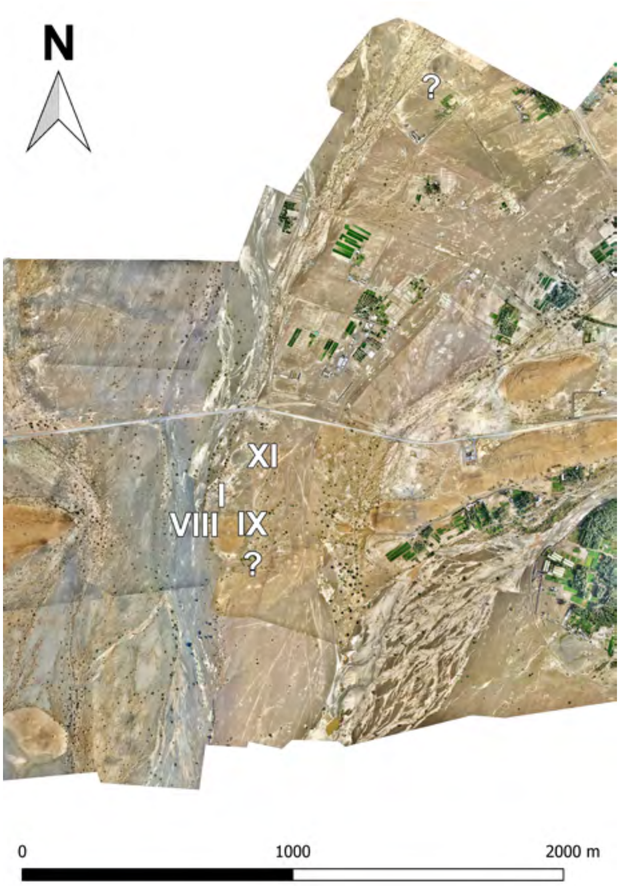

FIGURE 1. *Area B and Area F at Al-Khashbah with Hafit-period buildings (I, VIII, IX, XI) and other possible Hafit-period remains.*

period buildings in Area B. It comprises a small mound that is surrounded by two concentric ditches of 65 to 80 m in diameter, clearly visible in the magnetogram (Herrmann et al. 2018). The other two buildings, VIII and IX, are located south of Building I on a small rocky outcrop. Preservation of the monumental buildings VIII and IX is quite poor, with only minor parts remaining of their walls (Schmidt & Döpper 2017b: 221, fig. 10). In a foot survey, this area yielded the highest density of slag in the entire survey area of Al-Khashbah (Schmidt & Döpper 2017a: 129, Abb. 5). High concentrations of slag are typical for all Hafit-period buildings in Al-Khashbah, and were also encountered south of Buildings VIII and IX but so far, no architecture has been identified here (Fig. 1). There is another possible tower in Area F, which lies to the north of Area B (Fig. 1). Consisting of a small mound, it is very similar to Building XI in Area B both in its form and location, namely to the east of the same wadi arm.

The area upon which Building I sits is only about 1 m higher in elevation than the surrounding plain. This is the natural topography of the area and is not the result of earlier building activities at this place. The magnetogram of the site revealed the existence of at least three roughly rectangular structures with rounded corners each measuring *c.*20 x 20 m (Schmidt & Döpper 2017b: 222, fig. 12; Herrmann et al. 2018). In addition, there are smaller anomalies, especially a long structure running north–south in the eastern part of the site, composed of two semi-circles. Prior to the excavations at Building I, a foot survey was also conducted. Lithics made up the majority of finds from this survey, although there was also a number of slag and furnace fragments (Döpper & Schmidt 2018: 171, fig. 1). All these surface finds are clearly associated with the architectural structures visible in the magnetometry.

Excavations at Building I between 2015 and 2018 revealed a spacious late Hafit complex composed of several mud-brick structures. It remains unclear whether they superimpose each other or were a contemporary cluster of structures. Due to erosion and proximity to the surface, only one structure could be completely exposed while the others were only partially preserved. The mud-brick structures are surrounded by ditches that are 3 m deep and 4 m wide (Schmidt & Döpper 2017a: 148, Abb. 27). The authors previously proposed that they might represent drainage ditches (Schmidt & Döpper 2017b: 219). In the 2018 season, a small, square, and very well-constructed stone well came to light in the middle of one of these ditches (Fig. 3/a). As the well was built after sediments had already filled the ditch, the previous interpretation must be modified. The well demonstrates the availability of water at this location. The bottom of the ditch exposed a gravel layer, facilitating the collection of upward-seeping groundwater. Even after the ditch had silted up, the builders of the well must have known that groundwater was present here. Thus, access to groundwater was probably the main reason for establishing Building I at this location.

The area surrounded by the ditches of Building I contains mainly mud-brick architecture (Fig. 2). Characteristic of these structures are small

FIGURE 2. *Excavated area of Building I.*

compartments similar to other towers in Oman (Fig. 3/b), for instance at Bat. Usually, the mud-brick walls consist of a row of rectangular mud bricks (0.4 x 0.6 m) edged by two half-sized rows of mud bricks. A variation of this kind of construction is the combination of mud brick and stone. In this case, the two smaller mud-brick rows are replaced by stones (Fig. 3/c). Although completely stone-built walls are not common in Building I, they do exist, especially in the western part of the building (Fig. 3/d). This part of the building also contains the only evidence of more than one building phase. The rest of the complex consists of a single building phase. Additionally, the southern part of Building I consists solely of stone architecture (Fig. 4). The eastern part of this stone architecture is completely preserved. There is a stone-paved corridor, which separates the outer wall from a square platform in the middle of the structure. The western part is destroyed. The stone architecture follows exactly the edge of its surrounding ditches (see Fig. 2).

Building I dates to the late Hafit period. Analysis of charcoal from several fire pits and stratified accumulations within the building provide highly consistent dates of around 2800 cal. BC. Yet the material has also provided some older dates, which are considered to be older than the building itself (Fig. 5). Architectural comparisons for Building I can be found in the contemporary mud-brick tower of Hili 8, Phase I, in the UAE (Cleuziou 1989). Although Hili 8 is better preserved, the sub-rectangular ground plan and the

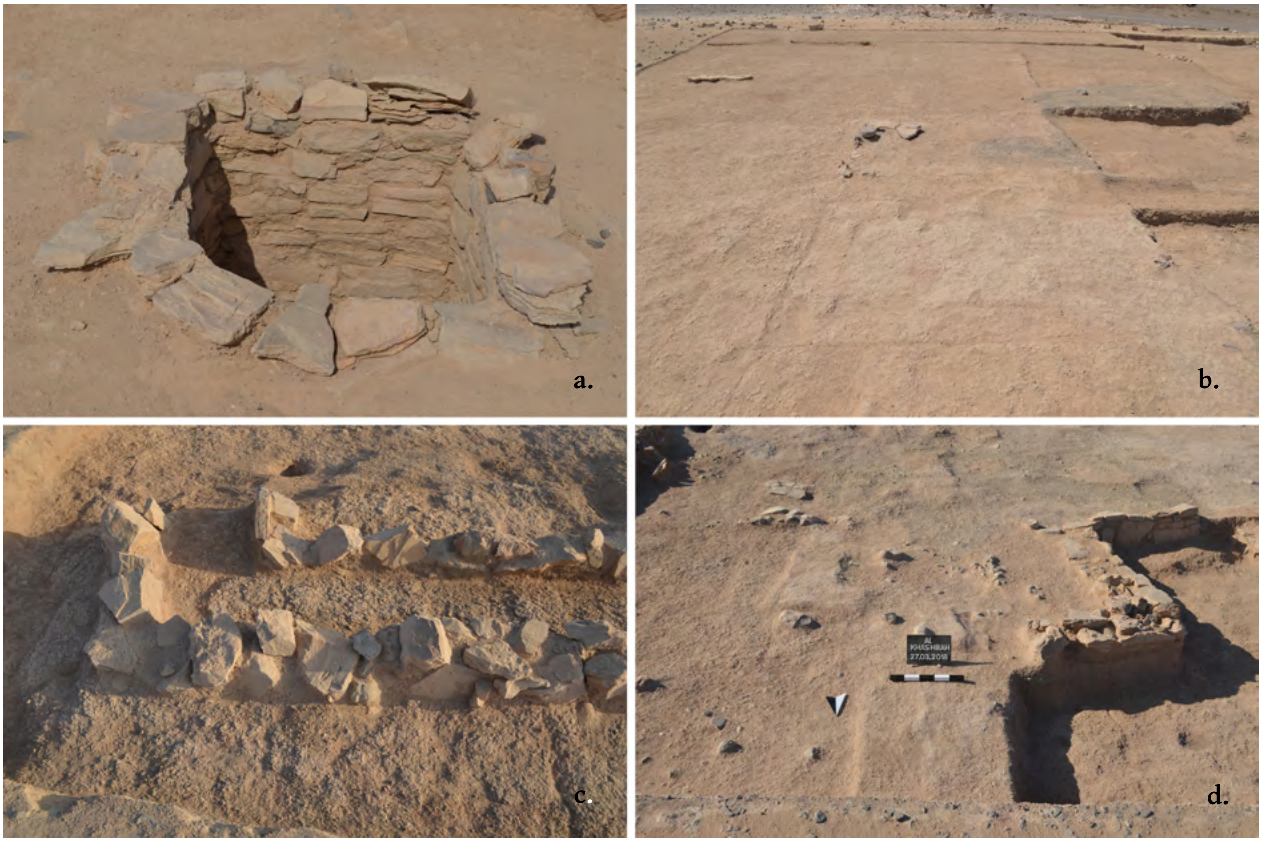

Figure 3. a. *A well cutting the filling of a ditch;* **b.** *mud-brick compartments;* **c.** *a wall built with a combination of mud brick and stone;* **d.** *an area with two building phases in the west.*

Figure 4. *Stone architecture in the south with surrounding ditches.*

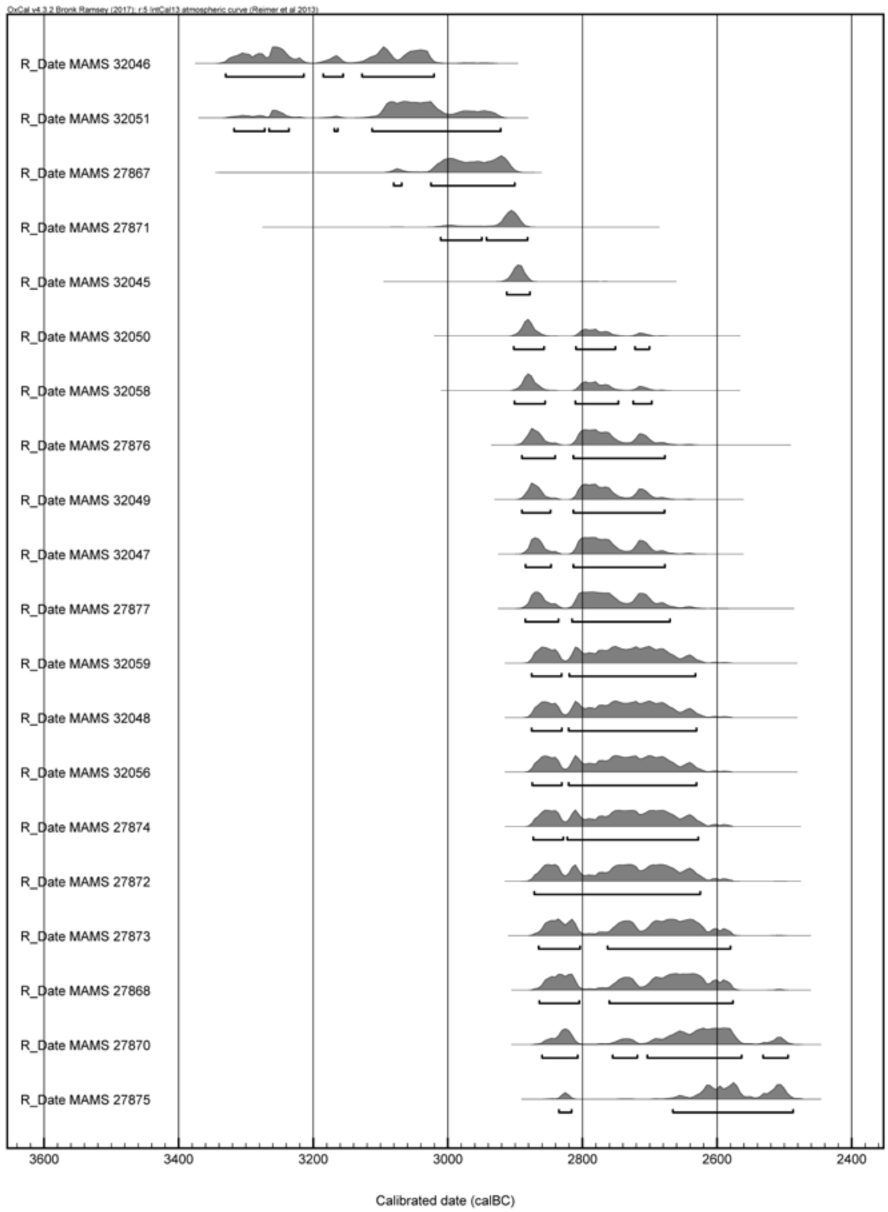

FIGURE 5. *Calibrated* ^{14}*C dates for Building I in Al-Khashbah (lab: R. Friedrich, Curt-Engelhorn-Zentrum Archäometrie, Mannheim, Germany; INTCAL13 [Reimer et al. 2013], and SwissCal 1.0 [L. Wacker, ETH-Zürich]) processed with OxCal v4.3.2 (Bronk Ramsey 2017).*

internal layout of small compartments are very similar to Building I at Al-Khashbah.

The various groups of finds from Building I provide valuable information on the activities conducted here. One hundred pieces of ground-stone tools have been found (Döpper, in press), including large upper and lower grinding stones and hammer stones.[1] Both types were most likely used in the course of the copper processing that is attested at the site. Copper processing was not the only activity undertaken in Building I. There are clear indications of a bead workshop, as attested by numerous beads and especially semi-finished products (Fig. 6/a–b). Other objects of personal adornment include pendants and perforated shell rectangles belonging to bracelets (Schmidt & Döpper, in press). Together with the many shell beads, these objects demonstrate the far-reaching contacts of Al-Khashbah with the coast. A

[1] All ground-stone tools from al-Khashbah are published online as 3D models: www.archaeoman.de/en/al-khashbah-3d-modelle-funde/

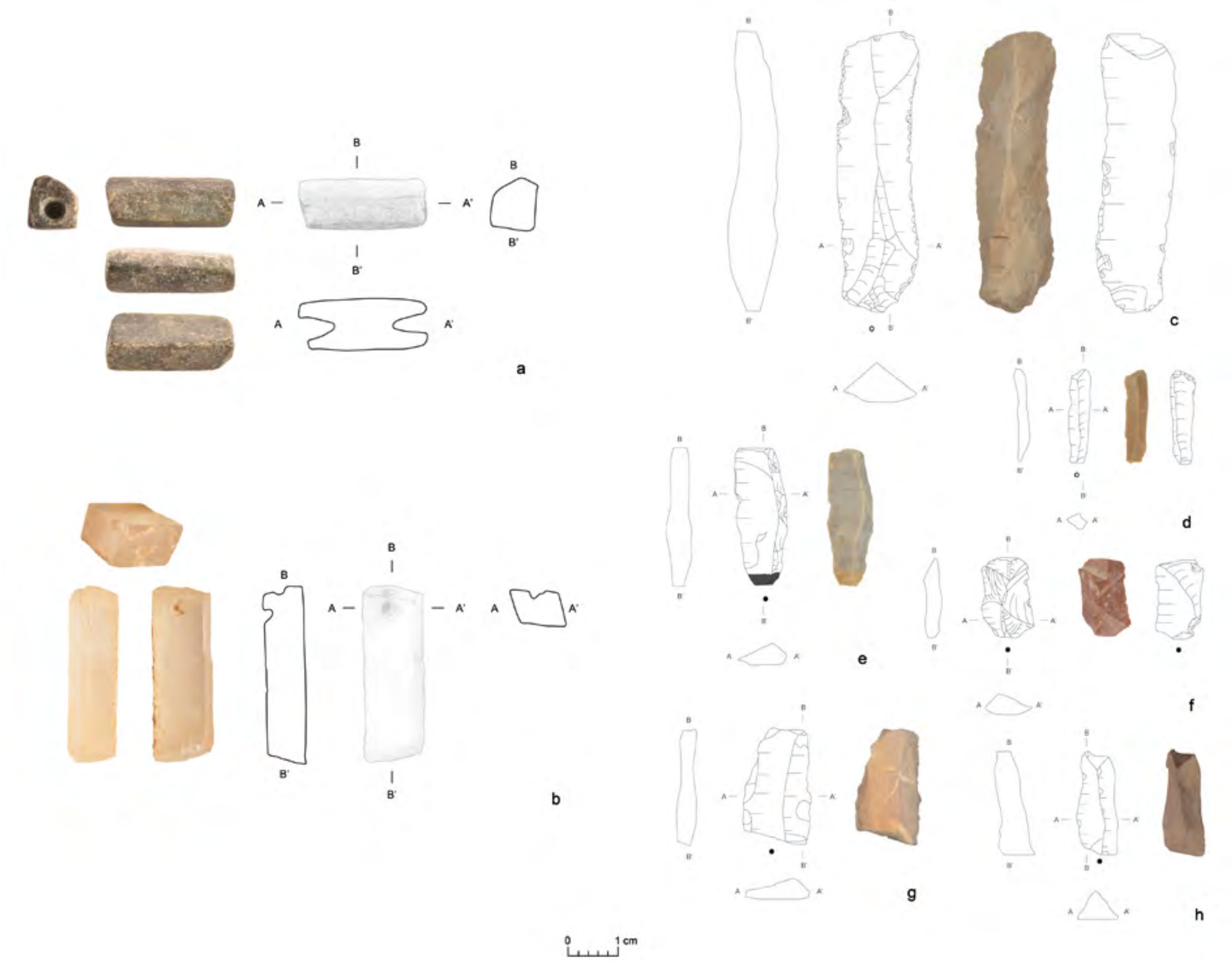

Figure 6. a–b. *Semi-finished beads;* **c–h.** *lithic blades.*

very important group of objects are the chipped stone artefacts. The presence of both tools and debris from their production clearly shows that the lithic objects were produced on-site. The analysed material from the foot survey consisted of 87.1% flakes; and sixty-eight blades (Fig. 6/c–h) and eighteen cores, as well as four scrapers, three lamina flakes, three arrowheads, one point, and two piercers. This assemblage is very interesting for the reconstruction of the socio-economic conditions of the Hafit period in Central Oman.

Anthracological analyses, conducted by Katleen Deckers from the University of Tübingen, were initiated in 2017 (Deckers, Döpper & Schmidt, in press). Preliminary results for Building I and Building V show that the wood burned at Al-Khashbah at the end of the fourth and the beginning of the third millennium BC mainly consisted of *Ziziphus*, *Acacia*, and *Tamarix*. Additionally, *Avicennia marina*, a species of mangrove, indicates contacts with the coast. Date palm was attested as well, but no differentiation between wild and cultivated date palm is possible.

The early Hafit-period Building V

The second area of intensive excavations is a monumental tower, Building V (Fig. 7). The tower is located on the eastern edge of a long rocky outcrop. Outside the tower, excavations revealed a series of three smaller stone walls to the south. These three walls do not run parallel to each other or to the outer ring-wall of the main tower (Schmidt & Döpper 2017b: 220, fig. 8). Thick accumulations of stone debris and waste from copper processing, such as slags, prills, as well as furnace and crucible fragments were present between the tower and these smaller stone walls. The outer ring-wall is built of large limestone blocks. It has a diameter of 25 m and a preserved height of up to 1.10 m. The most surprising result in this context is that this stone ring-wall does not represent the oldest phase of Building V but replaces a former mud-brick wall at the same location, of which only fragmentary sections have survived. The foundation pit for the stone wall was so broad that a massive packing of large stones was necessary to fill the gap (Fig. 8).

Apart from the outer mud-brick wall, the layout of the original tower is very well preserved in the form of compartments made of mud brick and stone walls (Fig. 7) (Schmidt & Döpper, in press: Beilage 2). While the eastern part of the excavated area is dominated by stone walls (Fig. 9), the western part is solely made up of mud-brick architecture. Occasionally, stone and mud-brick walls were used together, similar to the construction method used in some late Hafit walls in Building I. At a later stage some stone walls were added to the compartments. Unlike most of the other walls, they do not rest on the bedrock but on the accumulation of debris that fills the rooms.

One of the most important discoveries at Building V is its date. Charcoal samples from the accumulations outside the ring-wall, from fire pits on the bedrock on which the tower is founded and from the rooms inside the building, all associated with substantial copper

Figure 7. *An aerial view of Building V.*

Figure 8. *The remains of an older mud-brick wall cut by the foundation pit for the outer stone wall.*

processing debris, give consistent dates in the early Hafit period, around 3200 cal. BC (Fig. 10). This makes Building V the oldest known monumental building in Oman. The construction of the outer stone wall and all the modifications of the interior walls of the building also fall within this date. A second group of charcoal samples dates to the very end of the Hafit period, around 2800 to 2700 cal. BC. These samples come from a yellowish material close to the surface sealing the fourth-millennium remains.

Some of the finds from Building V are similar to those from Building I, such as large ground-stone tools, most likely used to grind copper during the processing, as well as hammer stones for crushing the ore or slag. Additionally, large seashells have been found at both Hafit-period buildings. In contrast to the wider variety of activities attested at Building I, other objects from Building V indicate that it had a rather specialized function as a copper workshop. Directly above the bedrock on which the tower is founded, is a thick layer of copper-rich slag. Together with the prills, the thousands of furnace and crucible fragments show that the smelting was conducted close to the tower. It is interesting to note that no pottery was found either at Building V or Building I.

Figure 9. *The interior of Building V with stone wall compartments.*

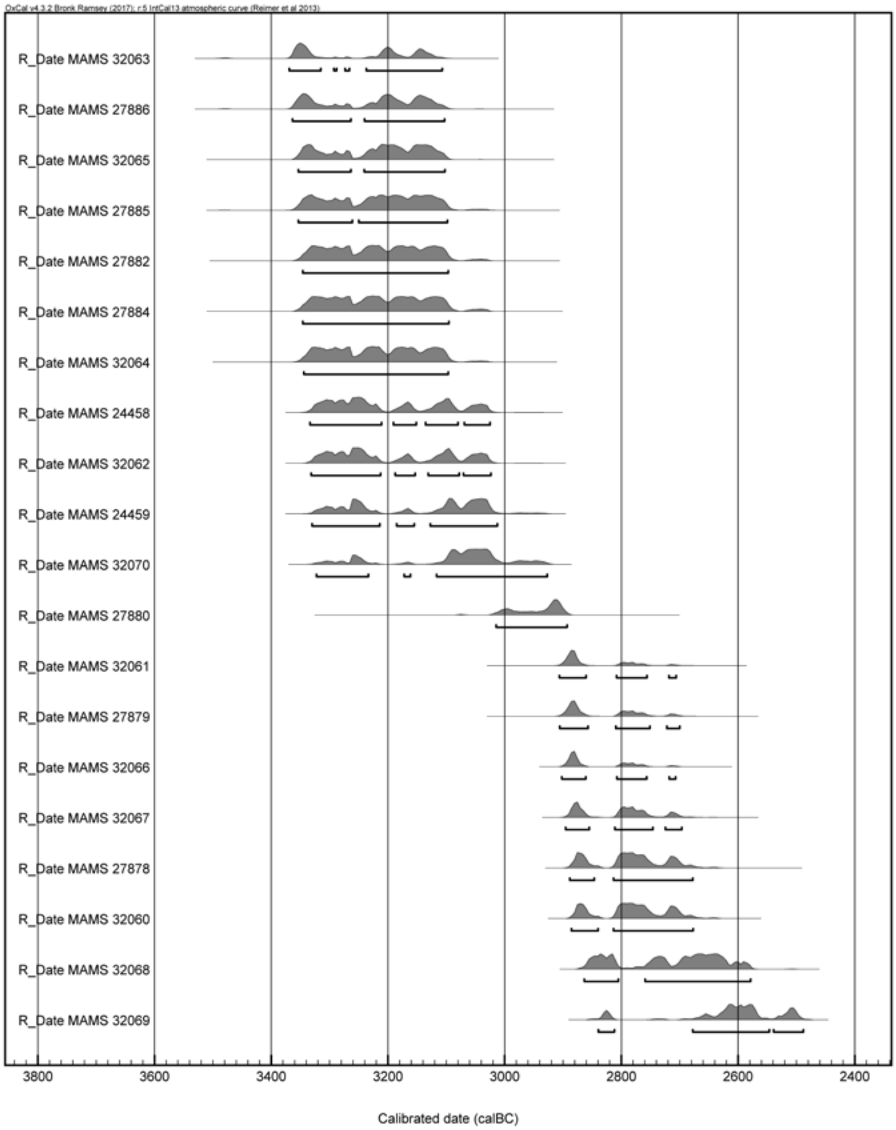

FIGURE 10. *Calibrated* ^{14}C *dates for Building V in Al-Khashbah (lab: R. Friedrich, Curt-Engelhorn-Zentrum Archäometrie, Mannheim, Germany; INTCAL13 [Reimer et al. 2013], and SwissCal 1.0 [L. Wacker, ETH-Zürich]) processed with OxCal v4.3.2 (Bronk Ramsey 2017).*

Conclusions

Both of the excavated monumental buildings at Al-Khashbah provide valuable insights into the socio-economic conditions of the otherwise sparsely attested Hafit period in Central Oman. Building I is a large and diverse late Hafit-period complex with parallels to Hili 8, Phase I in the UAE. It offers manifold evidence for a range of activities, including bead and chipped stone workshops, as well as small-scale copper processing. The early Hafit-period Building V yields the oldest substantial evidence of copper processing in Oman to date,[2] preceding the site of al-Maysar by 1000 years. It is roughly contemporary with the archaic texts from Uruk in southern Mesopotamia that mention copper objects from the Arab-Persian Gulf (Englund 1983). Thus, for the first time, archaeological and written records fit together.

[2] Further evidence for the use and working of copper in the Hafit period comes from the coastal sites of Ra's al-Hamra RH-10 and Ra's al-Hadd HD-6 (Giardino 2015).

Acknowledgements

The authors would like to thank the Ministry of Heritage and Culture of the Sultanate of Oman for its continuous support. Funding for the Al-Khashbah project was provided by the German Research Foundation (DFG), and by the Future Concept of the University of Tübingen, Platform 4 'Education – Society – Norms – Ethical Reflection', within the framework of the Excellence Initiative. The radiocarbon samples were measured in the Curt-Engelhorn-Centre for Archaeometry, Mannheim. Katleen Deckers analysed the charcoal samples and Ullrich Ochs studied the chipped stone assemblage. We would also like to thank all the students who participated in the field project of Al-Khashbah during the 2015–2018 seasons.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 275–282

Early Islamic and Ancient North Arabian graffiti and petroglyphs in Tabūk province — Saudi-Japanese al-Jawf/Tabūk Archaeological Project (JTAP), March 2017 field season (poster)

Risa Tokunaga, Sumio Fujii & Takuro Adachi

Summary
This paper provides an overview of early Islamic and Ancient North Arabian (ANA) graffiti and petroglyphs discovered by the Saudi-Japanese mission in Tabūk province, Saudi Arabia. Along with excavations in Wādī al-Muḥarraq, the March 2017 field season also focused on the epigraphic survey of Wādī al-Khirqah (*c.*75 km north-west of Tabūk), which yielded 105 new early Islamic Arabic graffiti and thirty-three ANA graffiti with some petroglyphs. Although no dated graffiti were found, we were able to establish the relative chronology of twenty-eight early Islamic graffiti by using the genealogies shown in the personal names. As for the ANA graffiti, the majority are Hismaic, but some show characteristics of Thamudic D. In addition to some graffiti, the team also found numerous petroglyphs of animals and humans in Wādī al-Ghubayy, al-Suwaylimiyyah, and Wādī Ḍamm. The importance of these petroglyphs is immense, as they provide us with clues for approaching the lives and spiritual aspects of the ancient hunters and pastoral people in the Ḥismā highlands.

Keywords: Arabic, Ancient North Arabian, Hismaic, graffiti, petroglyph

Introduction

The Saudi-Japanese al-Jawf/Tabūk Archaeological Project (JTAP) led by Prof. Sumio Fujii (Kanazawa University), and the Saudi Commission for Tourism & National Heritage (SCTH) conducted field surveys in the al-Jawf and Tabūk provinces of Saudi Arabia to clarify the process of pastoral nomadization in the Arabian Peninsula from the Neolithic to the Early Bronze Age. During the course of the survey, however, the team discovered a number of ancient and early Islamic graffiti as well as petroglyphs. In the March 2017 field season, along with excavations in Wādī al-Muḥarraq, the team conducted an epigraphic survey in Wādī al-Khirqah, which had the largest concentration of graffiti, and also visited supposedly prehistoric petroglyph sites in al-Suwaylimiyyah, Wādī al-Ghubayy, and Wādī Ḍamm.

Locations of the sites

The surveyed area lies in the southern part of the Ḥismā highlands in Tabūk province. Wādī al-Khirqah is situated *c.*75 km north-west of Tabūk (Fig. 1), about 20 km west of Darb al-Bakrah, the ancient major trade route that connects Hegra (Madāʾin Ṣāliḥ) and Petra via al-Qurayyah.[1] The locations of al-Suwaylimiyyah, Wādī al-Ghubayy, and Wādī Ḍamm are shown in Figure 1.

Wādī al-Khirqah graffiti site

The graffiti site of Wādī al-Khirqah is divided into three groups. Group I is a concentration of early Islamic graffiti and Group II, situated *c.*130 m south of Group I, is a concentration of ANA graffiti. Group III, located between them, is a small group with only two early Islamic graffiti with some petroglyphs. Several natural water reservoirs were observed on the wadi bed near Group II. It is highly probable that people used to stop at this place for water and left graffiti there.

Early Islamic graffiti

A total of 105 early Islamic Arabic graffiti were registered in Wādī al-Khirqah. The graffiti contain neither the *nisbah* (adjective indicating the person's place of origin or affiliation) in the personal names nor

[1] For the survey of Darb al-Bakrah, see al-Ghabban 2007.

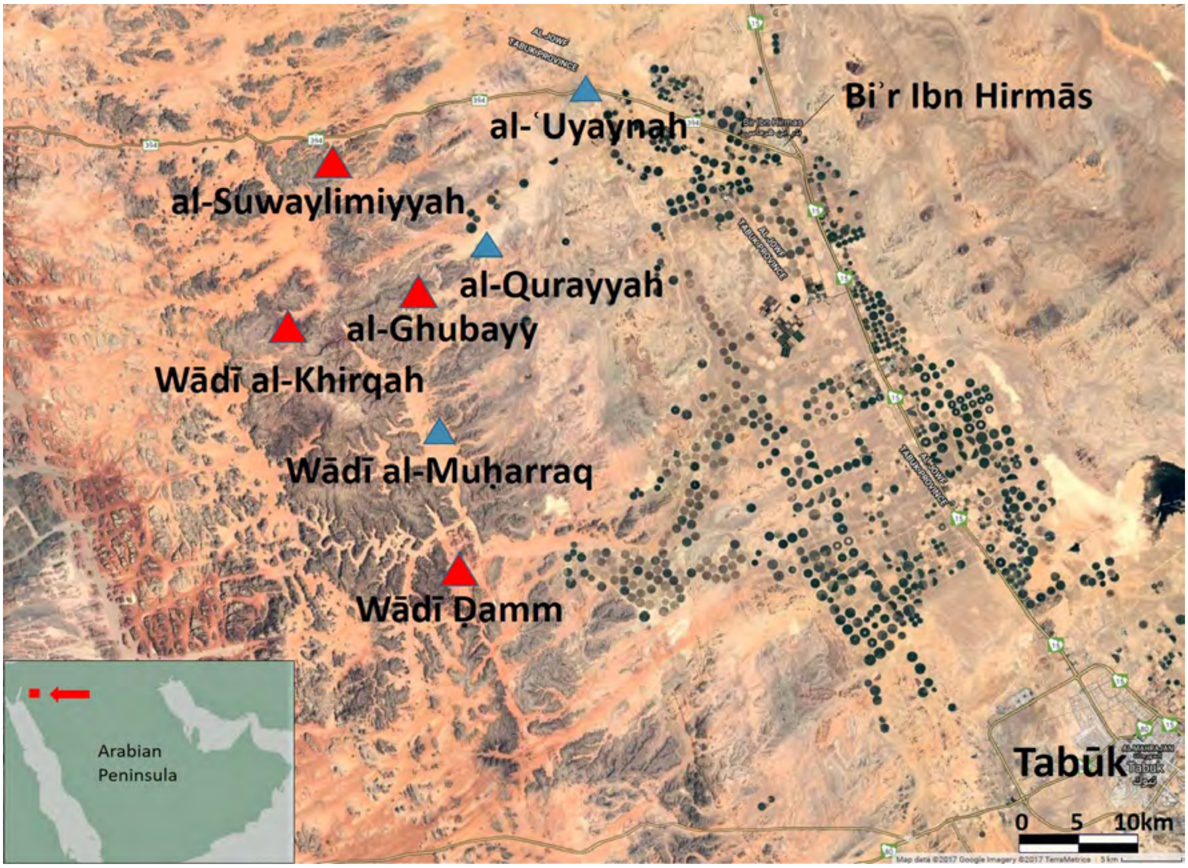

Figure 1. *The locations of the surveyed sites (red triangles represent sites discussed in this paper, blue triangles represent other archaeological sites).*

the date, although the personal names in the graffiti indicate that members of a few families incised many of them repeatedly throughout the generations. Present are names that represent up to four generations, which enables us to order the graffiti in an approximate chronological sequence and, accordingly, to trace the development of the formulaic expressions, orthography, and scripts in the first–second century AH/*c.* mid-seventh to early ninth century. Whereas the graffiti texts from the earlier generation are in the very simple format beginning with *anā PN* 'I am PN'/'I, PN' or *Allāhumma ighfir PN* 'O Allāh, forgive PN', those from later generations are more diverse in their formulae (Tokunaga 2019). Among them is a graffito composed of an 18-line text woven with *shahādah* (a confession of faith) and Quranic expressions (Fig. 2).

Ancient North Arabian graffiti

Among the thirty-three ANA graffiti in Wādī al-Khirqah, thirty-two were found in Group II and one in Group I. These ancient graffiti mainly consist of Hismaic invocations to the goddess Lāt (Fig. 3/a), but some graffiti partly show the features of Thamudic D. Names in some graffiti show genealogies up to eight generations long (Fig. 3/b). The shape of the letters reveals that a limited number of people wrote these graffiti repeatedly. Some of the ANA graffiti are accompanied by petroglyphs of animals such as camels, a lion, an oryx, and a horse/ass rider.

Petroglyphs

Apart from the petroglyphs mentioned in the previous section, petroglyphs were found in Groups I and II

Text:

1. *bi-ism Allāh al-raḥmān al-ra*
2. *-ḥīm hādhā kitāb*
3. *Mūsā bin ʿAbd al-Wahhā*
4. *-b wa yashhad anna lā ilāha illā*
5. *Allāh waḥda-hu lā sharīka la-hu*
6. *wa anna Muḥammad ʿabdu-hu wa*
7. *rasūlu-hu wa anna al-sāʿatah*
8. *ātiyah lā rayba fī-hā*
9. *wa anna Allāh bāʿith man fī*
10. *ʾl-qubūr shahādah li-Allāh*
11. *yaḥyā ʿalayhā wa*
12. *yamūtu wa (sic) ʿalayhā*
13. *inna Allāh yabʿathu-hu*
14. *ḥayyan Allāhumma ʿallim-hu al-kit[ā]*
15. *-b wa-ʾl-ḥikmah wa-ʾjʿal-hu*
16. *min al-muhtadīn wa-ʾrzuq-hu*
17. *al-shahādah la-hu fī*
18. *sabīli-ka muqbil ghayr mudbir*

Translation:

1. In the name of Allāh, the most merciful and
2. the most compassionate, this is the writing
3. of Mūsa b. ʿAbd al-Wahhāb
4. and he bears witness that there is no god but
5. Allāh, He is one and has no associate
6. and that Muḥammad is His servant and
7. His messenger and that the hour is
8. coming and there is no doubt in it
9. and that Allāh resurrect those who are in
10. the graves. Testimony for Allāh,
11. he lives on it and
12. he dies on it.
13. Indeed, Allāh resurrects him
14. to life. O Allāh, teach him the Book
15. and the wisdom, and make him
16. one of the rightly guided people and bestow upon him
17. the testimony for him for
18. Your sake, that he is advancing, not fleeing.

Expression from the Qurʾān: lines 7-10 (22:7) and lines 14-15 (3:48).

Figure 2. *An early Islamic Arabic graffito in Wādī al-Khirqah (KhRQ-I-Ar 53).*

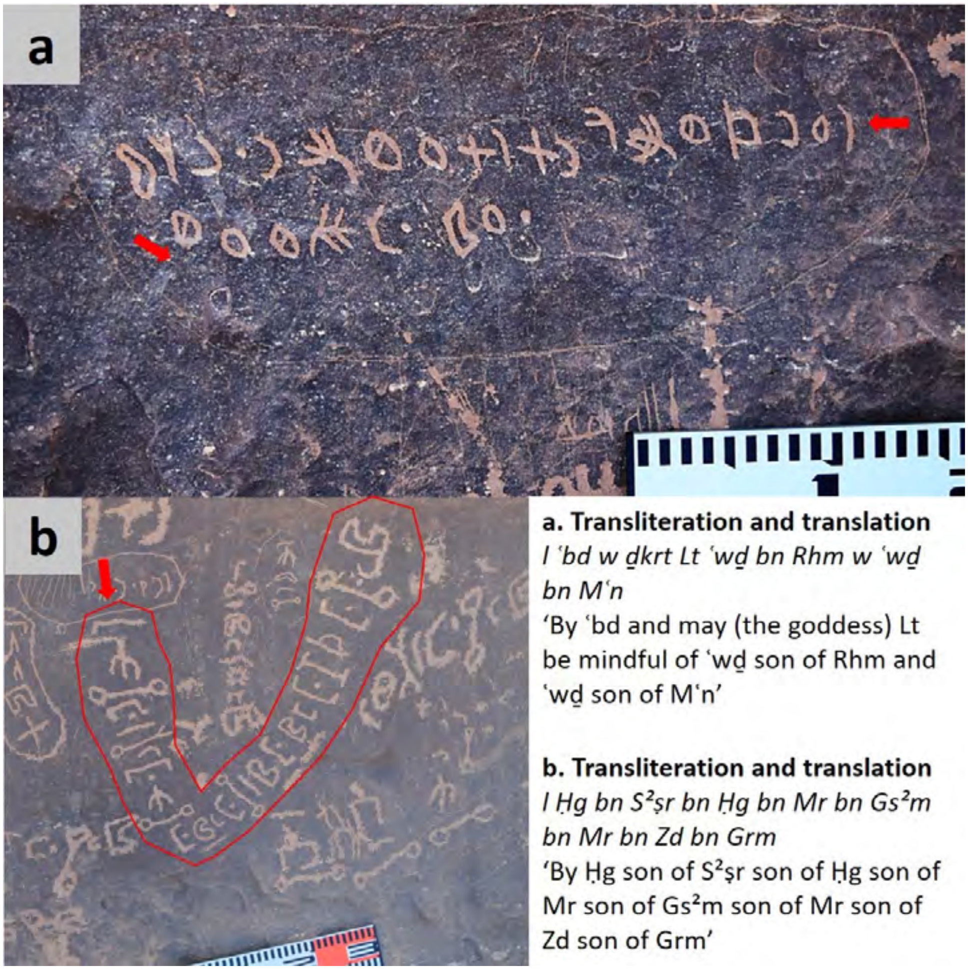

Figure 3. *Hismaic graffiti in Wādī al-Khirqah:* **a.** *an invocation to the goddess Lāt (KhRQ-II-ANA 13);* **b.** *a graffito containing the names of eight generations (KhRQ-II-ANA 22).*

as well as on the wadi bed between them. The highly stylistic figures of an elongated human with uplifted hands, probably depicting a worshipper (Fig. 4), can be seen on the rock surface of Group I and on the wadi bed. Similar petroglyphs have been found in the Arabian Peninsula[2] but at present their secure dating is quite difficult. Interestingly, there is also a petroglyph depicting what seems to be an oared boat on the left of the worshipper of Group I. Although depictions of boats are not common in Arabian rock art, we found similar depictions of boats in al-Suwaylimiyyah.[3]

Petroglyphs and graffiti in the surrounding area

The team also discovered various petroglyphs in Wādī al-Ghubayy, al-Suwaylimiyyah, and Wādī Ḍamm. In spite of many challenges such as the difficulty of dating, the petroglyphs, along with the excavation results in this area, will provide us with clues for understanding the lives and spiritual aspects of the ancient hunters and pastoral people in the Ḥismā highlands. Some graffiti were also found in Wādī al-Ghubayy and Wādī Ḍamm.

Wādī al-Ghubayy

The petroglyphs of Wādī al-Ghubayy are unique. Their depictions are compact yet bold and powerful. Archers with exaggerated feet (Fig. 5/a); handprints, a sitting

[2] Similar human figures have been reported by Khan (2007: 28–30, 32, 42, 43 & 65).
[3] See 'al-Suwaylimiyyah' below and Figure 7.

FIGURE 4. *A human figure in Wādī al-Khirqah Group I.*

human, an archer (Fig. 5/b); possibly a snake blowing darts and an ox (Fig. 5/c) are carved on the rocks in the wadi. On the other hand, several footprints with a pair of enigmatic motifs (Fig. 5/d) were found on the top of a rock hill. In addition, ten early Islamic Arabic graffiti; eight ANA graffiti; three Aramaic graffiti and petroglyphs of gazelles, an ox, a camel, and an ostrich; and some predacious animals and archers were observed in a different location. One of the early Islamic graffiti is by Qurra bin ʿAbbās, a member of the Hurmuz family, who left two graffiti in Wādī al-Khirqah. Most of the ANA graffiti were declarations of love in Thamudic C. The script of the Aramaic graffiti shows the characteristics of Imperial Aramaic and can probably be dated to around the fourth century BC.

al-Suwaylimiyyah

We visited this site for the first time while guided by a local elder who was grazing sheep in this area. Near the trace of an ancient water stream is a huge rock that has been used as a shelter since early times. Near the shelter, we discovered a large rock covered with numerous figures including supposedly prehistoric representations of wild animals (Fig. 6), which appear to have been carved at different periods. The observation of this rock surface enables us to grasp their relative chronology. In the earliest phase, oxen with big curved horns[4] and kudu[5] with wavy horns were depicted on a large scale, followed by smaller depictions, and later oryx or cattle featuring straight horns with curved tips. Numerous gazelles and lions, an ass and an ostrich were depicted along with many hunting dogs and hunters holding clubs or bows and arrows. On different rocks nearby, we found a dappled ox, gazelles with exaggerated horns, archers and men wearing daggers, and footprints, and interestingly, a possible oared boat with a mast similar to the one found in Wādī al-Khirqah. We also found three boat-like figures of the same type but without masts (Fig. 7). The shape of these boats is strikingly reminiscent of a Protodynastic Egyptian model of a boat found in Tall al-Farkhah in the Nile Delta, although the latter has a narrower body (Chłodnicki 2012: 108, 110, fig. 9). On the bedrock of the ancient water stream, depictions of footprints, a human with exaggerated hands and feet, and a gazelle and an archer (hunting scene) were found. No graffiti were found at this site.

Wādī Ḍamm

We paid a brief visit to a few graffiti sites in Wādī Ḍamm. Petroglyphs were found on some scattered rocks around the rocky hills in the downstream basin of the modern dam. These include depictions of oxen, worshippers with their hands uplifted, horse riders, ostriches, camels, etc. From the stylistic features it would appear that the horse riders were incised either in late antiquity or in the early Islamic period. We also found an ANA graffiti

[4] Oxen with curved horns can be seen in Shuwaymis, al-Ḥanākiyyah, etc. (Olsen 2010–2018; see Khan 2007: 110–111).
[5] Guanin et al. (2018) identified similar animal carvings from Hāʾil province as kudu.

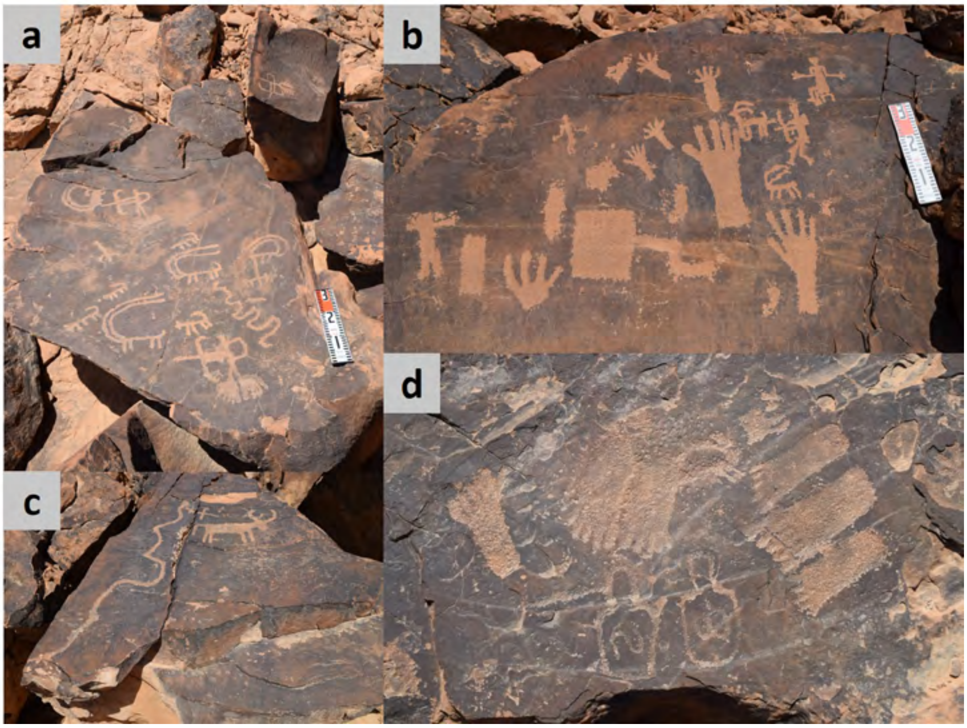

Figure 5. *The petroglyphs of Wādī al-Ghubayy.*

Figure 6. *A large rock in al-Suwaylimiyyah covered with various depictions.*

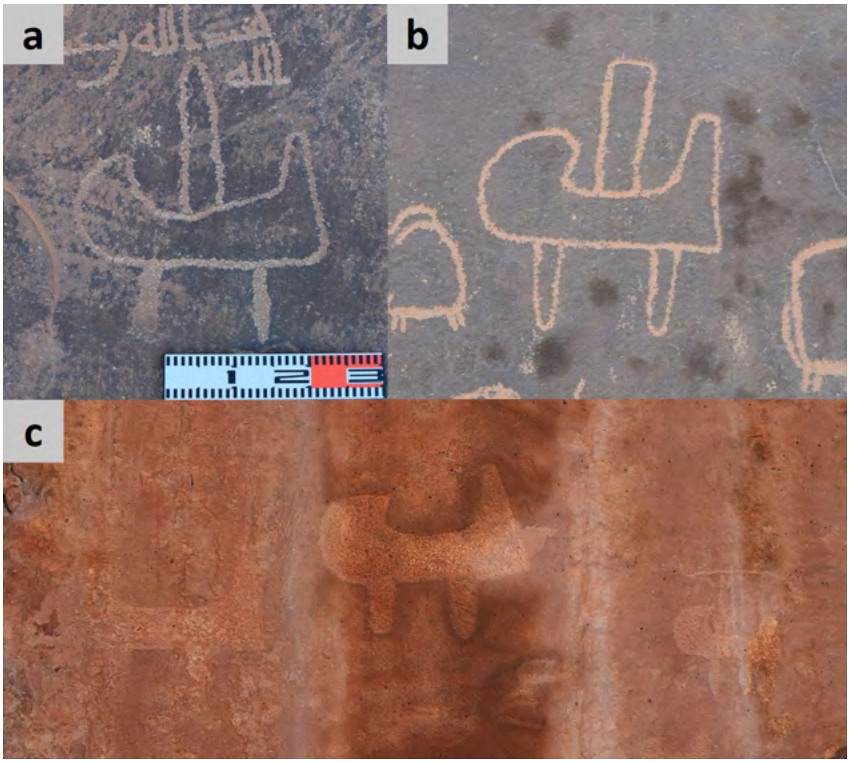

FIGURE 7. *Boat-like depictions:* **a.** *Wādī al-Khirqah;* **b–c.** *al-Suwaylimiyyah.*

(Thamudic C). M. Khan (1993a; 1993b) has already studied many petroglyphs in this wadi.

Acknowledgements

We would like to express our sincere gratitude to the SCTH and to the members of this survey, Mr Abdulrahman al-Mansoor, Mr Saud Al-Tamimi, Mr Abdullah al-Shehri, and Mr Fahid al-Harbi (SCTH), for their kind cooperation and for organizing this study.

Abbreviations

KhRQ-I-Ar	Early Islamic Arabic graffito of Wādī al-Khirqah, Group I.
KhRQ-II-ANA	Ancient North Arabian graffito of Wādī al-Khirqah, Group II.
PN	Personal name.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 283–292

Anthropomorphic figurines from Area 2A of Sārūq al-Ḥadīd, Dubai, UAE

Tatiana Valente, Fernando Contreras, Ahmed Mahmud, Yaaqoub Yousif Ali Al Ali & Mansour Boraik Radwan Karim

Summary

During three archaeological seasons held in Area 2A of Sārūq al-Ḥadīd, Dubai, UAE, from January 2014 until April 2018, over twenty anthropomorphic copper figurines were found in Iron Age II archaeological contexts. These were mainly found in charcoal deposits, where pit-like structures used for combustion activities were found. They present no similarities with any other discovered anthropomorphic figurines as they are unique in style and shape. We believe this was a local production, taking place exclusively at Sārūq al-Ḥadīd, as no similar finds were found in the region. So far, their significance and use remain a mystery, but it is hoped that they will help us understand some of the ceremonial rituals that we believe were held at Sārūq al-Ḥadīd.

Keywords: Sārūq al-Ḥadīd, Iron Age, copper, anthropomorphic figurines, ceremonial

Introduction

The archaeological site of Sārūq al-Ḥadīd is located on the fringes of the Rub al-Khali desert, close to the southern border of the Emirate of Dubai, in the United Arab Emirates. Here there are no apparent sources of water, fuel, or food that may have contributed to its settlement, but the environmental surroundings may have been quite different in the past. Evidence of an inland sabkha dated 5821 ± 282 BP (Herrmann, Casana & Qandil 2012: 51–52) and frequent inclusions of calcified roots or plant stem casts in the sand dated 2750 ± 30 BP (Contreras & Valente 2018: 40–42), show that the region may have had higher concentrations of rain and vegetation growth and may have been inhabited by several mammal species (Weeks et al. 2017: 40–42) prior to shifting to the desert environment that we see today.

Since the discovery of the site in 2001, several archaeological teams, including ours the Spanish Mission from Sanisera have shed light on the environment and the people who once inhabited it. Our team has focused its work in Area 2A of Sārūq al-Ḥadīd. Here, evidence of several activities was found with metallurgy being the most commonly identifiable. The slag, easily visible among the active sand dunes on which it sits, is the by-product of prominent metallurgical activity that was once practised here. Alongside it, twenty-four pit-like combustion structures were found in Area 2A, which appear to have been used in the production of the innumerable copper objects found throughout the site. Fragments of crucibles, technical ceramic, copper ingots, and re-melted objects attest to this metallurgical production (Contreras et al. 2017: 60; Contreras & Valente 2017: 105–107). In addition, the discovery of several copper rings, bracelets and earrings along with over 5000 beads of the most diverse types of materials semi-precious stones, pearls, clay, bones, among others, many of which are unfinished suggest that a prolific jewellery workshop was also present (Contreras & Valente 2017: 108–109). The presence of jewellery crafting is further reinforced by the countless gold beads produced here (Soriano et al. 2018). Associated with these two activities, there seems to have been a prolific commercial activity through which he above-mentioned goods were traded, as attested by the numerous scales and stamps that were in all likelihood used for trade (Contreras & Valente 2017: 108–110). Finally, it has been accepted by all the teams that have worked in Sārūq al-Ḥadīd that, in view of the absence of structural remains and the impossibility of agricultural production at the site, this place may have served only to practise the activities mentioned above in a collective environment, where people from different

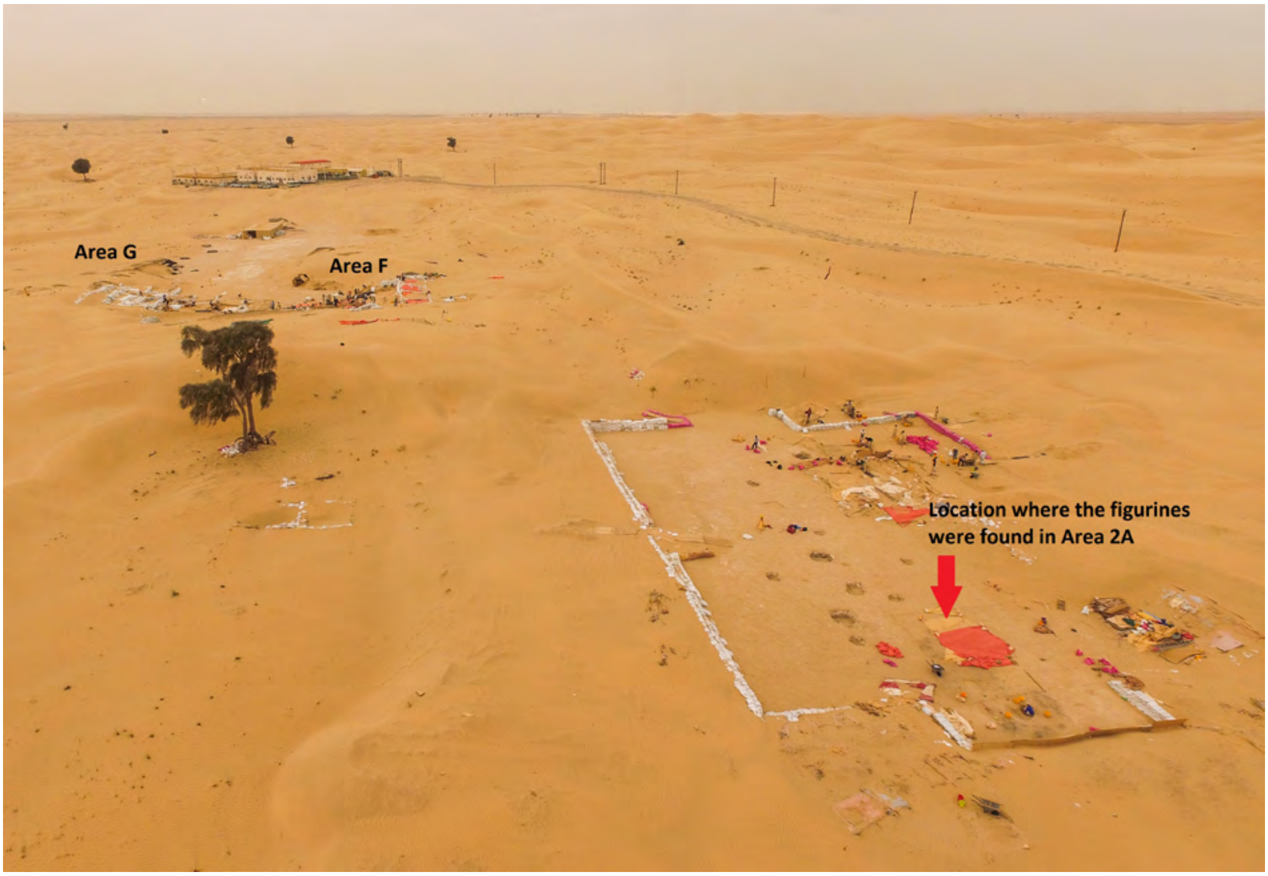

Figure 1. *The location of the anthropomorphic copper figurines found within Area 2A (aerial photography Qutaiba Al Dasouqi).*

locations within the region would gather to produce different metals (for copper and gold objects), trade them among themselves along with other perishable goods, and possibly strengthen their social, commercial, and political connections. Essentially, it was a meeting place where rituals/ceremonies could have been held, as evidenced by numerous potsherds (Benoist & Valente 2017) and soft stones similar to those only found in meeting/gathering places or burial sites (Benoist 2010; Benoist et al. 2015). These vessels were always found in 'ritual contexts', placed carefully in the sand deposits along with other votive objects, such as miniature daggers, axe heads, bundles of copper arrowheads, alabaster vessels, jewellery bracelets and necklaces, and copper snakes. These objects are similarly found in other 'ceremonial sites' of the region (Benoist et al. 2015; Magee 2003). It is within these highly ritualized contexts that the anthropomorphic copper figures were found clustered in a couple of squares from Area 2A of Sārūq al-Ḥadīd (Fig.1).

Spatial distribution of the anthropomorphic figurines

Since January 2015 the Spanish Mission of Sanisera has been working continuously in Area 2A of Sārūq al-Ḥadīd excavating sixty-eight squares measuring 5 x 5 m — 1700m^2 — during sixteen months of fieldwork. In this area, over 5000 copper objects were collected from the aeolian sand dunes, which included twenty-three copper anthropomorphic figurines.

Area 2A of Sārūq al-Ḥadīd presents a relatively simple stratigraphy when compared to other areas of the site, having a depth of no more than 3 m depth — sometimes

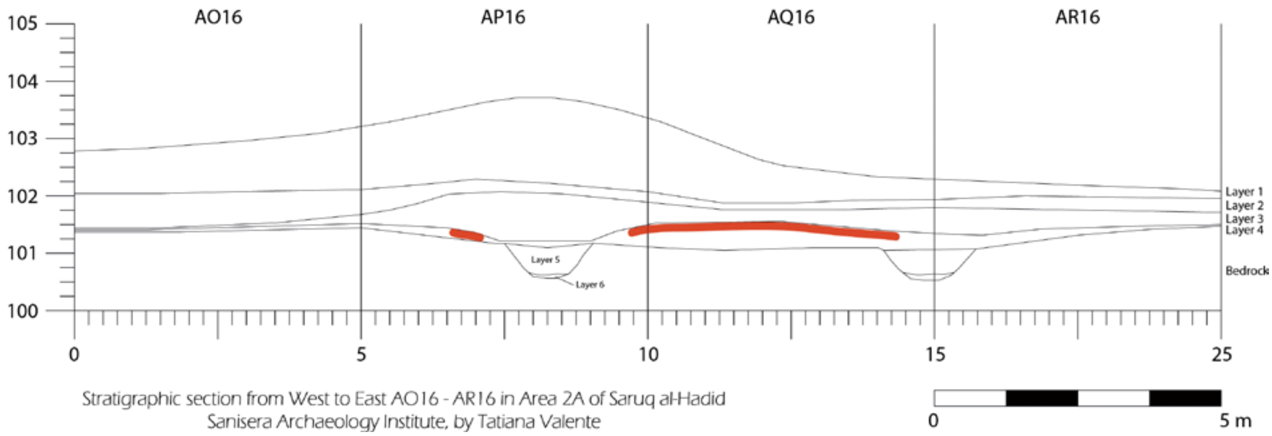

Figure 2. *The stratigraphic location of the anthropomorphic figurines (highlighted in orange in Area 2A (map Tatiana Valente).*

only 2 m — and only four identifiable layers. Throughout the site, the top layer (Layer 1) is commonly known as the 'slag layer', due to the abundance of slag fragments. The following layer is classified as an 'abandonment layer' (Layer 2), since almost no archaeological evidence is found, apart from a few sherds of Middle Islamic Ware (Benoist & Valente 2017: 20–23) and a few charcoal samples from the same period (Contreras et al. 2017: 59–60). Layer 3 is where most of the finds were collected. Based on the pottery (Benoist & Valente 2017) and the typology of the copper objects collected (Contreras & Valente 2017: 105–107), Layer 3 is a deposit from Iron Age II. It covers another deposit from this period (Layer 4), most specifically from 1100 to 700 BC, as shown by several charcoal samples that were collected from the pit-like combustion structures that were found in Area 2A (Contreras et al. 2017: 59–60). Layer 4 consists of a deposit of sand, burned sandstones, and charcoal in decomposition. This is the same type of composition which is found in the deposit filling the structures. This deposit surrounds the structures and was formed by the continuous combustion activities that took place inside these structures; the area was cleaned after every combustion activity. As a result, debris was deposited in the immediate surroundings forming a 'debris layer'. It is within the first 5 cm of Layer 4 — just before Layer 3 ends — that the anthropomorphic copper figurines were found (Fig. 2).

The anthropomorphic figurines were mainly clustered between structures 11 and 12 (Fig. 3), which were dated 1015-970 and 1050-1000 BC respectively (Contreras et al. 2017: 59–60). In view of the fact that these dates represent the final combustion activities undertaken inside these structures before abandonment, the figurines found in Layer 4 would also have the same date as the last or second to last combustion activity undertaken within the structures, on the assumption that they *were* made within them. Unfortunately, this theory cannot be proved with certainty.

Along with the anthropomorphic figurines, a few other objects were found, namely two miniature copper axe heads, five copper snakes, and three small copper discs. It is plausible that these objects were left here because they may have been produced in these pit-like structures, but it is also possible they were placed here for symbolic purposes. The copious amount of materials found in Layer 3 in the form of copper arrowheads, jewellery necklaces, alabaster vessels, copper snakes, and copper daggers may be indicative of ritual activity (Contreras et al. 2017: 61–63). The objects from Layer 4 may therefore have been representative of the beginning of a series of 'ritualized' abandonments in this location, which through time continued as the inhabitants revisited the place.

The anthropomorphic figurines

All twenty-three anthropomorphic figurines found in Area 2A were produced with the same type of production techniques. They are all made of copper that was cast

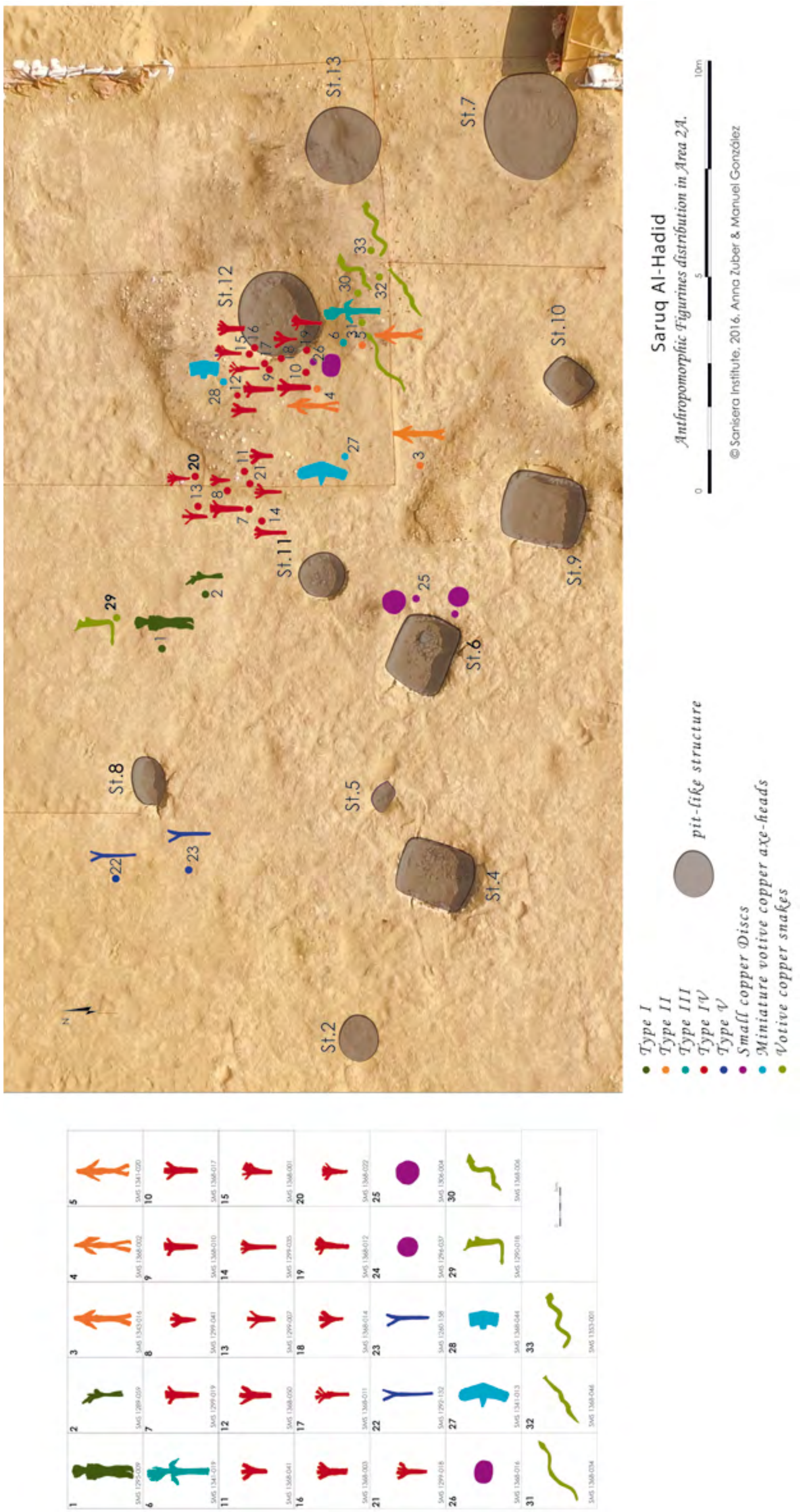

FIGURE 3. *Spatial distribution of the anthropomorphic copper figurines between structures 11 and 12 (map Anna Zuber and Manuel González).*

into small bars, which could then be hammered, cut, folded, and incised to create different styles of figurines. As they were studied, five major styles were identified, which are now presented individually.

The first style identified resembles a praying man with his hands open and facing up (Fig. 4). The features were created by hammering the whole body while the copper bar was still soft — to flatten it — followed by a central cut on the base, and a double cut on the top, to create the legs, arms and head, respectively. The legs and arms were then folded upwards to resemble feet and hands. This piece is unique,[1] and was found between structures 11 and 8 (Fig. 3), near a copper snake. Furthermore, next to this figurine was another one that presented some common features, although it had a more complex appearance (Fig. 5). Nonetheless, it was decided to include it in this first style because of its basic features, although it appears to be an accidental production. Two legs slightly folded at the base to resemble feet, two raised arms, and a possible head were identified, although these interpretations are somewhat subjective. This figurine was also executed from a single copper bar which was hammered flat; it appears the piece became too thin and, as a result, the cutting process went wrong. The cuts to separate the legs and arms from the head are very crooked, presenting several irregularities. The proximity to the first figurine also seems to reinforce the idea that this figurine belonged to Style I, but this cannot be confirmed.

Three pieces belonging to the second style identified (Style II) were found, all south-west of structure 12. These pieces were also found alongside another figurine of the third style, four copper snakes, a small disc, and a miniature copper axe head (see Fig. 3). Differing from the first style, the body of these pieces is less flat, presenting

[1] There are three other figurines with similar features — though of larger dimensions — that can be included in this style, discovered by other archaeological missions excavating in Sārūq al-Ḥadīd, namely the Jordanian team and a national team from Dubai Municipality. These figurines were all found in locus 3 of Saruq 7, Area B, as the site was previously known (Herrmann, Casana & Qandil 2012: 53). One in square N1 and the other two in square S8. We decided not to include these figurines in our study as we did not have access to more detailed information on the stratigraphical contexts in which they were found.

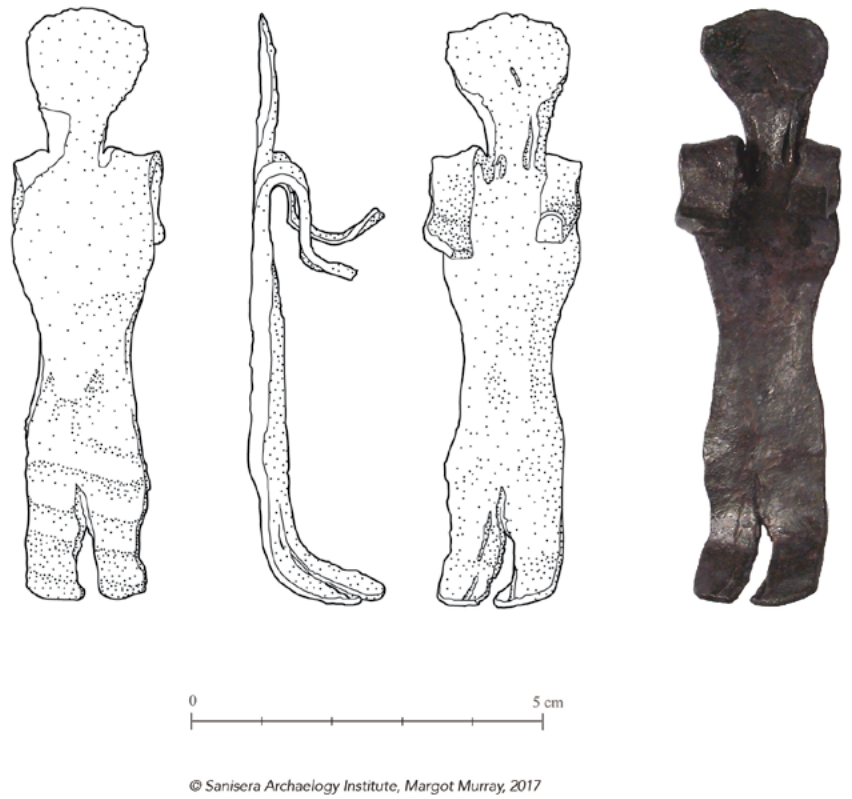

Figure 4. *Style I, figurine SMS-1295-009 (illustration and photography Margot Murray).*

Figure 5. *Style I, figurine SMS-1289-059 (illustration and photography Manuel González).*

Figure 6. *Style II, figurine SMS-1368-002 (illustration and photography Manuel González).*

a thicker section, except for the bottom and the upper mid-section that are flatter so that the arms and legs could be cut out. The arms and legs were then opened outwards and the legs slightly folded upwards to resemble feet. One of these figurines presents two incised dots — probably eyes — and what seems to be a representation of female genitalia (Fig. 6). Compared to the first style, this one seems to have a more 'rudimentary' appearance, with triangular arms and the absence of a head — apart from the incised eyes that suggest a head.

Style III appears to portray a man with a hairstyle resembling a palm tree (Fig. 7). In view of the importance of the palm tree in the Iron Age societies of the region (Potts 2001: 39), it is possible that it is a manifestation of a cult associated with this tree. As in the first style, only one example of the third style was found. It was discovered south of structure 12, near the three figurines of the second style, a small disc, and four copper snakes. The body was also shaped from a small copper bar, which was only flattened on the top half — the bottom half was not hammered. The top half was then cut into seven prongs, with longer outside prongs so they could be folded downwards to portray arms, and the remaining five central prongs slightly opened to the sides to resemble palm tree-styled hair. The right-hand prong in the centre was found broken.

The fourth identifiable style shares slight similarities with our third style figurine. As with Style III, the figurines from the fourth style seem to suggest a connection with the palm tree. Fifteen figures of this style were found, making these the most numerous but also the smallest, in comparison with the other styles. Their appearance is very rudimentary, being formed from small copper bars that were hammered at the top. The top end could then be cut into prongs, which were subsequently opened sideways and slightly folded inwards. The main difference among the figurines of this style is the number of prongs, which vary between three and six (Figs 8 and 9). Is possible that this style was supposed to portray the third style; however, they are smaller in size, and the outside prongs are not folded downwards to resemble arms as in the third style. It is also possible that the figurines from this style were just experiments, considering their unrefined and unfinished appearance. Careful examination shows that their prongs are not trimmed or polished, something we would expect to see if we consider all the other copper objects found in similar deposits from Sārūq al-Ḥadīd, all of which exhibit high levels of production techniques and decorative styles. Finally, it is important to mention that all examples of the fourth style were found randomly distributed between structures 11 and 12.

The fifth and last figurine style led to several debates about whether it should be included in this paper, as it does not resemble a human figure at all (Fig. 10).

Figure 7. *Style III, figurine SMS-1341-019 (illustration and photography Anna Zuber and Manuel González).*

Figure 8. *Style IV, figurine SMS-1299-007 (illustration and photography Anna Zuber and Manuel González).*

Figure 9. *Style IV, figurine SMS-1368-022 (illustration and photography Anna Zuber and Manuel González).*

Figure 10. *Style V, figurine SMS-1292-132 (illustration and photography Anna Zuber and Manuel González).*

However, there are two examples of this style, both found west of structure 8, approximately 5 m from the figurines of the first style. Furthermore, these were found in the same context as the previously mentioned figures, are made with the same production techniques, and are roughly the same size. They were made from a small thin copper bar, which was lightly hammered on the top, so that a cut could be made to create two prongs opening sideways. Unfortunately, we cannot be sure if these were unfinished experiments that were supposed to have additional details or if they represented some kind of tool that we are unable to identify.

Conclusions

Despite all that has been said about these anthropomorphic figurines, it is still difficult to define what they were really used for and what they meant for the inhabitants of Sārūq al-Ḥadīd. Nonetheless, we can suggest some theories based on the data gathered and on the knowledge we have about other finds discovered in the same archaeological context.

All these figurines were found clustered in two 5 x 5 m squares from Area 2A of Sārūq al-Ḥadīd, in a deposit from the first half of Iron Age II. Their direct connection with the pit-like structures 8, 11, and 12 is clear, as they were discovered in the first centimetres of debris removed from the combustion activities practised inside these structures. This also suggests that they were produced in these structures, in either the last or second to last combustion activity. Furthermore, the figurines do not show any specific pattern of distribution (see Fig. 3) as they were randomly scattered. This fact, along with their rudimentary appearance and unfinished trims, seems to suggest that they were only experiments, even more so if we consider all the other objects found in Sārūq al-Ḥadīd which are of exquisite decoration achieved by highly skilled metallurgists. This begs the question, why would such skilled metallurgists create such unrefined final products? It is important to remember that these anthropomorphic figurines have not been discovered anywhere else and we therefore need to acknowledge that they might just have been an isolated action without ritualistic significance. Further study of these figurines and other finds found in close proximity may lead us to think otherwise.

As mentioned above, five copper snakes, two miniature axe heads, and three small copper discs were found in direct association with the anthropomorphic figurines. Despite the use of the discs being unclear, the copper snakes and the miniature axe heads have been commonly associated with ceremonial/ritual contexts (Benoist 2010; Benoist et al. 2015). Although these finds may have been here solely because they were produced in these structures, we still have to take into consideration a possible connection with the twenty-three anthropomorphic figurines, especially since the above Layer 3, which presents the highest concentration of finds from Area 2A, substantiates the frequent arrangement of objects as 'offerings' of some kind. So, what are these anthropomorphic figurines? Objects created and used for a ceremonial purpose? Or an experiment for something without significant meaning? There was also a suggestion that they might have been amulets, because of their small size. But if so, who or what were they trying to protect? And what were they actually portraying? Could the resemblance of some of these figurines to palm trees to be significant? In just the same way that these trees stirred our imagination, so the inhabitants of Sārūq al-

Ḥadīd may also have thought about them, even more so in the context of the importance of palm trees to the flourishing of oasis settlements in the region (Potts 2001: 39). All these ideas should be considered, although, unfortunately, many are speculative.

Despite their apparent uniqueness in south-eastern Arabia, other Iron Age II anthropomorphic figures have been found before. Two appeared in Bithnah-50: one is an anthropomorphic incense burner, whose pedestal portrays a man carrying an incense burner — a small cup with a snake on the exterior — found near structure J, a chapel-like construction (Benoist 2007: 47, fig. 14); another example came from a brazier handle, found near structure H (terrace), which was sculpted in the shape of a woman man (2007: 48, fig. 15.7). In Rumeilah, a clay-baked human head was found along with other zoomorphic figurines (Boucharlat & Lombard 1985: 44–73, pl. 65:3). Recently (September 2018) in Area F of Sārūq al-Ḥadīd, a dagger with a handle sculpted in the shape of a man's head was found in an Iron Age II context, depicting a man with a helmet, a beard, and a prominent nose.[2]

Based on the assemblage of finds from Bithnah-50 as described by Anne Benoist (2007) — the baked-clay head from Rumeilah — and the evidence from Sārūq al-Ḥadīd presented in this paper, a direct connection between the 'snake cult' and the anthropomorphic figurines appears to have existed, at least during the Iron Age II period. There is still not enough evidence to define its importance or how the association between 'snake and man' might have worked, but it existed, whether men and snakes were represented individually or together. Clearly, the snake cult had a great impact on the society of this period, as shown in countless representations, whether on pottery decoration or even as individual zoomorphic figurines like those found at Sārūq al-Ḥadīd. Throughout south-eastern Arabia, snake representations have been found in abundance, suggesting that this cult that may have developed locally or was influenced through foreign contacts. Snake representations were found in Iran, in objects such as libation tables and Elamite cylinder seals. Its cult was widespread throughout north-western Arabia and in the Levant and Egypt during the Middle and Late Bronze Age and in the Early Iron Age (Benoist 2007: 50–51). These influences may have reached south-eastern Arabia during the Iron Age period through the flourishing of a maritime trade in the Gulf, and the trans-Arabian trade that was now possible with the use of camels (Magee 2004: 24–26). The depiction of the male and female figurines mentioned above could have also been brought about through the same line of contacts as the snake cult and developed locally as well. However, considering the relatively small number of anthropomorphic representations found so far, it is difficult to define the purpose of these figurines within the context of the snake cult. In the future it is hoped that more anthropomorphic figurines such as these may be found in other archaeological sites, to help us further debate these theories.

[2] To date, there are no photographs of this dagger and it has not been published.

Acknowledgements

We would like to express our gratitude to everyone from the Spanish Mission of Sanisera, for the team spirit, resilience against adversity, enjoyment in the work, and immeasurable efforts. Special thanks to Manuel González, Anna Zuber, and Sofia Baqueiro, for the illustrations, photographs, and precise descriptions of the anthropomorphic figurines. We would also like to thank all the members of Dubai Municipality for their help and support in overcoming the difficulties of each archaeological season. Without their care and interest none of the research undertaken by our team would have been possible.

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Proceedings of the Seminar for Arabian Studies 49 (2019): 293–302

The origins of the traditional approach towards the *jinn* of poetic inspiration in tribal Arab culture

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Summary
In the late pre-Islamic and early Islamic period, *jinn* imagery was employed by poets as a conventional artistic means to refer to creative energy in the context of challenge. The examples provided by the medieval literary-historical tradition on the one side, and by contemporary ethnographic data on the other, indicate that, generally in the Islamic period, with respect to the issues of inspiration and talent, poets remained within the paradigm presenting the relationship between man and spirit as assistance offered to the poet by his loyal 'brother' in the moment of need.

Keywords: poetry, *jinn*, *shayāṭīn*, inspiration, Arab poets

Introduction

In tribal Arabia, a clear connection has been made between being a poet and coming into direct contact with *jinn* (sing. *jinnī*)[1] or *shayāṭīn* (sing. *shayṭān*)[2] of inspiration. Medieval Arabic writings provide reports on the spirits of well-known poets, giving their personal names and describing encounters with them (al-Jāḥiẓ 1965–1969, vi: 225–226; al-Qazwīnī 1967: 373; al-Qurashī 1981: 47–63; al-Thaᶜālibī 2003: 62–67). Pre-Islamic and early Islamic poets, as well as heathen soothsayers, address *jinn* in their production (al-Ṣafadī 2000, xxiv: 305; al-Aᶜshā 1968: 125, 221), which proves that these reports may have truly reflected ancient popular notions of the source, or agents, of divinatory and poetic inspiration. Medieval accounts, in their turn, find parallels in contemporary ethnographic data. Anthropologists who worked in the 1980s and 1990s in different parts of Yemen, where the most archaic elements of Arab culture have been preserved to the present time, report that the poets they interviewed kept the tradition of addressing *hājis* and *ḥalīla* — daemonic[3] forces responsible for poetic inspiration or merely the embodiments of the poet's faculties.

The term *hājis* is already known in the medieval literary-historical tradition. As a designation of a type of *jinn*, it is applied to Misḥal, the attendant spirit of the poet al-Aᶜshā (d. after 3/625).[4] A belief in the female *jinnī* of poetic inspiration named *ḥalīla* is recorded with regard to nineteenth-century Ḥaḍramawt by I. Goldziher (1896–1899, i: 213), but is not reflected in the preserved medieval sources. In Yemeni tribal poetry, *hājis* is sometimes addressed in the beginning of creation, being invoked when poets urgently need inspiration.

[1] On the etymology of the word *jinnī*, see Wensinck 1920: 506–514; Zbinden 1953: 75; Henninger 2004: 44–48; Nünlist 2015: 22–26. On the types and designations of *jinn*, see Ḥamīda 1956: 54; Nünlist 2015: 313–322, 326–327; Tritton 1934: 715–716.

[2] A.S. Tritton (1934: 716) notes that the term *shayṭān*, although a foreign word, found its way to Arabia early. That the word is a Hebrew loan (cf. He: *sāṭān*) is not doubted, but whether it was known already to the pagan Arabs is debated by J. Wellhausen (1961: 157, n. 3), who asserts that it may have been only the early Islamic tradition that had presented Arab paganism as being aware of it. P.A. Eichler (1928: 63–64) contests this opinion, arguing that the term could not have been brought to Arabia only after the advent Islam. He supports the view of T. Nöldeke, I. Goldziher, and G. van Vloten who proceed from an assumption that the word was used by the Arabs long before Muḥammad. On the word *shayṭān* and its derivatives in the Arabic language, see also Fahd & Rippin 1997: 406.

[3] The word 'daemon' (*sic*) is employed specifically to refer to the inspirational agents of poets. It is peculiar to the context in which *jinn* and *shayāṭīn* are used as synonyms. M. Zwettler (1990: 76) was the first to find 'demons' to be an infelicitous translation of the words *jinn* and *shayāṭīn*. 'Daemons', in his view, is acceptable to render these terms.

[4] Al-Ālūsī (1964, ii: 367), al-Qurashī (1981: 50), and ᶜAlī (1993, ix: 119) write on Misḥal as the *shayṭān*, *jinni*, and *tābiᶜ* (following spirit) of al-Aᶜshā. Ḥamīda (1956: 54), explaining the term *hājis* among several other designations of the types of *jinn*, notes that al-Aᶜshā had a *hājis*, but cannot provide any other examples. Derived from the verb *hajasa* ('to bestir itself in one's mind'), the active participle *hājis*, when referring to an inspirational agent, implies 'a secret voice bestirring itself in one's mind'.

The inspirer of poetic creativity is treated as a familiar assistant. Adhering to the poetic convention and, at the same time, to a kind of superstition, poets may start as follows: 'Oh, my *hājis*! I got used to your prompt replies'[5] or 'Oh, my head, remember this evening your *hājis*!'[6] When the poet's request is accepted and creative energy is afforded to him, it is presented as the aid of a friend that appears to lend a hand when needed: 'It (*hājis*) said, 'Quickly I came to you; // I am not like one who vanishes [the moment he is needed].// Seize hold [of me] to extract'.// And he answered me in meters.'[7]

Whether the authors of the quoted lines, recorded in different parts of Yemen, invoke daemons or simply refer to inspiration is unclear. Mikhail Rodionov, who worked in western Ḥaḍramawt in the 1980s, understands *hājis* and *ḥalīla* as the personal names (*Hājis* and *al-Ḥalīla*) of '*shayṭāns* or *jinn* of poetry'. According to his data, speaking of poetry-making, the Ḥaḍramīs present *Hājis* as a daemon that whispers poetic words to the poet. The role of his female counterpart *al-Ḥalīla* is to inspire the poet's imagination (Rodionov 2007: 164). Steven Caton, who worked in the same period in the north of Yemen, gives both words not as personal names but as local terms. According to his data, the word *hājis* is used by the tribesmen to refer directly to poetic talent or inspiration, classified among the mental faculties of the poet, while the term *ḥalīla* denotes the poet's imagination. He observes that *hājis* also serves as a term for poet-genius whose talent is inexhaustible and bottomless (Caton 1990: 37–38, 73). Flagg Miller, who conducted fieldwork in the 1990s in Yāfiʿ, found the following representation: a male-gendered muse referred to as *ḥājis* (with pharyngeal *ḥ* instead of glottal *h*) enables poets 'to contextualise wild emotion appropriately' and produce verse well suited to occasions, while the forceful female *ḥalīla* produces fleeting verse, 'the stuff of raw energy' (Miller 2007: 159).

Recent studies on Yemeni tribal poetry do not relate *hājis* and *ḥalīla* to medieval accounts on *jinn*.[8] It would be difficult to speculate about the relationship between the late pre-Islamic representation of *jinn* and the modern Yemeni idea of poetic inspiration. The sources would not allow us to reach across the gap of almost 1500 years to substantiate a link between the conventions as well as between the understandings they express. As for medieval production in the classical idiom, the sources did not preserve tribal poetry dated later than the second/eighth century, and the authenticity of the existing corpus is doubted. As for tribal poetry in the vernacular, almost all examples available for scholarship have been collected in the twentieth century.[9] *Hājis* and *ḥalīla* are neither mentioned in *The History, Poetry, and Genealogy of the Yemen* (*Akhbār al-Yaman wa-ashʿāruhā wa-ansābuhā*), the earliest known history of pre-Islamic Yemen, attributed to the South Arabian historian ʿAbīd b. Sharya al-Jurhumī (d. 67/686),[10] nor found in the

[5] *Yā hājisī ʿahdī illā bik biddī!* (Rodionov 2007: 188–189).

[6] *Yā rāsī al-lēla tadhakkar hājisak!* (Suvorov & ʿAwdalī 2000: 59).

[7] *Gāla jītak sarīʿ // mā mathīlī yiḍīʿ // iltagif l-in-nazīʿ // jāba baḥḥārā* (Caton 1990: 190, 319).

[8] M. Rodionov (2007: 164) only notes that, in the tribal Yemeni idea of poetic inspiration, the notions of *Hājis* and *Ḥalīla* coexist with the Quranic representation of poetry as communication transmitted by *shayāṭīn* (26. 221–224). In the same context, Ibn Shaykhān (2006: 138–145), who compiled a collection of modern Yemeni poems with references to *hājis* and *ḥalīla*, addresses himself to the Islamic stand on the issue of poetry. To defend the tribal tradition, as against the Quranic representation of poetry as communication received from *shayāṭīn*, he provides quotations attributed to Muḥammad to illustrate his complimentary attitude toward poetry. Scholars, thus, seem to be aware of the theoretical relevance of the Quranic bond between poets and *shayāṭīn* to *hājis* and *ḥalīla*. The Quranic idea of inspiration through *jinn* and *shayāṭīn*, however, should be studied apart from the accounts on the *jinn* of poetic inspiration provided by the medieval historical-literary tradition. The Quranic conception of divinatory-poetic inspiration through *shayāṭīn* (understood as errant spirits – devils or satans) is too different from the conception of inspiration through *jinn* (often referred by the poets themselves as *shayāṭīn*) observed in early Arabic poetry.

[9] It is highly likely, as Marijn van Putten (2017) has argued recently, that no koine of intertribal communication and poetry existed in the pre-Islamic era. Nevertheless, since the late eighth century, Arab philologists have tried to retrieve, or to construct, the unified, ideal form of the *ʿArabiyya* as a standard of reference and used pre-Islamic poetry for that purpose. At the same time, in the tribal world, the language, and the idiom of poetry in particular, was undergoing inevitable transformations. After it had been far from the pre-Islamic idiom reconstructed by the philologists on the basis of the retrieved and grammatically unified examples of pre-Islamic poems, the poetry of the desert was not considered worthy of further study and preservation (Bonebakker 1970: 82; Gründler 2015: 93). Therefore, while the earliest tribal poetry included in written reports refers to the very last years of the fifth century, the sources did not preserve ancient tribal poetry dated later than the eighth century. Until the end of the twentieth century, Arab specialists of literature showed interest mainly in poems composed in classically styled language, while vernacular poetry was traditionally ignored, for its character was deemed local and limited. See e.g. the explanation of the Yemeni philologist al-Saqqāf (1934–1935, i: 3) who, at the beginning of the previous century, compiled a collection of local poetry from Ḥaḍramawt and intentionally ignored vernacular poetry. As for Western scholars, they started collecting vernacular Arabic poetry only at the end of the nineteenth century.

[10] The book recounts in prose and poetry six saga cycles of ancient personages and events of the Yemen. Two sagas, the dispersion of

database of North Arabian inscriptions (OCIANA). The only definite thing that can be said is that, at the turn of the twenty-first century, similar notions of *hājis* and *ḥalīla* were recorded by all scholars who addressed themselves to Yemeni poetry. This fact and the account on *ḥalīla* by Goldziher for nineteenth-century Ḥaḍramawt enables the admission that the idea of these daemons has been a deeply rooted phenomenon that was still widespread in Yemen a couple of decades ago. As for the absence of *ḥalīla* in medieval discourse and the particular association of *hājis* with al-Aʿshā, they rather speak against direct continuity between the conception of inspiration reflected in the early Arabic tradition and the respective idea shared by the Yemeni tribesmen.

It would be prudent to allow the possibility that the coincidence of a reported pre-Islamic and early Islamic practice and a similar practice of poets in late twentieth-century Yemen is due not to an unbroken chain of transmission — that is, a surviving ancient practice — but rather to an invented tradition in which a literary culture adopted practices reported of their classical antecedents to lend legitimacy and prestige to their art form. This assumption would have by no means been proved. Even in the last century, tribal poets were largely illiterate and could hardly learn the classical convention related to the *jinn* of inspiration from medieval reports and *dīwāns* of early Arab poets. Of course, the reception of pre-Islamic and early Islamic elements could have occurred through the educated poets that were able to appreciate classical poetry and produce verse in classically styled language. However, invocation of *hājis* in contemporary tribal poetry belongs to the local vernacular tradition. Firstly, the Yemeni verbal practice is completely different from the references to the *jinn* of inspiration in early Arabic poetry. As shown above, contemporary tribal poets actually invoke *hājis*. Early Arab poets, as will be shown below, refer to their inspirational agents in the third person, by way of allegory and often with an ironic twist. Secondly, it is indicative of how an inspirational agent is considered in tribal Yemeni *qaṣīda*, which is built according to a peculiar verbal ritual and combines different styles used for its various constituent parts. Invocation of God obviously relies on the poet's knowledge of Islamic teaching and may clearly lean towards the written tradition. Invocation of *hājis* which, in theory, could rely upon the poet's knowledge of the early Arabic tradition, is markedly oral.[11] Finally, the conceptual difference between the conventions is huge. Unlike their modern Yemeni colleagues, early Arab poets seem not to distinguish between inspiration for words and inspiration for imagery, and none of them claim to have a female-gendered *jinnī* along with a male-gendered familiar spirit.

It stands to reason that the conception of *hājis* and *ḥalīla* recorded in last-century Yemen could not have evolved from the understandings of the early Arab poets presented by the classical tradition. Rather it would be correct to assume that, as the contemporary Yemeni dialects have evolved from the local cluster of ancient Arabic dialects, the contemporary Yemeni conception of poetic inspiration originates from a distinctive local variation of the ancient Arabian representation of inspiration. As the old Yemeni dialects, though representing varieties of the Arabic language, may have been influenced by the Old South Arabian languages, the ancient Yemeni inspirational conception may have been influenced by South Arabian representations and beliefs.[12] At the same time, as the dialect cluster of Yemen, being very conservative, shares many classical features not found across most of the Arabic-speaking world, the contemporary Yemeni tradition to invoke daemons of inspiration is unique for vernacular Arabic poetry but, at the same time, has parallels with the notions of inspiration reflected in the classical tradition.

Firstly, as the representation of *hājis* and *ḥalīla*, the attitude of the early Arab poets toward the *jinn* of poetry seems ambivalent. Studying poetry and anecdotes about familiar spirits, it would be hardly possible to

Sam's descendants from Babel to the Yemen and the destruction of the tribes of ʿĀd and Thamūd, have been published in English with complete annotation by Elise W. Crosby (2007). In this edition, the tales of Luqmān b. ʿĀd and his seven vultures, Sulaymān and Bilqīs, the Himyarite kings, and Ṭasm and Jadīs are given in full synopses.

[11] F. Miller (2007: 162–178), studying the genre of *qaṣīdas* called 'initiation and response' (*bidʿ wa-jiwāb*), pays considerable attention to the issue of written and oral styles. For instance, the supplication (*duʿāʾ*) of the poem — the opening part devoted to praising the God and the Prophet Muḥammad — is markedly written. The prelude — the following part which indicates the main theme of the message and establishes the authorship of the composition — is markedly oral. 'Invoking the *hājis*' is distinguished as a separate part of the tribal *qaṣīda* by S. Caton (1990: 190). In his scheme, this part follows the 'opening' and the 'invocation of God'.

[12] On the pre-Islamic history of the Arabs in South Arabia, see Retsö 2003: 536–566.

understand with certainty whether poets believe in *jinn* or simply refer to inspiration, talent, and creative energy in a conventional way.

Secondly, the traditional invocation of *hājis* in Yemeni poetry indicates that this male-gendered muse is usually treated by the poet as a friend or a fellow tribesman who is expected to come and back him up in the moment of need. Precisely this conception of familiar spirit is shared by the early Arab poets. In both cases, the idea is dissimilar from the early pre-Islamic and, on the other hand, from the Quranic conception of the relationship between the poet and his following spirit.

Finally, a bond between true poethood and contacts with *jinn* is stressed both in the medieval accounts about inspiration and in the recent field reports from South Arabia. According to al-Jāḥiẓ (d. 255/869), in pre-Islamic and early Islamic times all great poets (those referred to as *fuḥūl*, sing. *faḥl*) were considered to be accompanied by *shayāṭīn* (al-Jāḥiẓ 1965–1969, vi: 225, 229).[13] Similarly, in the view of modern Yemeni tribesmen, only outstanding poets who compose verse constantly, unlike 'petty poets' (*shuʿayr*) who compose occasionally, can claim a connection with preternatural forces (Rodionov 2007: 164).

Studying parallels between two types of literary material, one has three possible modes of historical comparison. Genetic comparison is applicable when two phenomena originate from the same root. Typological comparison explains similarities resulting from identical conditions of development and mechanisms of functioning. The third type concentrates on influences and borrowing. Considering the outlined parallels between the early Arabic and the contemporary Yemeni conventions, I assert neither the likelihood of genetic continuity between them nor borrowings. None of the two can be demonstrated with any evidence. The unlikelihood of genetic continuity, however, does not exclude a genetic connection. It is possible that the mere idea of inspirational daemons is present in both traditions because both — contemporary vernacular poetry recorded by anthropologists and early Arabic poetry retrieved by ʿAbbāsid scholars — stem from the same root, namely, pre-Islamic tribal poetry. Admitting this sort of connection, which can be responsible merely for the most general commonness, I will explain the outlined parallels, focusing not on the genetic factor but rather on identical mechanisms of functioning.

The argument to be put forth is that the idea of creative energy shared by the early Arab poets and the contemporary tribal poets of Yemen is equally different from both the early pre-Islamic notion of inspiration (which associates poets with diviners, implying that both groups operate under the preternatural control and repeat verbatim the words of invisible beings) (Izutsu 1964: 169; Zwettler 1990: 77) and the Quranic conception, which reinterprets the *jinn* of poetic and divinatory inspiration as errant spirits that take possession of humans to lead them astray and make them lie (Qurʾān 26. 210, 221–224; see Bukhārī 2002: 795, 809, 1458, 1550, 1869; Muslim 1994, xiv: 323; Zbinden 1953: 83; Fahd 1966: 75; Bürgel 2006: 44; Nünlist 2015: 343. I argue that the outlined parallels between the poetic conventions reflect the similarity of communication practices related to the identical challenges faced by the poets in both forms of tribal Arab society. In both of them, the major task of the poet has been to defend personal and tribal honour against the opponents. The practices of cognition and expression, therefore, have been influenced by poetic experience of challenge.

References to *hājis* and *ḥalīla* in Yemeni tribal poetry have not gained such a consistent interpretation and conceptualization as those provided by the medieval literary-historical tradition for the *jinn* of the early Arab poets. Consequently, in this paper, the phenomena that are evident in the parallels between the conventions are studied on the material of early poetry and the related tradition. Due to the outlined parallels between the conventions, insights into the nature of these phenomena, though received from the medieval tradition, contribute to the understanding of the contemporary tribal tradition as well.

Inspiration as brother and friend

Depicting his tandem with his *hājis* Misḥal, al-Aʿshā says that they are 'two close partners' (*sharīkān*) in the state of mutual sympathy (*hawāda*)[14] and 'sincere friends — a *jinnī*

[13] The section on the *jinn* of poetic inspiration in *Al-ḥayawān* of al-Jāḥiẓ is entitled *Shayāṭīn al-shuʿarāʾ*, and the term *shayāṭīn* is mostly used in it. That the word is used without its Quranic connotations to evil, perversion, and deviance is proven by the parallel use of the term *jinn* in the same section.

[14] In the version studied by T. Nünlist (2015: 351), the word *mawadda* (love) appears instead.

and a man in harmony [with each other]' or 'a *jinnī* and a man assisted [by him]' (*ṣafiyyān jinnī wa-ins muwaffaq*). The poet declares that whenever the *jinnī* affords him support, 'there is nothing he would have been incapable of saying [in verse]' or 'there is no shortcoming in what he says' (*fa-lā aʿyā li-shayʾin aqūluhu*).[15] In another poem, al-Aʿshā 'calls his friend Misḥal' (*daʿawtu khalīlī Misḥalan*), refers to him as 'my brother *jinnī*' (*akhī ʾl-jinnī*) and even employs the formula 'may my soul be a ransom for him' (*nafsī fidāʾuhu*), which points to a very strong friendship or brotherhood (al-Aʿshā 1968: 125). Similarly, Ḥassān b. Thābit, boasting in verse of his inspiration, refers to his genius as a 'sharp-sighted brother from the *jinn*' (*wa-akhī min al-jinn al-baṣīr*) (Ḥassān b. Thābit 1994: 106).

The same conception of the relationship between man and spirit is traceable in reports on early Arab poets. In the anecdote about the *jinnī* of Zuhayr, the spirit refers to the poet as *ilfī min al-ins*, which may be understood not just as 'my familiar from humankind', but also as 'my friend from humankind' (Yāqūt 1993: 2161). Similarly, al-Farazdaq, a court poet of the Umayyads, in an anecdote by Abū ʿUbayda, invokes his *jinn* in the moment of need by exclaiming: 'Respond to your brother!' (*ajībū akhākum*) (Abū ʿUbayda 1998, ii: 4). In the same situation, Jarīr, al-Farazdaq's competitor, is reported to address a pair of his familiar spirits by exclaiming: 'Oh two companions (or friends) of mine!' (*yā ṣāḥibayya*) (al-Iṣfahānī 2008, viii: 51).

It is notable that the discussed conception of the relationship between the poet and his inspiration is reflected for early Arab poets of all generations and types. While al-Aʿshā (d. after 3/625) is a pre-Islamic wandering artist who travelled in search of earning opportunities, Zuhayr (d. 13 before Hijra/609) remained purely a tribal poet. Ḥassān b. Thābit (d. 54/674) started his career as a tribal poet, but later became a wandering artist and, finally, converted to Islam and gained the ascendancy of 'the poet of the Prophet'. Al-Farazdaq (d. 112/730) and Jarīr (d. 110/728) are tribal poets of Bedouin background who became famous as court poets of the Umayyads. Judging by the quoted examples of poetry, the referred reports of the ʿAbbāsid period may have leaned upon the earlier notions of poetic inspiration. If so, the fact that the tradition associates the outlined conception with such a wide range of early Arab artists may indicate that the representation of the attendant *jinnī* as the poet's friend or brother was widespread and had been maintained for a relatively long period.

The dependence of the early Arab poets on their 'brothers' from the *jinn* is different from the dependence of the soothsayers (*kāhin*, pl. *kuhhān*). The Islamic tradition presents the *kuhhān* as fully controlled by their spirits. It was believed that when a *kāhin* was in the state of possession and did not speak of his volition, but rather a *shayṭān* spoke through his mouth, his speech was fragmented to the extent that even separate words might have been cut. According to one of the traditions, it is using this characteristic that Muḥammad defined that a *shayṭān* spoke through the *kāhin* Ibn al-Ṣayyād (Ibn Kathīr 1999, vii: 248). On another *kāhin*, Musaylima, Muḥammad told that 'he has a *shayṭān* whom he cannot disobey'.[16]

Thus, the soothsayer is presented by the tradition as depending on secret knowledge imparted to him by *shayāṭīn* and must always utter what he receives. In opposition to this conception, the dependence of the poet on his fellow *jinnī* implies no obedience and is best described by the expression 'a friend in need'. Studying the context in which the dependence of early Arab poets on their *jinn* is indicated, one easily recognizes the same typical situation: the poet experiences powerlessness in the moment of inability to compose a verse when inspiration is urgently needed but not forthcoming.

The mentioned cases in which al-Aʿshā, Jarīr, and al-Farazdaq invoke their *jinn* are very similar. In each of them, the poet receives a poem and has to compose a better one of his own. Feeling challenged, he does not delay the endeavour till the next day and tries to compose the response in the night, but realises at the dawn that the inspiration has not come. Thus, in each case, it is not the poet who must be loyal to his familiar spirit, but rather loyalty is expected from the poet's inspiration.

Al-Aʿshā is attacked by an opponent whom he mentions as Sharāḥīl b. Ṭawd. Alluding to his unsuccessful nightly attempts in absence of inspiration, the poet depicts his bitter feeling in the following words: 'I was not an apprentice [in the craft of poetry], but I thought to myself: If only Misḥal would grant me words, I would

[15] Al-Aʿshā 1968: 221. For the explanations of the meaning of the verse, see also Izutsu 1964: 170 and Nünlist 2015: 350–351.

[16] *Inna maʿa Musaylima shayṭānan lā yaʿṣīhi* (al-Ṭabarī 1967, iii: 293).

utter [verse]' (al-Aʿshā 1968: 221).[17] The *qaṣīda* in which al-Aʿshā invokes Misḥal to attack another of his opponents, ʿAmr b. Qaṭan, is also related to the situation of challenge: the poet needs urgent inspiration to defend himself in the face of the attacking enemy (1968: 125). Similarly, Ḥassān b. Thābit boasts of his 'brother from the *jinn*' in the context of challenge, when being insulted by enemy poets. This clearly follows from the two lines preceding the verse in which the poet mentions his inspiration.[18]

Returning to the context of ineffectual attempts, some other examples should be mentioned. Jarīr depends on his *jinnī* in a specific situation, when challenged by a poem in which the poet Surāqa al-Bāriqī (d. 79/698) preferred al-Farazdaq over him. The insulted poet unsuccessfully tries over one night to compose an invective response and then hears the voice of his *jinnī* addressing him from the corner: 'Do you pretend to compose poetry yourself? I was not with you during this night, and that is why you were unable to compose anything' (al-Iṣfahānī 2008, viii: 51). The challenge of al-Farazdaq is to compose a poem which would be more beautiful than an ode by Ḥassān b. Thābit occasionally recited to him in Medina. After intense, but unsuccessful, nocturnal efforts, early in the morning, he rides a she-camel into the desert to find his familiar *jinn*, and the latter help him to compose an entire poem of 130 lines (Abū ʿUbayda 1998, ii: 4).[19]

Thus, the conception of inspirational *jinnī* as 'a friend in need' is not relevant for throes of art as such. Rather it should be a situation of battling, challenge, and urgent need for inspiration to defend the poet's honour. One reason for this is probably that true poetry in Arab tribal culture does not appear for the poet's own sake but, as S. Sowayan holds, has to defend a case or lay a claim (Sowayan 2003: 134). Another possible reason linking the use of *jinn* imagery specifically to poetic battling is that this genre of invective maintained the archaic idea of word magic longer than any other types of Arabic poetry (Izutsu 1964: 169).

In the early Arabic tradition, the representation of the relationship between man and spirit as friendship and brotherhood is stressed by verbs describing the process of communication as 'granting' and 'presenting': *ḥabā*, *saddā*, *manaḥa*, *nāla*. For example, Habīd, the familiar spirit of ʿAbīd b. al-Abraṣ, stresses that he has *granted* rhymed words (*ḥabawtu ʾl-qawāfiya*) to the chieftains of the tribe of Asad (al-Qurashī 1981: 48). Al-Aʿshā boasts that his brother *jinnī* used to *grant* him (*ḥabānī ʾl-akhī ʾl-jinnī*) poetry (al-Aʿshā 1994: 125). Dreaming of inspiration, he exclaims 'If only Misḥal granted (*saddā liya ʾl-qawla*) me words' (1994: 221). Lāfiẓ b. Lāḥiẓ, the attendant *jinnī* of Imruʾ al-Qays, says that he has *granted* the poet (*anā wa-ʾllāhi manaḥtuhu*) all the amazing in his poetry. Likewise, ʿAmr, the *jinnī* of al-Farazdaq, is described as 'the one who grants him (*nāʾiluhu*)' (al-Qurashī 1981: 51, 63).

This is a good moment to be reminded that, in the contemporary tribal tradition of Yemen, *hājis*, as a familiar prompter, is also presented as a friend that is expected to grant words when needed. This may be illustrated with the following lines from a *qaṣīda* recorded by S. Caton: 'The anxious one [i.e. the poet] said: // "Hand over [verses], O my genius // do not make excuses to me, // refrain from apologies. // It is as if you relied on me // and then you left me in the lurch // in this ignominious time // helpless."' (1990: 190, 319). That the poet refers to himself as 'the anxious one' (*al-muʿtanī*) indicates that rhymed words are needed by him urgently. This is stressed by the request not to make excuses to him and hand over as many verses as possible. The genius is referred to as *milgan-ī*, which can be literally translated not merely as 'my inspirer', but also as 'my prompter' (cf. Classical Ar. *mulaqqin*). Akin to pre-Islamic poets longing for inspiration and urging their familiar assistants to come and grant them words, the contemporary Yemeni poet describes the situation of inability to express himself, when it is so necessary, as helplessness and ignominy. Similarly, openings such as 'Oh, my *hājis*! I got used to your prompt replies' or 'Oh, my head, remember this evening your *hājis*!' indicate that *hājis* is a familiar assistant, from whom loyalty and aid are expected as something usual.

Creative energy without impelled discourses

In the context of poetic battling, *jinn* imagery is used to talk of inspiration understood as creative energy. Mūsā b.

[17] On this verse, see also Izutsu 1964: 170; Nünlist 2015: 349.

[18] 'I compete in dignity with those who challenge my dignity, // and my claw is turned against the one who bears a grudge [against me and insults]. || I do not steal from [other] poets what they told. // On the contrary, my poetry does not correspond [i.e. is not similar] to their poetry. || (...) || And my sharp-sighted brother from the jinn // has decorated [my] speech with the best ornaments' (Ḥassān b. Thābit 1994: 105–106).

[19] On this anecdote, see also Goldziher 1896–1899, i: 11.

Jābir al-Ḥanafī, one of the poets of the straddling period (in Arabic, these poets are referred to as *mukhaḍramūn*), once expressed his readiness to carry on battling against his opponent in the following way: 'My *jinn* have not yet fled' (*fa-mā nafarat jinnī*) (al-Marzūqī 2003: 270). On the other hand, ʿAbdallāh b. Ruʾba al-ʿAjāj, the poet of the same period, admitting his defeat in a poetic duel, described the situation by saying about his opponent: 'My invective could not contain his *shayṭān*' (*fa-lam yulith shayṭānahu tanahhumī*) (Ibn Manẓūr 2003, ii: 186). This discourse does not necessarily reflect beliefs in *jinn* as a genus of anthropomorphic creatures. Based on the examples provided above and below, one may only conclude that conventional imagery is used to speak of a specific emotional experience of challenge and contest.

According to the Islamic literary tradition, early Arab poets did not have to obey their companions, while their 'brothers' could not impel any utterances. Judging by one of the poems of Imruʾ al-Qays, in his imagination the *jinn* that surrounded him were responsible for transmitting his poetry and setting it to music (*tarwī mā aqūlu wa-taʿzifu*) (Imruʾ al-Qays 1984: 325). In the mentioned anecdote about Jarīr, being discontented with the first of his two inspirational agents because of a long absence, the poet rejected his assistance and turned to the second companion (al-Iṣfahānī 2008, viii: 51).

The notion that the *jinnī* does not speak through the poet's lips is reflected in several other reports, of which the most noticeable is that on Abū ʿAṭāʾ al-Sindī (d. shortly after 158/774). The poet lived in Kūfa as a client of the Banū Asad. Being born to a father from Sind, he had impure Arabic pronunciation and once remarked in jest that even his *shayṭān* complained about his accent (*wa-shakānī min ʿujmatī shayṭānī*) (al-Iṣfahānī 2008, xvii: 242). Thus, unlike the *shayāṭīn* of the *kuhhān*, the *jinn* of poetry were not regarded as capable of controlling the pronunciation of their familiars.

Poets occasionally reflected on the fact that they did not utter every verse their *jinn* offered. Already Imruʾ al-Qays, boasting of his rich inspiration that allowed him to choose and present the best poetry (or, perhaps, to choose the best among several variations in the process of composition), declared: 'Jinn offer me to choose from their poems // and I choose what I want from their poetry'.[20]

According to an anecdote provided by al-Jāḥiẓ, in response to a boastful mockery of one poet claiming, 'I compose a *qaṣīda* every hour, while you produce one in a week', the second parried: 'This is because I do not accept from my *shayāṭīn* the kind of things you accept from yours'.[21] This was a metaphorical way of saying: 'I do not utter all nonsense coming into my mind'.

Similarly, Bashshār b. Burd (d. 176/783), the early ʿAbbāsid master of invective, claimed that he not once restrained himself from insulting his friend, the poet Ḥammād b. ʿAjrad (d. 161/778), with overly pungent lines of lampoon coming into his mind. Describing the situation, he used *jinn* discourse in the following way: 'I used to return to my *shayṭān* some parts of invective [he gave me against Ḥammād] so that my friendship (with Ḥammād) would survive'.[22]

Another relevant line of Bashshār is an expression of his refusal (apparently, in a bad mood) to compose poetry following the invitation of his familiar *jinnī* named Shiniqnāq: '*Shiniqnāq called me from behind a young she-camel, // but I said: Leave me, as solitude is better*'.[23] It is unimaginable that a *kāhin* could claim to voice only a part of the words received from *shayāṭīn* or to refuse to repeat them at all.

Establishing leadership

In the context of battling, contest, and competition, to claim leadership and supremacy the poet boasts of having the best *jinnī* or describes how his familiar spirit has beaten the inspirational agent of his opponent. Ḥassān b. Thābit says that his *jinnī* 'decorates his speech with the best ornaments' (*ḥāla ʾl-kalāma bi-aḥsani ʾl-ḥibri*).[24] In another poem, he boasts of having 'a companion (*ṣāḥib*) from the Banū al-Shayṣabān' (al-Thaʿālibī 2003: 65), implying the tribe of the greatest *jinn*, which, consequently, must be the best in poetry.

Al-Farazdaq, who is reported to have a familiar *jinnī* named ʿAmr, in the poem of praise for Asad b. ʿAbdallāh al-Qaṣrī (d. 120/738), the governor of Khorasan in 106–

[20] *Tukhayyirunī ʾl-jinnu ashʿārahā // fa-mā shiʾtu min shiʿrihinna -ṣṭafaytū* (Imruʾ al-Qays 1984: 322).

[21] *La-innī lā aqbalu min shayṭānī mithla alladhī taqbalu min shayṭānika* (al-Jāḥiẓ 1998, i: 206–207).

[22] *La-qad kuntu aruddu ʿalā shayṭānī ashyāʾa min hijāʾihi ibqāʾan ʿalā ʾl-mawadda* (al-Iṣfahānī 2008, xiv: 223).

[23] *Daʿānī Shiniqnāqun ilā khalfi bakratin // fa-qultu utrukannī fa-ʾl-tafarrudu aḥmadu* (al-Thaʿālibī 2003: 65).

[24] See Ḥassān b. Thābit 1994: 106. The commentary explains that by *ḥibr* (ink), the poet implies *washy* (ornament).

117/724–735, boasts of his own panegyric and claims to have the best inspirational *jinnī*: 'As if with pure gold has decorated it [this panegyric] // the tongue of the most poetic *shayṭān* of all God's creation' (al-Jāḥiẓ 1965–1969, vi: 226–227).

Jarīr, after receiving from the caliph ʿAbd al-Malik b. Marwān (d. 86/705) less money than he expected, complains in verse: 'I found that [my] *shayṭān*'s incantations (*ruqā ʾl-shayṭān* [i.e. poetry]) were not exciting him, // [even though] my *shayṭān* was the most charming among the jinn' (Ibn ʿAbd Rabbih 1983, i: 327). In another poem, Jarīr claims that his poetry comes to him from 'the most mature of the *shayāṭīn*' (*muktahal min al-shayāṭīn*) and the greatest devil of the devils — *iblīs al-abālīs* (al-Thaʿālibī 2003: 64). Similarly, an unknown poet quoted by al-Jāḥiẓ claims that his *shayṭān* is the greatest among the *jinn* (*fa-inna shayṭānī kabīr al-jinn*) or 'the prince of the *jinn*' (*amīr al-jinn*) (al-Jāḥiẓ 1965–1969, vi: 229; al-Thaʿālibī 2003: 66). In all these examples, *shayṭān* means simply 'poetic talent', which indeed can be great, mature, or charming. The quoted poets employ *jinn* imagery to establish leadership.

Accordingly, in the context of a contest, in order to ascribe to a poet more mastery and talent than to his competitor, one had to declare that the *jinnī* of the first was better than that of the second. For instance, al-Aʿshā of the Banū Sulaym, a second-/eighth-century poet, preferring al-Mukhabbal al-Qaysī (d. 12/633) over al-Farazdaq and other poets, claims that 'the *jinnī* of al-Farazdaq is not the one to follow, // whereas none of them (of the *jinn*) could have come near the genius of al-Mukhabbal' (al-Thaʿālibī 2003: 65). In the next line, the poet declares that, 'after ʿAmr, there is no poet like Misḥal', which simply means that, in his view, the talent of al-Aʿshā b. Qays is the second greatest after that of al-Mukhabbal.

Much more original claims for leadership, exceptional mastery, and victories in poetic battling are based on sexist expressions. The most vivid example dates back to the third/ninth century, showing the burlesque character of *jinn* discourse. When the court poet Marwān b. Abī ʾl-Janūb al-Aṣghar was challenged by the caliph al-Mutawakkil (r. 232–247/847–861) to compete with the poet ʿAlī b. al-Jahm (d. 249/863), the former attacked the latter with invective, saying among other things: 'When we (he and me) clashed (in a competition), my verse mated (*nāka*) his verse, and my *shayṭān* has "screwed up" (*nazā*) his *shayṭān*' (al-Ṣafadī 2000, xxv: 230). That the images of the *jinn* are used for constructing a metaphor clearly follows from the fact that the verses of two poets are brought into the same relation as their *shayāṭīn*. In the quoted verse, Marwān al-Aṣghar implies that his talent is male, while that of ʿAlī b. al-Jahm is female, which is also a traditional way of mockery in poetic battling. A similar example belongs to the Umayyad poet Abū al-Najm al-ʿIjlī (d. 120/738). Claiming the strongest talent, he proclaims that the *shayṭān* of each human poet is female, whereas only his *shayṭān* is male (al-Jāḥiẓ 1965–1969, vi: 229). Most likely, in the same context of masculine domination one should regard the use of *jinn* imagery by al-Aʿshā who, counter-attacking ʿAmr b. Qaṭan, claims to have invited Misḥal to deal with Jihinnām, implying that the latter was a female-gendered muse of his opponent (al-Aʿshā 1968: 125).

Conclusion

The conception of poetic inspiration, or its allegoric representation, as a loyal brother and friend reflects the situation of challenge experienced in tribal Arab culture. Apparently, in contrast to the early pre-Islamic conception of divinatory-poetic inspiration, metered and rhymed pronouncements of the late Jāhilī poet were not expected to contain any secret knowledge or to produce a magical effect. It was rather his excessive imagination and linguistic virtuosity that were linked to unseen powers. Unlike the inspiration of a soothsayer or an early pre-Islamic poet-shaman, such a link did not imply the full loyalty of a man to his spirit — neither preternatural control nor impelled discourses. It was rather the artist that demanded loyalty from his spirit, and the link between them meant that extraordinary creative energy was afforded to a gifted person in the moment of need.

As argued in this paper, conventional *jinn* imagery is used for very specific situations and experiences: poetic battling, other forms of rivalry between poets for leadership, and a very urgent need for inspiration to defend personal honour. In this respect, the use of discourse based on *jinn* imagery reflects the pre-Islamic tribal ethics of manly pride and loyalty to the kin. This detail indicates the tribal origins of the tradition to refer to the *jinn* of inspiration. In view of the specific contexts in which *jinn* imagery is employed, it is unlikely that this tradition has been an invention of ʿAbbāsid scholars.

The examples provided by the medieval historical-literary tradition on the one side, and by contemporary ethnographic data on the other indicate that, generally, in the Islamic period, with respect to the issues of inspiration, talent, and creative energy, poets remained within the late Jāhilī paradigm presenting the relationship between man and spirit as assistance offered to the poet by his loyal 'brother'. In opposition to it, the Quranic conception of impure inspiration through *shayāṭīn*, which does not distinguish between divinatory and poetic, seems to be proximate to the early pre-Islamic model depicting this relationship as possession, control, and direction. This model helped to dissociate the Messenger of Allah equally from the poets and the soothsayers but was, probably, different enough from the conception of inspiration through *jinn* shared at the advent of Islam by the poets themselves to affect it.[25] Another possible explanation of the phenomenon is that *jinn* imagery and the related discourse are, first and foremost, an artistic convention. As such, they could have been kept by Muslim poets among other traditional pre-Islamic elements of tribal poetry, most of which appeared to be too stable or useful to be easily given up.

Acknowledgements

The author expresses his gratitude to the Fritz Thyssen Foundation for its support of the research for this paper.

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[25] Regardless of the differences between the late pre-Islamic notions of poetic inspiration and the conception of divinatory-poetic inspiration elaborated in the Qurʾān, for a number of poets Islam brought an ethical conflict between religion and poetry precisely because of the *jinn* issue (Meier 1966: 425).

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Papers read at the Seminar for Arabian Studies held at the British Museum, London, 3–5 August 2018

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ISBN 978-1-78969-230-3

ISSN 0308-8421