

Neolithic settlement patterns and subsistence strategies on Marawah Island, Abu Dhabi Emirate, United Arab Emirates

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Summary

Recent work has revealed that there are three major Neolithic settlements present on Marawah Island, Abu Dhabi, known as MR1, MR2.5, and MR11. Excavations at the settlement of MR11 are radically changing our ideas of Neolithic architecture, in particular the spatial organization of settlements. MR11 comprises a group of seven mounds (Areas A to G), the first of which (Area A) was subject to excavation in 2003 and 2004 (Beech et al. 2005). Work has continued every year since 2014 on Areas A, B, C, and F. Radiocarbon dating of charcoal fragments have demonstrated that this settlement was occupied from c.8000 to 6500 years ago (Beech et al. 2019). The excavation of each of these areas revealed different forms of architecture. It is now clear that a part of the tripartite house in Area A post-dates an earlier building. Areas B and C comprise a series of differently shaped rooms and paved areas with multiple entrances. Preliminary excavations on Area F indicate the presence of a multi-celled structure that is very different in character from the other areas. Some of the key finds from the excavations are discussed, including lithics, plaster vessels, fish bones, marine shells, mineralized date stones, and radiocarbon dates.

Keywords: Neolithic, settlement, architecture, subsistence, Arabian Gulf

Introduction

Marawah Island is located about 100 km to the west of Abu Dhabi city, the capital of the United Arab Emirates (Fig. 1). The island forms one of a chain of barrier islands located on a shallow submarine ridge along the western seaboard of Abu Dhabi. Geomorphological survey undertaken in 2002 identified that the island comprises several rocky cores of Pleistocene limestone linked by areas of unconsolidated Holocene carbonates (Evans, Kirkham & Carter 2002).

The first archaeological survey of Marawah Island was undertaken by the Abu Dhabi Islands Archaeological Survey (ADIAS) between 14 and 20 April 1992 (King 1998). This survey discovered a total of thirteen sites from the Late Stone Age to the late Islamic period, with MR1, MR2.5, and MR11 thought to date to the Late Stone Age or Neolithic (8000 to 4000 BC).

MR1 comprises several mounds, wall lines, and structural traces. These are located on a raised limestone plateau at the south-west end of Marawah, c.2 km to the south of Liffa village. Arrowheads, tile knives, scrapers, and other tools dated to the Neolithic period were

collected from the surface of the plateau (Shepherd-Popescu 2003; Charpentier & Beech, forthcoming). Three radiocarbon dates from ash samples of surface hearths indicated a sixth- to early fifth-millennium BC date (ADIAS 2006).

MR2.5 consists of four mounds and is situated on a low rocky ridge just to the west of Ghubba. On 26 February 2021 our team visited the site and discovered an Ubaid pottery sherd, a finely made leaf-shaped flint arrowhead, a stone fishing-net sinker, and a pierced shell button on the surface. Further investigations need to be conducted here for a better understanding of this site.

MR11 comprises a group of seven large cairns at the north-western end of a triangular-shaped limestone outcrop, located c.2 km west-south-west of Ghubba village (Fig. 2). The largest mound measured 20 × 8 × 2 m high (MR11.1; King 1998; Beech et al. 2005: fig. 4; 2019), had structural elements visible within the surface of the mound, and for the purposes of these excavations was designated Areas B and C. The other mounds varied in size standing up to 1.5–2 m in height. The lowest of the mounds (MR11.6, Excavation Area A) measured only 5 m across and 0.5 m in height.

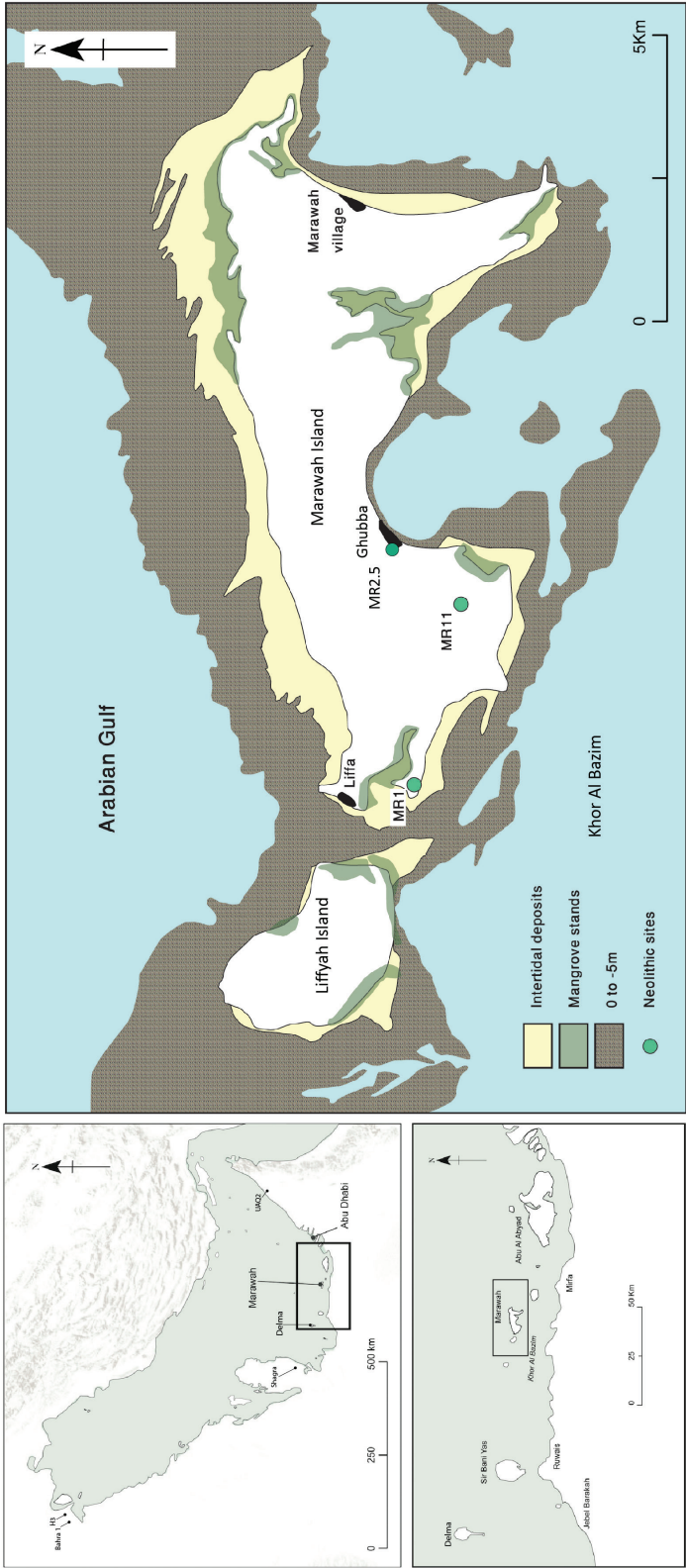


FIGURE 1. The location of MR1, MR2.5, and MR11 sites on Marawah Island, as well as other sites referred to in the text.

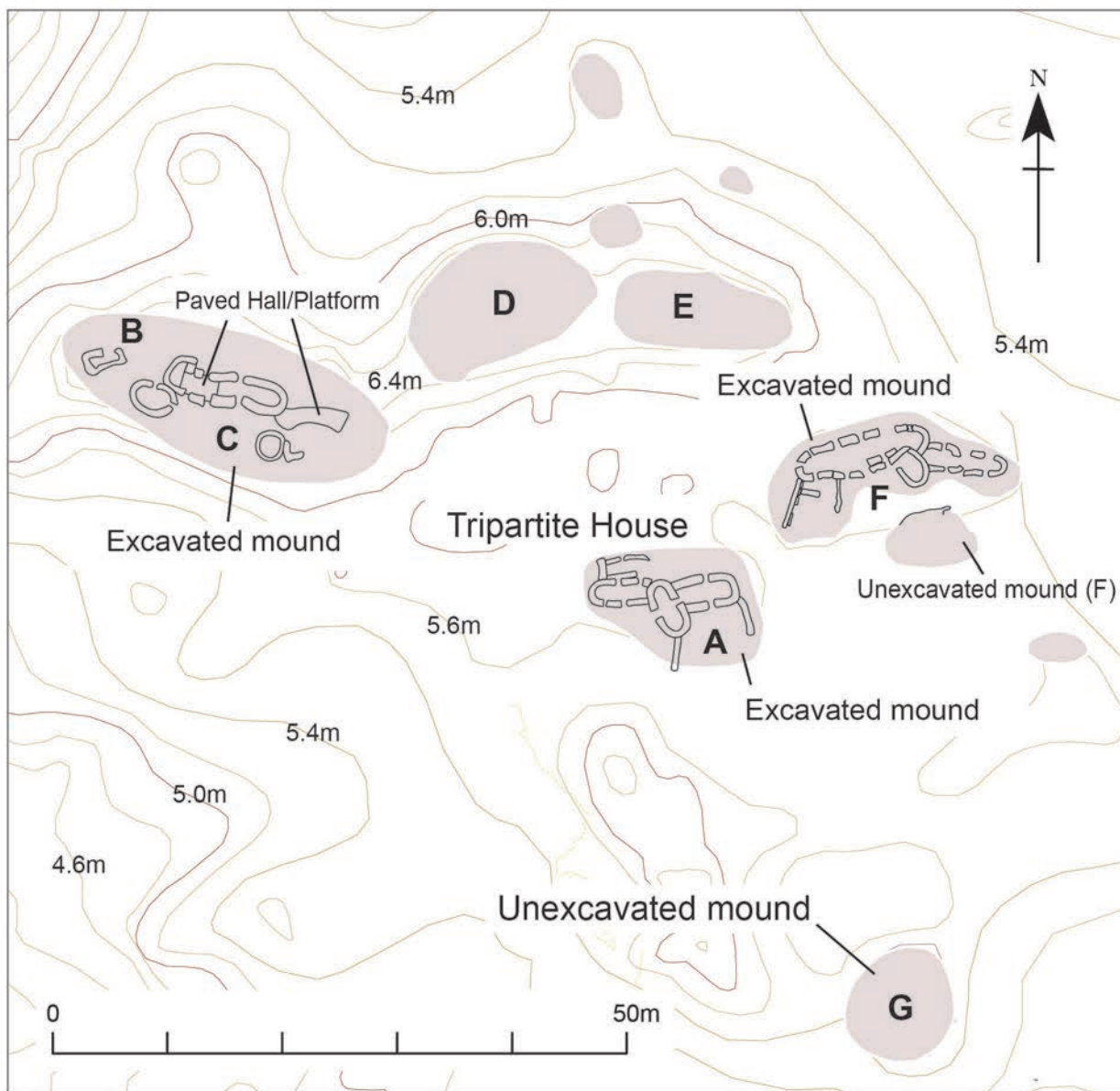


FIGURE 2. A site plan showing the different excavation areas at MR11 and the presence of other mounds at the site.

Notably, all three sites are located on limestone outcrops: MR11 at 8.6 m above present mean sea level (PMSL), MR1 at c.5–6 m, and MR2.5 at c.5 m PMSL. Higher relative sea levels during the occupation of these sites (possibly as much as 2 m higher than the present day; Bernier et al. 1995), would indicate that Marawah Island

would have been a small archipelago of islands. With the sea in closer proximity than the present day, the sites of MR1, MR2.5, and MR11 appear strategically placed, with uninterrupted views of the surrounding territory as well as access to anchorages for potential maritime transport (Carter 2006; 2018).

Excavation areas

Area A — the tripartite house

The ‘tripartite house’ in Area A is a remarkable example of Neolithic architecture. The first excavation of Area A took place during March to early April 2004. This work revealed Room 1 of the structure (Fig. 3).

Important finds discovered in this room included an almost complete Ubaid pottery vessel, now on display at the Louvre Abu Dhabi (Méry et al. 2016a). This was followed by short excavation seasons that took place during 2014 and 2015. These excavations concentrated on investigating the external courtyard area, south of Rooms 1 and 2. Traces of a hearth were identified in the south-east corner of the excavated trench,

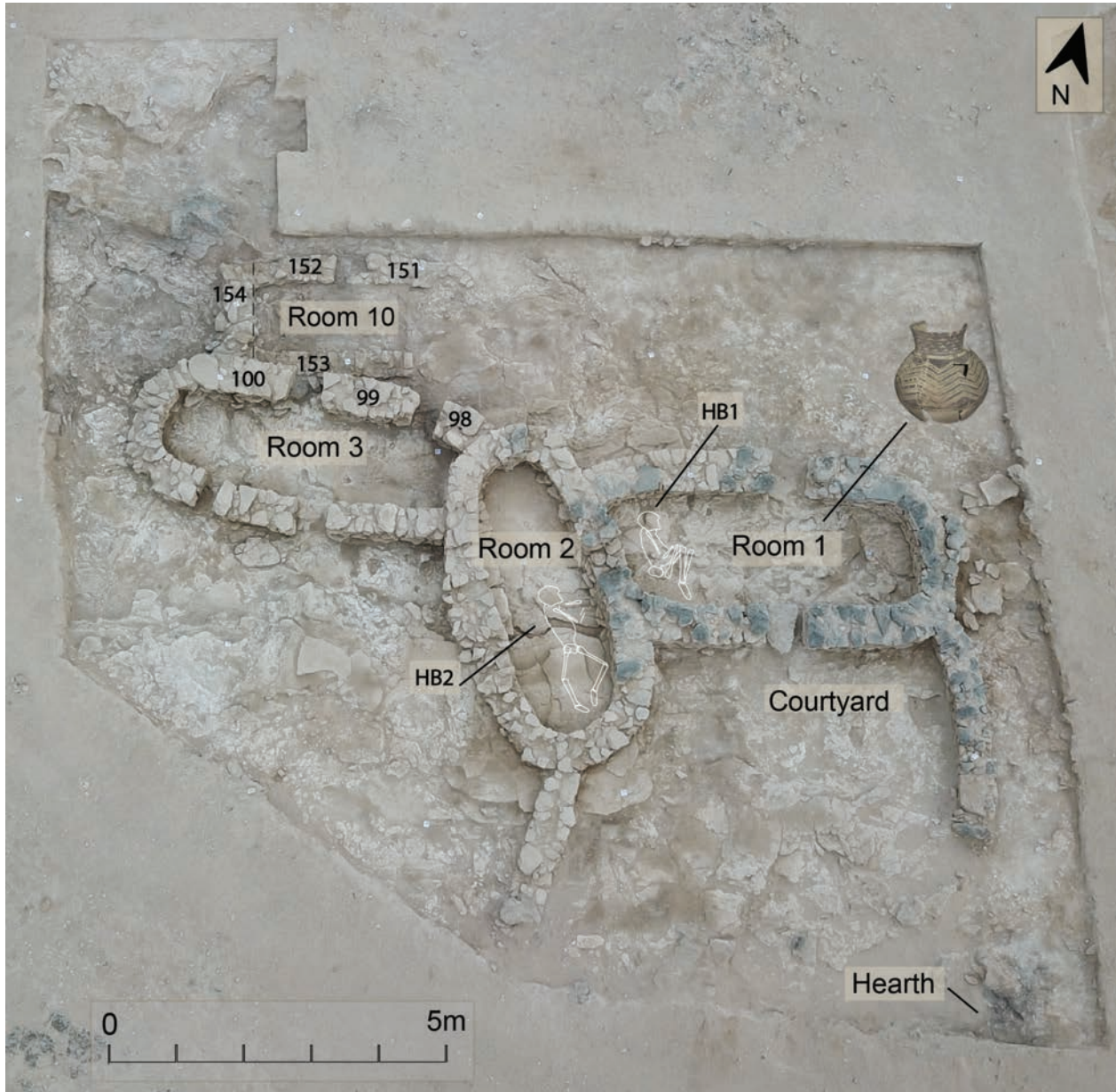


FIGURE 3. An aerial photograph and plan of MR11, Area A: the tripartite house.

directly overlying the natural outcrop. Excavations then continued in 2016–2017 to reveal the presence of Rooms 2 and 3. This uncovered a similar stratigraphic sequence to that identified in Room 1 (Beech et al. 2005). There were traces of occupation material on top of the bedrock, followed by the structural elements of the house. Occupation debris in the room interiors and exteriors were overlain by a human burial. The burial had been placed deliberately on a stone platform inside Room 1, adjacent to the threshold to Room 2. The room was then subject to a period of collapse and disuse before being buried further by wind-blown sand. A later phase saw the insertion of a further human burial into Room 2, which had also been placed on a stone platform. A find worth noting was a dolphin mandible that had a series of parallel lines carved into it, mirroring the line patterns we see on plaster vessel sherds (Beech et al. 2019: figs 6 & 8). The remains of dugong and turtle and considerable quantities of fish bones were all noted from within the tripartite house (Beech et al. 2005; Lidour & Beech 2019a). Room 3 also had traces of food storage and consumption, the remains of plaster vessels being excavated from the eastern and western ends of the room.

Excavations in Area A continued for two more seasons in 2020–2021. These excavations focused on removing the heavy layer of rubble and overburden north of the structure and investigating the external spaces of the structure surrounding the walls. These seasons led to the discovery of Room 10, an earlier phase of the structure, located to the north of Room 3. The external space to the west of Room 10 is associated with dump layers and pits represented by the various sizes and depths of dark ashy material and limestone undulating the bedrock surface. The interior space of the room was excavated to reveal a relatively flat surface, appearing more residential in contrast to the external spaces. The removal of the rubble layers also exposed the extent of the southern and northern walls of Room 10 which uncovered an entrance, oriented north-east–south-west. The south-western wall of Room 10 runs under the northern wall of Room 3. The intersection of these structural elements improved our understanding of the stratigraphic phasing for most of the occupational sequences of Area A. The external extent of the room has been excavated down to the bedrock, fully uncovering the structure.

The 2021 season Area A excavations identified four phases, with three main phases of occupation. Phase 1 consisted of dump deposits of dark and ashy layers overlying the natural bedrock and were sealed by the architectural features from Phase 2. Phase 2 consisted of the foundation courses for Room 10 and related deposits, which were located to the north of the tripartite house. There is a clear physical relationship between Room 10 and Room 3; the most concrete example being that Wall 100 of Room 3 was built directly on top of Walls 153 and 154 of Room 10. This shows that Room 10 is earlier than Phase 3 and could not have been extant when Room 3 was constructed. Phase 3 is associated with the occupation of the tripartite house, and with external activity spaces that contain dump deposits and hearths. Phase 4 consisted of post-occupational rubble, mixed with and partly covered by aeolian sand layers. This phasing is based on the stratigraphical relationships established by excavation. However, the analysis of ^{14}C samples will provide a clearer time frame for the chronology of occupation in Area A.

Areas B–C — the elongated hall/platform and other structures

Area B was first investigated in 2003 with a focus on the internal space of a structure at the western extent of the mound (MR11.5). A trench was excavated along the western and northern exterior walls, into the doorway of the structure (Beech et al. 2005). This structure (Room 4) was constructed directly on the natural bedrock and has no stratigraphic continuity with Area C (Fig. 4). Area B was last investigated in 2020 when the removal of rubble layers exposed the external faces of Room 4 and the natural bedrock between Area B and Area C. To the west and north-west of Room 4, the removal of overburden and rubble layers exposed a single course of medium to large stones with a rubble core, interpreted as possible revetments or bases for a series of platforms. Areas B and C both produced flint tile knives and shell beads, with similar, dark-ashy occupational deposits to the exterior of the structures.

Area C lies to the east of Area B and is situated on the highest point of the MR11 plateau. This is a multi-cell complex comprising four rooms built against a central area of open pavements and platforms that exploited a natural rise in the bedrock. At the centre of this complex

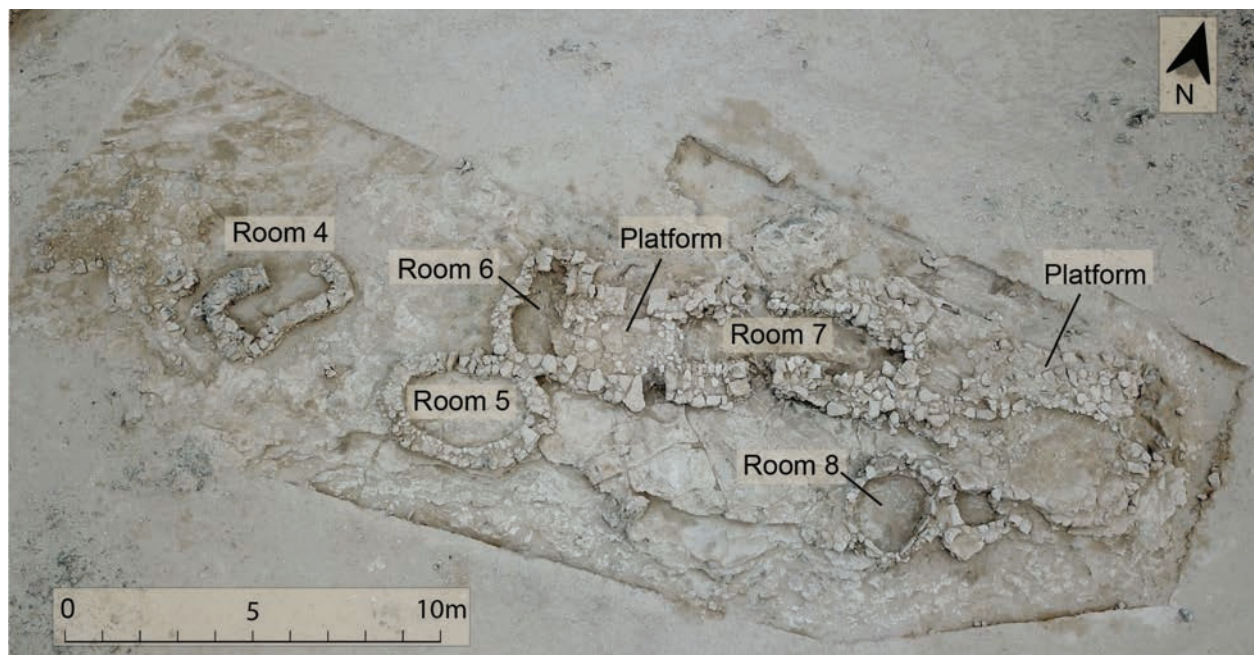


FIGURE 4. An aerial photograph and plan of MR11, Areas B-C: the paved hall/raised platform and other structures.

was an east-west aligned 'room' (Room 7). Note that in this context the term 'room' is used to describe an area defined by low, dry-stone walls. This area may include pavements and platforms rather than solely enclosed structures. Room 7 has two entrances to the north and two to the south leading to the exterior. During the early stages of excavation, it was thought that Room 7 had walls; however, it became clear that rather than being walls, these structures formed a series of revetments for several phases of platforms, with the highest platforms at the western end of the 'room'. These platforms may be indicative of a communal rather than a domestic use of the structure. The earliest deposits within Room 7 contained evidence of plaster vessel manufacture. These layers also produced a significant amount of fish bone, shells, arrowheads, and other lithics. To the north and south of Room 7 were accumulated layers of charcoal and ash that appeared to 'fan out' from the entrances, indicating that an extensive amount of burnt waste was being discarded from Room 7.

The western extent of Room 7 continued into Room 6, which was entirely filled with rubble and contained no clear occupation deposits. Rather than resulting from collapse, this rubble may have been a deliberate attempt to raise the level of the western end of Room

7, potentially for a higher platform that subsequently collapsed. Abutting Room 6 to the south-west was Room 5, which had two entrances, one to the north and one to the east. The rubble from Room 6 produced a pearl and the lowest horizon in Room 5 produced the 'Abu Dhabi pearl' (Beech et al. 2019: fig. 9).

To the south of Room 7 was a small circular room (Room 8), which was formed using one course of large, upright limestone slabs. A later burial had been cut into the upper fills of Room 8. At the eastern extent of Room 7 were several smaller, semi-circular walls that were in-filled with rubble. These were far too small to be rooms and were more likely used to extend the raised bedrock further to the east. These semi-circular walls may also have supported elevated platforms at the eastern extent of the outcrop. The architecture of Area C serves as an example of social shifts in culture influencing structural elements and overall aesthetics to serve a new, different purpose.

The structural phases in Area C indicate that life on MR11 was perhaps more sedentary than had previously been considered, allowing the society to experiment with innovative architectural concepts. The change from small domestic spaces to larger communal buildings and the broad typology of artefacts, indicate progressive

cultural development, where MR11 may have become a focus for the wider community.

Area F — various structures

Area F is located to the north-east of Area A and was initially excavated in 2020 to investigate a row of orthostats aligned south-south-west to north-north-east, which was visible prior to excavation. By the end of the 2021 season most of the rubble collapse had been removed to reveal the upper courses of a series of rooms with a bedrock platform at their western extent (Fig. 5). Currently the interior spaces remain unexcavated as work to date has focused on the removal of rubble overburden across the mound. The largest and earliest of these rooms (Room 11) has an interior size of 8.35×2.55 m, and has three entrances to the south, three entrances to the north, and one entrance leading to a bedrock platform to the west. The southern wall of Room 11 has two walls constructed on the same alignment side by side. Prior to excavation of the interior of these rooms, it is unclear which is the earliest wall. However, it seems likely that one wall was built to provide architectural or ‘buttress support’ for the other.

Alternatively, excavation may reveal that they relate to different phases.

Two further rooms were added to the eastern extent of Room 11 (Rooms 12 and 15). The walls of Room 12 abut the eastern apsidal end of Room 11 but there is no connecting doorway between the two rooms. Room 12 is ovoid in plan, measuring 3×1.6 m and aligned north-north-west to south-south-east. Room 15 would appear to abut both Room 11 and Room 12 and is therefore later. At the northern extent of Room 15 is an entrance that appears to have been deliberately blocked with several courses of stone.

Abutting the eastern walls of Rooms 15 and 12 is a later room (Room 13), which has entrances to the north and south. This is abutted at its eastern extent by one further room (Room 14), which also appears to have an entrance on the northern and southern sides and is the latest room in the sequence. Within its interior are large lintel and limestone slabs that have, post-abandonment, fallen into a vertical position. Due to the compact layers of rubble overburden, the stratigraphic relationship between Rooms 13 and 14 is not entirely clear but further excavation will elucidate this.

While the stratigraphic phasing of Area F is becoming clear, the analysis of radiocarbon dates is needed in order

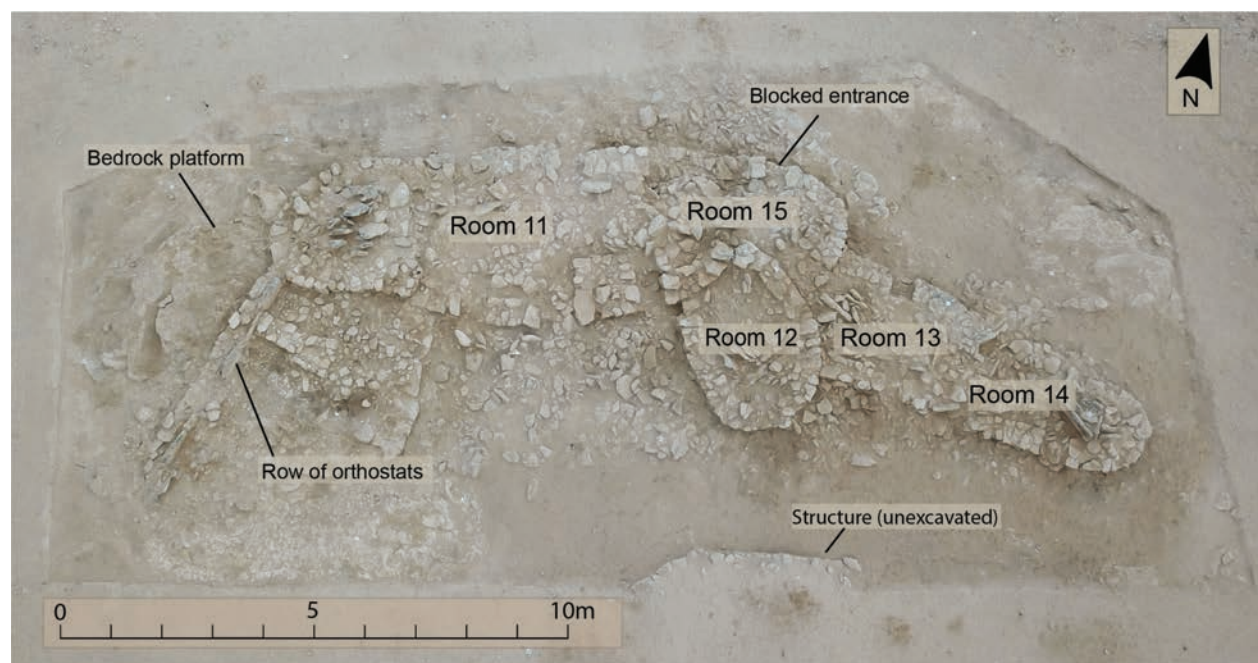


FIGURE 5. An aerial photograph and plan of MR11, Area F: various structures.

to place the occupation of these rooms within the wider site chronology. Occupational deposits and the full extent of the architectural features currently remain sealed under post-abandonment collapse and rubble. The finds uncovered in the process of excavating the rubble layer and external spaces of Area F include various typologies of arrowheads (triangular, as well as barbed and tanged), tile knives, net sinkers, and shell and stone beads.

Lithics and stone artefacts

The MR11 lithic assemblage is very homogeneous throughout the stratigraphy and between the different excavated areas and structures. The assemblage comprises rather opportunistic tile knives and highly refined arrowhead technology that draws from a range of forms, from the typical South Arabian triangular points (Crassard et al. 2020) to the more ubiquitous bifacial barbed and tanged arrowheads with symmetric or asymmetric flat sections (Charpentier 2004; Maiorano et al. 2020). There are also a few net sinkers (Fig. 6). Apart from some rare surface finds, the majority of this lithic material comes from stratified contexts. The lithics are mainly made of flint (or chert), with a few examples of other types of rocks (e.g. quartzite, quartz, and jaspoid-like). As observed previously, flint does not occur naturally on the island and is necessarily imported. Dalma Island, Sir Bani Yas Island, and the mainland coast of Abu Dhabi Emirate offer these materials (Kallweit & Beech 2020), mostly thin tabular flint of rather low quality, while fine-grained knappable stones in the form of wadi pebbles were also probably introduced from more distant places.

Plaster vessels

Fragments of plaster vessels were commonly found at the site, particularly in Areas A and C. Some of these are decorated on their exterior surfaces with orange-pink and grey-black stripes, chevrons, and general coatings (Fig. 7). Concentrations of plaster shallow bowls/plates were found in Area A at the eastern and western ends of Room 3. These vessel forms appear to be related to food consumption. Area C had significant quantities of plaster vessel fragments within the pavement layers of Room 7. Plaster fragments with finger impressions were also noted. Since the discovery of the Ubaid pottery

vessel (now on display at Louvre Abu Dhabi) in Room 1 of Area A, no further examples of Ubaid pottery have been recovered from any contexts excavated in Areas A, B, C, or F. Moreover, lime plaster and gypsum plaster pyrotechnology antedates Ubaid ceramic technology in the broader region, reaching as far back as the PPNB (Kingery, Vandiver & Prickett 1988).

Similar plaster vessels have also been identified at the Ubaid coastal settlement of DLM11 on Delma Island (Beech & Elders 1999; Beech, Elders & Shepherd 2000) and more recently within a Neolithic stone-built structure excavated on Ghagha Island (GHG14; DCT 2019). Previous work on the plaster vessels from Delma Island revealed that three types of material were used for both the vessels and construction materials: two are gypsum plasters, one with quartz aggregate, the other an impure gypsum mixed with calcareous clay and added limestone and quartz aggregate; the third type is lime-rich with limestone aggregate (Joyner 2001; Al Hameli et al., forthcoming). Both gypsum and calcareous materials are locally available on Delma, Marawah, and Ghagha Islands. The plaster vessels were built up in layers, sometimes using different plaster recipes for the different layers. Some plaster vessels were decorated on their exterior surfaces with black or pink pigments. These pigments are made from haematite, pyrolusite, and possibly ochre. They contain manganese and iron oxides. A pink slip applied to the exterior surface of a few vessels was made from a mixture of finely ground haematite and gypsum. These mineral resources such as haematite and gypsum can readily be found at all the salt dome geology localities in Abu Dhabi's western region, such as on seven offshore islands at Dayana, Das, Qarnain, Zirku, Arzana, Delma Island, and Sir Bani Yas Island, as well as at Jebel Dhanna on the mainland coast (Thomas, Ellison & Goodenough 2013). This means that such vessels and the raw materials for their production such as haematite must have been imported to Marawah Island and Ghagha Island from one of these other locations.

Fishing activities, shellfish consumption, and pearls

Comparatively few terrestrial mammalian bones have been discovered at MR11, although the presence of sheep/goat or gazelle has been noted. Most of the



FIGURE 6. Lithic finds from MR11, Area C: 1. Context 501, SF#613; 2. Context 536, SF#823; 3. Context 557, SF#878; 4. Context 555, SF#863; 5. Context 562, SF#904; 6. Context 503, SF#634; 7. Context 526, SF#812; 8. Context 555, SF#869. Area A: 9. Context 156, SF#1655; 10. Context 165, SF#1661.

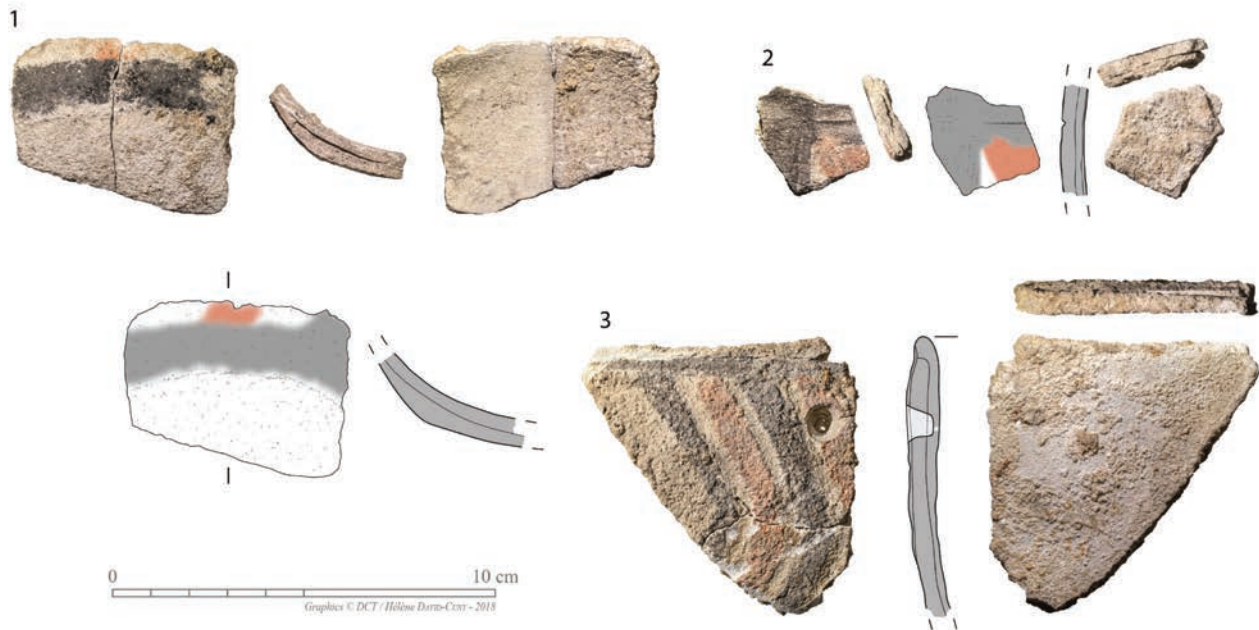


FIGURE 7. Decorated plaster vessels from MR11, Area C: 1. Context 562, SF#952; 2. Context 506, SF#708; 3. Context 506, SF#681 & 710.

faunal remains comprise fish bones with occasional turtle, dugong, dolphin, bird, and small mammal bones present. The fish remains comprised bamboo sharks, requiem sharks, sawfish, stingrays, anchovies, sardines, sea catfish, mullets, silversides, needlefish, flatheads, groupers, sillagos, jacks and trevallies, snappers, mojarras, grunts, threadfin breams, emperors, seabreams, drums, goatfish, grunTERS, parrotfish, rabbitfish, barracudas, and tuna. The predominance of small coastal fish such as grunts, emperors, and seabreams in the faunal assemblage suggests that fishing was essentially carried out in the surrounding shallow waters where soft-bottoms and seagrass meadows predominate. Non-selective fishing techniques probably involved the use of small-mesh devices such as beach seines and coastal barrier traps (Lidour & Beech 2019a). The range of species captured compares favourably with other known sites in the region (Beech 2002; 2004; 2010; Beech, Charpentier & Méry 2017; Lidour & Beech 2019b; Lidour, forthcoming).

The shell assemblage from MR11 was identified using Bosch et al. (1995) and is composed mainly of turban shells (*Lunella coronata*), pearl oysters (*Pinctada radiata*), bearded ark clams (*Barbatia setigera*), and

the violet asaphis (*Asaphis violascens*). Other common species include murexes (*Hexaplex kuesterianus*), spiral shells (*Turritella fultoni*), Kotschy's gibbula (*Priotrochus kotschy*), cockles (*Vasticardium lacunosum*), circes (*Circe rugifera*), and Venus clams (*Callista umbonella*). Pearl oysters and turban shells are by far the most frequently recorded species in Areas A and F. Conversely, two main types of assemblages are represented in Areas B and C: one is composed mainly of turban shells and violet asaphis and the other of bearded ark clams and pearl oysters. Large Venus clam valves are frequently worked on their ventral margin to be reused as cutting or scraping tools (Charpentier, Méry & Phillips 2004; Méry et al. 2016b).

The two types of shell assemblages observed in Areas B and C correspond to the exploitation of two separate near-shore zones: 1) the upper intertidal rocks and sandy gravels which are suitable for the collection of turban shells and violet asaphis; and 2) the shallow subtidal waters where bearded ark clams and pearl oysters can be found. Shell gathering would have been entirely possible on foot at low tide and did not require the use of boats. The complete absence of typical mangrove species (such as *Terebralia palustris* and

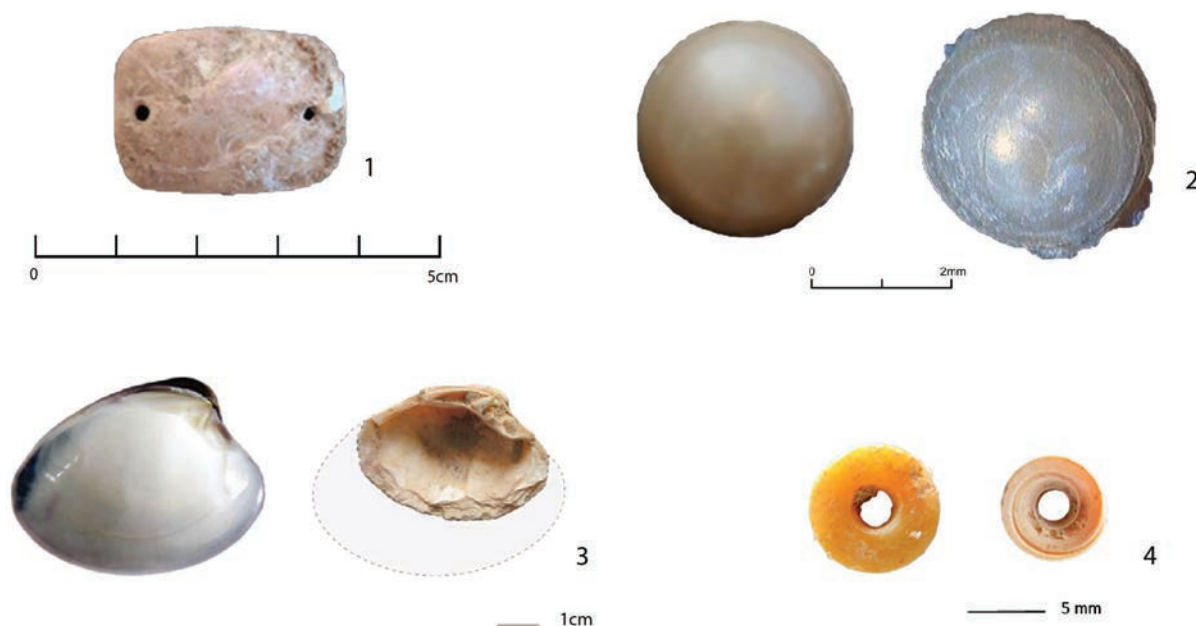


FIGURE 8. Marine shell artefacts from MR11: **1.** pearl shell plaque (Area A, Context 181, SF#1730); **2.** the two pearls discovered in Rooms 5 and 6 (Area C, left: Context 507, SF#737; right: Context 554, SF#451); **3.** example of a worked Venus clam (*Callista umbonella*) (Area C, Context 697, SF#1387); **4.** Spondylus shell disc beads (Area C, left: Context 623, SF#1034; right: Context 624, SF#1036).

Saccostrea cucullata) suggests that no dense mangrove was present on Marawah Island during the Neolithic. It is thus likely that the local environment on the island was quite like the modern one.

The recovery of two natural oyster pearls within Rooms 5 and 6 (Area C) is an exciting discovery which provides some of the earliest dated evidence for the exploitation of pearls in the world (Fig. 8). Radiocarbon dates suggest that these pearls pre-date those previously discovered at the Umm Al Qaiwain UAQ2 site in the UAE by up to 300 years (Charpentier, Phillips & Méry 2012). We know that the mother-of-pearl from pearl oysters was already being exploited to manufacture jewellery (Beech et al. 2005: fig. 12) and later to manufacture fish-hooks (Méry, Charpentier & Beech 2008). It is therefore not surprising that pearls were exploited from the very beginning of the sixth millennium BC. They are, of course, attested from other slightly later sites such as Dosariyah (Drechsler 2018) and Al-Buhais 18 (Kiesewetter, Uerpmann & Jasim 2000).

Mineralized date stones

The important discovery of mineralized date stones (Fig. 9) in well-stratified contexts within Room 7 of Area C may provide Arabia's earliest evidence of the consumption of dates. Two carbonized date stones were previously discovered at the coastal Ubaid-related settlement on Delma Island, which were AMS radiocarbon dated to 4670 $\pm$ 130 Cal BC and 5120 $\pm$ 170 Cal BC (Beech & Shepherd 2001; Beech 2003). The age of these mineralized date stones may be significantly older as the radiocarbon dates so far received from Area C (from the adjacent Room 5) span the period 5572–5839 cal BC (Fig. 10). The size and morphology of these date stones is similar to the mineralized examples known from H3 site in Kuwait, with a pronounced groove (Beech 2003).

Radiocarbon dates

A total of ten radiocarbon dates have so far been obtained from MR11 (Fig. 10). Four radiocarbon dates were obtained from the archaeological deposits in



FIGURE 9. Mineralized date stones from MR11, Area A: 1. Context 164 (SF#1700); 2. Context 164 (SF#1658); 3. Context 163 (SF#1609).

AREA	ROOM	SAMPLE REFERENCE	TYPE OF SAMPLE	RADIOCARBON AGE BP	LAB CODE	CALIBRATED RADIOCARBON DATE BC (2 sigma)	DELTA ¹³ C REL. PDB
C	5	Context 510, SF 752, Sample Mar 2017/5	charcoal	6870 +/- 30 BP	Beta-478084	5838–5705 (0.983), 5688–5678 (0.017)	-23.7
C	5	Context 504, SF 645, Sample Mar 2017/3	charcoal	6800 +/- 30 BP	Beta-478082	5839–5713 (1.000)	-23.1
A	1	Context 58, SF 283	charcoal	6750 +/- 40 BP	SUERC-3612	5725–5617 (0.994), 5580–5575 (0.006)	-23.1
C	5	Context 506, SF 691, Sample Mar 2017/6	charcoal	6740 +/- 30 BP	Beta-478085	5712–5620 (1.000)	-23
C	5	Context 507, SF 749, Sample Mar 2017/4	charcoal	6730 +/- 30 BP	Beta-478083	5711–5616 (0.975), 5583–5572 (0.025)	-23.9
A	1	Context 55, SF 195	charcoal	6675 +/- 40 BP	SUERC-3608	5562–5526 (1.000)	-23.4
A	2	Context 87, Sample Mar 2017/1	charred material	5880 +/- 30 BP	Beta-465718	4827–4815 (0.028), 4804–4692 (0.972)	NA
B	4	Context 26, SF 16	ashy soil	5850 +/- 50 BP	SUERC-1181 (GU-11460)	4834–4580 (0.991), 4567–4559 (0.009)	-15.3
A	1	Context 32, SF 17	ashy soil	5630 +/- 50 BP	SUERC-1182 (GU-11461)	4554–4351 (1.000)	-15.7
C	South of 7	Context 529	small mammal bones from raptor pellet – apatite ¹⁴ C date	4220 +/- 25 BP	Muse 18060	2900–2859 (0.508), 2809–2753 (0.427), 2721–2702 (0.065)	-

FIGURE 10. Radiocarbon dates from MR11 (all dates are calibrated with CALIB7.10).

Area A, contexts 32, 55, 58, and 87. Two were charcoal samples, the third was ashy soil from Room 1, the room that also produced Ubaid pottery. The age range of calibrated 2-sigma values suggests that Room 1 in Area A was occupied between c.5700 and 4350 cal BC. A fourth radiocarbon date was on charred material from the upper layers of Room 2, context 87, which provided a calibrated 2-sigma value age range of c.4800–4700 cal BC.

A single radiocarbon date was obtained from a dark ashy soil layer (context 26), which was evident beneath the wall of Room 4 (Area B). The age range of the calibrated 2-sigma values suggests that Room 4 was occupied c.4800–4500 cal BC or later.

Five radiocarbon dates have been obtained from the archaeological deposits in Area C. Four were charcoal samples from Room 5, contexts 504, 506, 507, and 510. Context 507 is where the 'Abu Dhabi Pearl' was found. The age range of calibrated 2-sigma values which bracket the layers above and below the pearl suggests that Room 5 was occupied between c.5800 and 5600 cal BC.

A single sample of small mammal bones from a raptor pellet discovered in a post-abandonment rubble layer (context 529) in Area C, was dated using apatite fraction by Antoine Zazzo at the National Museum of Natural History in Paris. This provided an Early Bronze Age date, although one has to be careful interpreting this as the apatite fraction method of radiocarbon dating does not have the precision of the standard method. Bronze Age pottery has been found at MR12, which is a series of stone cairns at the top edge of the nearby escarpment located c.100 m to the south of MR11. A similar radiocarbon date has also been obtained on charcoal from the grave fill of an apparently Early Bronze Age burial constructed on top of an earlier Neolithic settlement at site GHG0014 on Ghagha Island (DCT 2019). Bronze Age pottery is present on many of the islands along the coast of Abu Dhabi, including Ras Ghanadha, Umm an-Nar, Marawah Island, Sir Bani Yas Island, and Ghagha Island (Carter 2003).

Environment

What is clear from the terrestrial archaeological investigations on Marawah and other barrier islands, is that between 8500 and 7000 years ago islands and coastal areas, rather than the mainland, were the focus of Neolithic settlement. The settlement of Marawah is

located on high ground at the southern extent of the island, an area that appears to have provided favourable conditions for a community based on a maritime economy.

Bathymetric models of sea levels at -10 to -8 m indicate that during the early Holocene Marawah was part of an east-west aligned peninsula. The headland of this peninsula would have been somewhere to the north-east of Sir Bani Yas Island, and would have extended eastwards to join with the mainland close to Abu Al Abyad Island. Between this peninsula and the mainland was an area of water that has a maximum depth of around 10 m, known as the Khor Al Bazim (flood analysis of GEBCO gridded bathymetry data, 15 arc seconds, 2019 and Satellite Derived Bathymetry 5m resolution 2012 to 2019; see www.gebco.net/data_and_products/gridded_bathymetry_data/ [accessed June 2021]). During the early Holocene the peninsula would have provided the Khor Al Bazim with shelter from the deeper waters of the Arabian Gulf and the northern shamal wind. Within the Khor Al Bazim, therefore, the conditions for boat travel, fishing, etc. would have been more favourable than within the Arabian Gulf to the north. As sea levels rose this peninsula would have become a series of islands/archipelagos, of which Marawah is one of the few that remains above sea level (Bird et al. 2010; Stanford et al. 2011; Cuttler & Al Naimi 2013).

Settlement organization

The latest phase of excavations at the site of MR11 has revealed evidence of very different structures within each mound. The building within Area A has a series of stone-built rooms intended for domestic use, with later burials as a secondary, post-abandonment function. The discovery of food waste, flint tools, and shell jewellery would also support this interpretation. Of particular note is the discovery of an earlier phase of construction to the north of Room 3 (Room 10). Part of this earlier building is directly overlain by Room 3, so the two buildings could not have been in use at the same time. There was no surface expression of Room 10 before Area A was extended to the north, which indicates that archaeological remains are present not only within, but also between the mounds. This three-roomed house may have developed in sub-phases reusing stones from earlier structures.

The domestic building within Area A is constructed very differently from the structures within Area C. In Area C the walls of the central room function very specifically as retaining walls for rubble-supported paved areas or platforms. The highest platforms are at the western end of the outcrop, with lower platforms used to elevate the height of the bedrock at the eastern extent of the mound. Deeply stratified ash and charcoal layers fanning out from the entrances on both the north and south sides indicate the clearance of hearth waste from within the central 'room' (7). Platforms used to extend the height of the bedrock outcrop suggests that elevation was important to the function of the structure and may demonstrate an entirely new component besides domestic use.

Excavations on Neolithic sites along the southern Gulf highlight a predominantly mobile population surviving on a pastoral economy. However, the discovery of carefully constructed stone buildings at MR11 challenge this interpretation. While stone buildings may suggest a more sedentary lifestyle, the presence of permanent structures does not in itself indicate a sedentary society as groups could still use ephemeral structures when travelling. What is perhaps more striking is why a predominantly nomadic society would consider building permanent structures? Perhaps a clue to this is revealed by the platforms within Area C. Did these platforms/pavements perform a communal function as a meeting or social gathering place, a place where the local community or even wider groups could come together to communicate, resolve disputes, exchange gifts, or trade? Or like Unit 6 at Bahra 1 in Kuwait (Bieliński 2019), could they be related to a ceremonial and/or cultic space?

More widely, the stone architecture at MR11 contrasts markedly with other late sixth–fifth-millennium BC settlements within the UAE, notably, the circular post-hole structures from Dalma Island and Umm Al-Quwain (Beech & Elders 1999; Beech et al. 2016; Flavin & Shepherd 1994; Méry & Charpentier 2013). Broadly similar circular stone hut or tent foundations dating to the Neolithic are also known at Ras Al-Hamra RH-5, Suwayh SWY-1, and Al-Khabbah KHB-1 on the coastline of the Ja'alan region in the Sultanate of Oman (Marcucci, Badel & Genchi 2021; Cavulli & Scaruffi 2020; Charpentier, Marquis & Pellé 2003: fig. 6). However, in comparison to other examples of Gulf Neolithic stone

architecture, the thickness and height of the walls at MR11 are substantial. At Shagra in Qatar (Inizan 1988: 99–125), as well as at the H3 settlement in northern Kuwait (Carter & Crawford 2010), the walls are narrower and much lower, and most likely could only have served as the base for a superstructure of barasti or similar lightweight materials. As a series of apparently randomly spaced buildings, MR11 also contrasts sharply with the more extensive planned alignment and rectilinear arrangement of rooms at the Bahra 1 site in Kuwait (Bieliński & Szymczak 2016; Rutkowski & Zakrzewski 2014).

Future work

Further excavations on Marawah Island at the MR11 site are planned for February–March 2022 and will continue providing fresh insights into the Neolithic of the southern Arabian Gulf. The presence of two other Neolithic settlements on the island, MR1 and MR2.5 (see Fig. 1) suggests that settled life was more widespread than initially thought. We hope to carry out further investigations of these sites in the future to determine if these are broadly contemporary. Of particular interest is the extent to which the local population selectively adapted, experimented, and created their own version of the so-called Neolithic Package through a unique blend of local and 'foreign' elements (Magee 2014: 52). While some material culture is clearly imported or demonstrates external influences, such as the Ubaid pottery, some of the lithic finds, and some of the stone beads, most finds were manufactured from materials that were available locally or regionally. Social groups clearly identified themselves with particular locations within the landscape. The distinctive use and manufacture of plaster vessels on Marawah and Delma Islands and the use of locally available mineral sources indicates a cohesive social community within this part of the lower Gulf at this time. While these communities do not appear to have adopted agriculture or traditional pottery manufacture, as in Levantine Neolithic communities, they built well-structured architecture, produced plaster vessels, and maintained some domestic animals. At the same time, they continued to hunt and relied primarily on maritime resources such as fish, dugongs, turtles, crabs, and marine shells for their daily subsistence (Beech 2004; Lidour & Beech 2019a;

2019b). These subsistence strategies, combined with a clear maritime trade, identify cohesive groups within the lower Arabian Gulf that created their own pathways in contrast to other Neolithic communities elsewhere in the ancient Near East and Europe at that time.

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