The International Journal of Nautical Archaeology (2007) **36**.2: 265–281
doi: 10.1111/j.1095-9270.2007.00151.x

Locating the Harbour: Myos Hormos/Quseir al-Qadim: a Roman and Islamic Port on the Red Sea Coast of Egypt

Lucy Blue

Centre for Maritime Archaeology, University of Southampton, School of Humanities, Avenue Campus, Highfield, Southampton, SO17 1BJ, UK

Recent maritime investigations at Quseir al-Qadim, on the Red Sea coast of Egypt, have revealed the importance of this port in both the Roman and later Islamic periods. This paper outlines the key evidence for the location of the harbours, from survey, sedimentological analysis and selective excavation. The Roman harbour, occupied between the 1st century BC and the 3rd century AD, was located in a now-silted lagoon. Over 100 sedimentological cores indicated its siltation process. By the time the site was reoccupied in the 12th century AD, the harbour was reduced to a small bay at the entrance to the former lagoon.

Key words: Harbour, Roman, Islamic, Red Sea, sedimentology, silted lagoon.

From at least the middle of the 2nd millennium BC Egypt was sending vessels to the mouth of the Red Sea, to Punt and beyond, to bring back myrrh and frankincense, along with other exotic artefacts of trade and tribute (Casson, 1989: 11, n.2; Bard and Fattovich, 2004). Subsequent voyages were undertaken by Phoenician, Arab, and Indian seafarers. However, it was not until descriptions given by the Classical geographers, and accounts in the 1st-century-AD *Periplus Maris Erythraei* (Casson, 1989) of voyages within the Red Sea and beyond, that detailed evidence for these seafaring activities was forthcoming. From the late-1st century BC, when Egypt became part of the Roman Empire, Roman merchants plied the route to Arabia and India in ever-increasing numbers. Key to this development of trade and maritime activity was the role of harbours, providing an interface between land and sea and a conduit for the transfer and storage of goods. It is clear from both the archaeological and documentary evidence that one harbour in particular, Myos Hormos, played a major role in facilitating trade along the northern reaches of the Red Sea coast, and with its sister port Berenike to the south, acted as the departure point for exports from the Roman world (Sidebotham, 1986; Casson, 1989; Peacock and Blue, 2006a).

The location of Berenike has long been established. Strabo (17.1.45) states that Ptolemy II Philadephus cut a road across the desert to the port in the late-3rd century BC, and according to the *Periplus* it was located 1800 stades (300 km) from Myos Hormos (Casson, 1989). The location of the Roman port of Myos Hormos, however, was until recently in dispute. Peacock (1993) first proposed that the site of Quseir al-Qadim was potentially Myos Hormos of the *Periplus.* And recent discoveries at Al-Zerqa (a Roman station on the road between the coastal site of Quseir al-Qadim and Coptos in the Nile Valley) (Bülow-Jacobsen *et al.*, 1994), and excavations at Quseir al-Qadim, have revealed a wealth of evidence in the form of papyri, ostraca (Van Regen, 2000: 51) and archaeological data, which now confirms that Quseir al-Qadim was the Roman port of Myos Hormos (Peacock and Blue, 2006a). It is clear from historical sources that Myos Hormos was a major Roman trading port; Strabo, for example (2.5.12), states that 'Now 120 ships sail from Myos Hormos to India', and the archaeological record reveals a wealth of imported artefacts.

Trade activity at Myos Hormos ceased with the decline of the Roman Empire in the early-3rd century AD, but after a period of abandonment of some 1000 years, the Islamic port of Quseir al-Qadim was again thriving. It is described by Arab geographers as the Red Sea port of Qus (Garcin, 1976; Whitcomb and Johnson, 1979: 3)

Published by Blackwell Publishing Ltd. 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

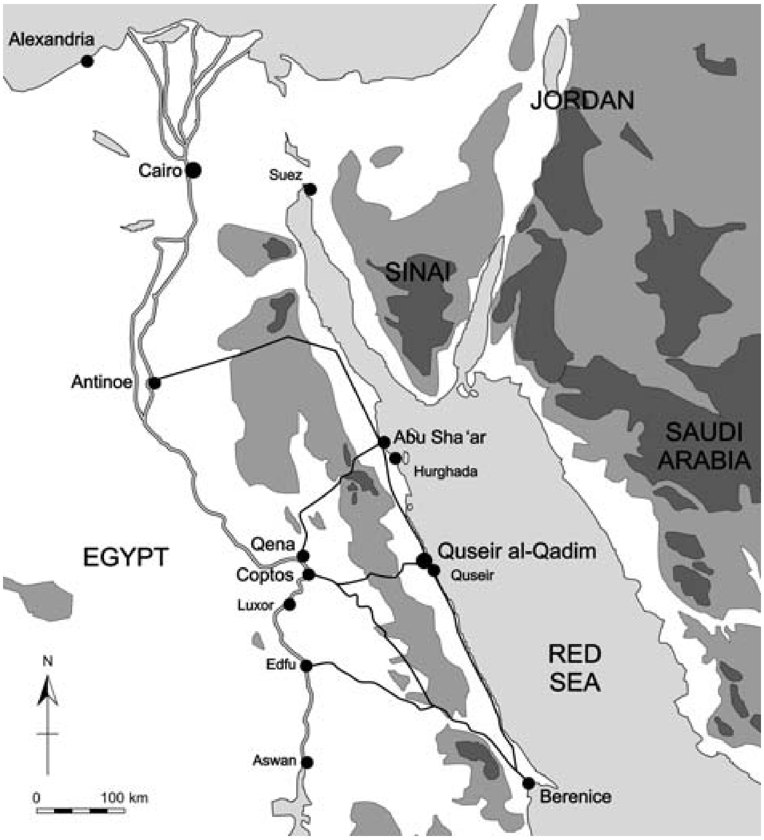

Figure 1. Location of Quseir al-Qadim and Berenike. (shading indicating relief)

and for a while operated alongside the chief port in this region, Aydhab, facilitating trade and overseeing the protection of pilgrimage to the Holy Cities, particularly Mecca. Yaqut (626/1228) describes it as 'a harbour of Yemenite ships' (trans. D. Agius), and Qalqashandi, writing in the 14th century, recorded how ships frequented the port in order to transport merchandise the shortest distance across the mountains to Qus (Al-Qalqashandi 1913, iii: 465, cited by Whitcomb and Johnson, 1979: 4). Archaeological evidence confirms activity at the site until the beginning of the 16th century, when operations appear to have shifted to the present town of Quseir some 8 km to the south (Peacock, 2006a: 4).

Location and previous research

Quseir al-Qadim occupies a crucial position on the Egyptian Red Sea coast (Fig. 1). It is located at the end of Wadi Hammamat, the route which connects the Luxor region of the Nile Valley (Coptos) some 180 km across the Eastern Desert to the west, with the Red Sea. The port of Quseir al-Qadim lies at the head of a bay or *mersa*, behind which is a silted lagoon or *sabkha* (Fig. 2). The small inlet cuts the Late-Pleistocene coral reef which runs parallel to the shore (Plaziat *et al.*, 1995). The main area of the site (over 10 hectares) is located on the northern arm of this reef terrace, approximately 8 m above the silted lagoon, overlooking the entrance to the bay to the south and west (Fig. 3). The silted lagoon extends some 700 m inland to the west, is approximately 2 km long (north to south), and is linked to the back of the bay by a silted channel. Two wadi systems, Wadi Quseir al-Qadim and Wadi al-Anz, drain into the western reaches of the lagoon, although in recent years the wadi flow is limited to rare periods of flood. Surrounding the site to the west and south are the foothills of the Eastern Desert.

Early investigations at the site by Whitcomb and Johnson (1979; 1982a; 1982b) established that it was occupied from the late-1st century BC to the beginning of the 3rd century AD, and reoccupied again some 1000 years later in the Islamic period from the 12th to early 16th centuries AD. They suggested that 'the present sabkha behind Quseir al-Qadim might have been a shallow

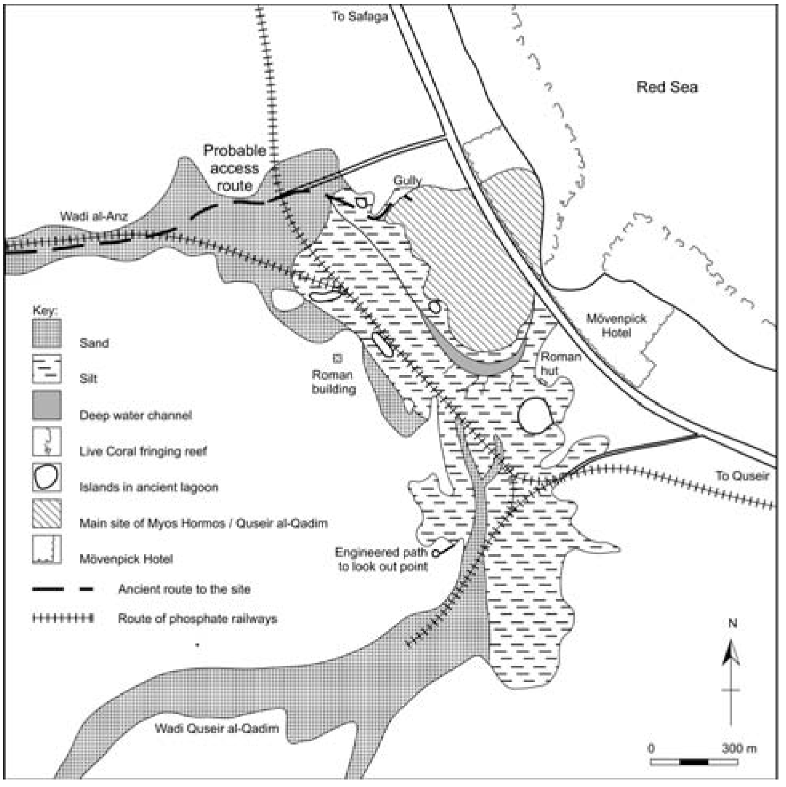

Figure 2. Site of Quseir al-Qadim and the silted lagoon.

Figure 3. View of Quseir al-Qadim and the silted lagoon taken from the north of the site from a hot-air balloon. (Ayman S. Taher)

lagoon suitable for naval utilization' (1979: 1) and identified two areas of interest (Fig. 4). The first is the so-called 'island' to the south of the site, situated in what Whitcomb and Johnson refer to as the Roman 'harbour area' (1979: 37, pl.12, S11–12). This area is currently located on the northern edge of the silted channel, and the 'island' (some 4 m above the surrounding area) revealed walls of Mamluk houses standing on an accumulation of sand and gravel over 3 m deep. Bedrock was not reached but the lower levels revealed Roman pottery dating from the 1st to 2nd centuries AD. Whitcomb and Johnson described this as a 'spoil heap from successive Roman dredging operations' in the harbour (1979: 37). They also interpreted the low area between the higher ground of the main site to the north and the 'island', as being 'open water in the Roman period', which served as the site of the Roman harbour (1979: 37). Despite their identification of two possible quay walls on either side of the harbour depression (1982a: 8), subsequent sedimentological investigations of the silted lagoon by the University of Southampton have rendered this interpretation redundant, as explained below.

Whitcomb and Johnson's excavation and research priorities were not the specific identification of the harbour (1979: 7–8), but they did conclude that in 'the absence of any possibility of agricultural hinterland and the [fact that] results from the excavations had pointed to a considerable capital investment in the foundation and maintenance of the port (e.g. Roman dredging operations to keep the harbour open), Quseir al-Qadim was seen to take its locational rationale ... as a focus of communications located by convenience of external contacts' (1982a: 11). Tantalising accounts of finds including metal nails indicating shipbuilding activities, fishing-hooks, sailmakers' awls and needles, as well as toggles and pulleys (Whitcomb and Johnson, 1979: 203), were the primary indications of port activities, besides those specifically relating to goods of trade and exchange. The significance of the site, therefore, is clearly determined to be based on its role as a port, and therefore the value in actively seeking out the harbour area and associated warehouses cannot be underestimated in terms of both furthering our appreciation of the specific port complex, and understanding the broader trade mechanism within which the port operated.

A number of questions specifically relating to the port at Quseir al-Qadim still remained unanswered. Besides needing to establish the full importance of the port, particularly its role in facilitating trade, the Roman and Islamic harbours still remained elusive—the exact location, dimensions and depth of the harbours, the dimensions of the entrances, and the detailed layout of the associated harbour facilities, were not yet known.

Methodological approach

In 1999 the University of Southampton commenced a re-investigation of the site of Quseir al-Qadim. Since then five seasons of excavation have considerably added to our knowledge of this important port (Peacock and Blue, 2006a). One of the key objectives of the Southampton investigation was to confirm the location of the harbour in both the Islamic and Roman periods. Excavations focused on the western regions of the site, which are predominantly Roman in occupation, with some occupation and reuse in the Islamic period, as well as overlying Islamic *sebakh* or rubbish layers (Fig. 4). The dry conditions ensure excellent preservation of artefacts, particularly organic materials, which have added greatly to our understanding of trade in the Red Sea and beyond. However, to survive 'the ancient port must ... have relied on the import of food' (Van der Veen, 1999: 40); the water supply was limited and basic raw materials were virtually non-existent (Peacock, 2006b: 11–12). The main objective, therefore, of the maritime-orientated investigation, was to examine the harbour area, attempting to define its exact extent and configuration during both the Islamic and earlier Roman periods, in order to ascertain how it may have changed over time, and why. Specific objectives were: to confirm that the current 'silted lagoon' was at one time open to the sea and functioned as a harbour; to clarify the extent and depth of the ancient harbour in both the Roman and Islamic periods; and to identify the nature and location of the Roman and Islamic waterfronts.

Attempts to locate the harbour were undertaken employing a number of methods, primarily survey, both topographical and geophysical (magnetometry), which mapped the site and provided some indication of sub-surface anomalies, particularly in relation to the nature and extent of the underlying bedrock (Earl and Glazier, 2006: 34–42). Subsequently, a sedimentological investigation was conducted, guided to an extent by the geophysical survey and aided by targeted excavation. In order to ascertain the nature of the sedimentary

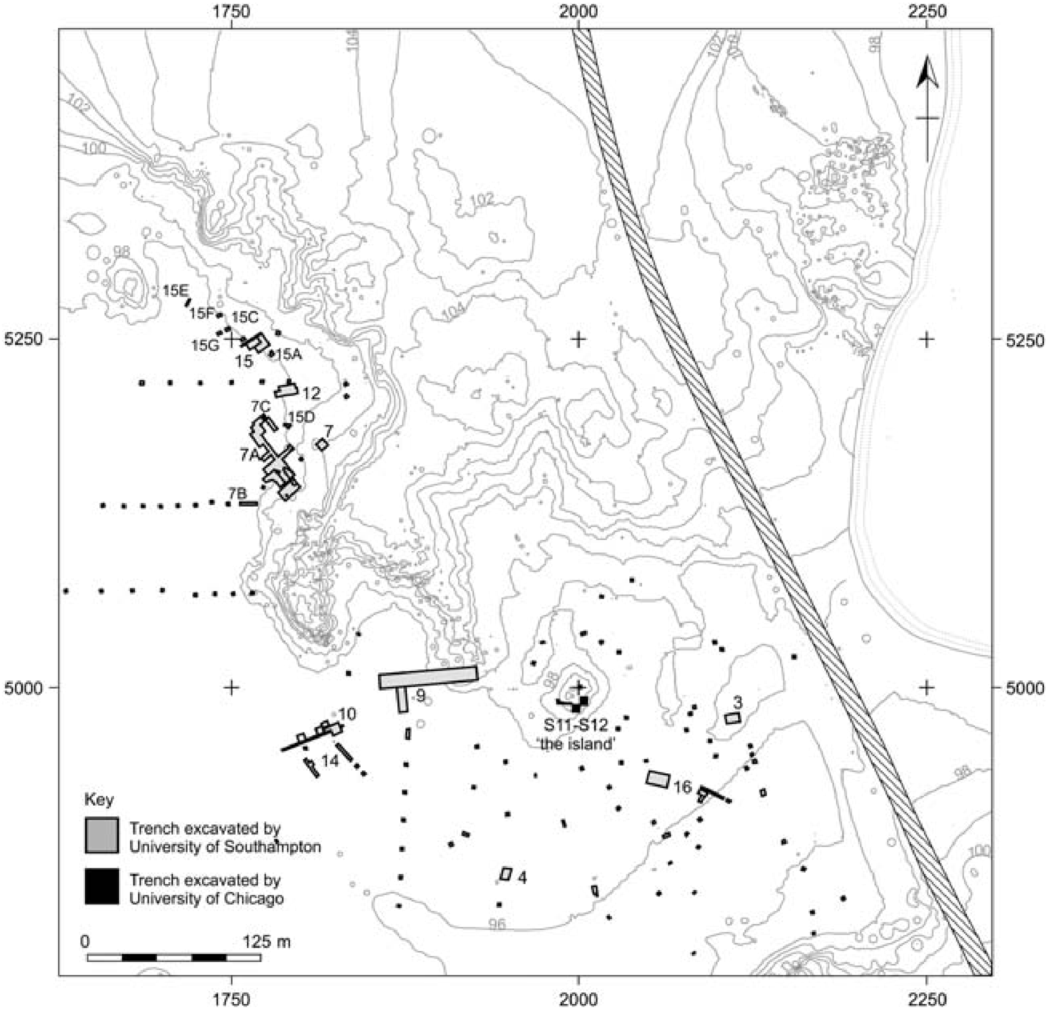

Figure 4. Location of excavation trenches at Quseir al-Qadim. (1-m contour intervals; MSL at 95.5 m LD)

stratigraphy, and hence identify the process of siltation which operated within the harbour, over 100 pits were excavated along predetermined transects (Fig. 5) and auger core samples extracted from the majority of the pits (Blue, 2006b: 43–61).

Any assessment of the sedimentary regime of coastal lagoons would not be complete without an appreciation of the relative sea-level curve for the region. In the Red Sea region a detailed relative sea-level curve has yet to be determined for the Holocene period. However, a eustatic curve developed exclusively from Red Sea Basin data indicates that the last 2000 years appear to have been relatively stable (Siddall *et al.*, 2003). Likewise, tectonic activity along this portion of the Red Sea coast is thought to have been negligible during the last 150,000 years (Plaziat *et al.*, 1995). As limited precise detail was available for current mean sea-level, a number of sea-level measurements were taken and an average high-water level of 95.8 m LD (local datum) was recorded on the site-grid. The average high-water mark was considered in relation to the average tidal range of 0.6 m (Braithwaite, 1987: 41; Said, 1990: 356, 359) to indicate a current MSL of 95.5 m LD (the topographical site-maps reference the LD (local datum) whereas the sedimentological cross-sections have been altered to reflect the actual MSL).

A number of transects were established across the lagoon, and samples extracted from pits and cores associated with these transects so that a comprehensive sedimentary record could be compiled for subsequent grain-size analysis and foraminifera examination (Fig. 5) (Blue, 2006b: 43). Transects were located in order to gain an

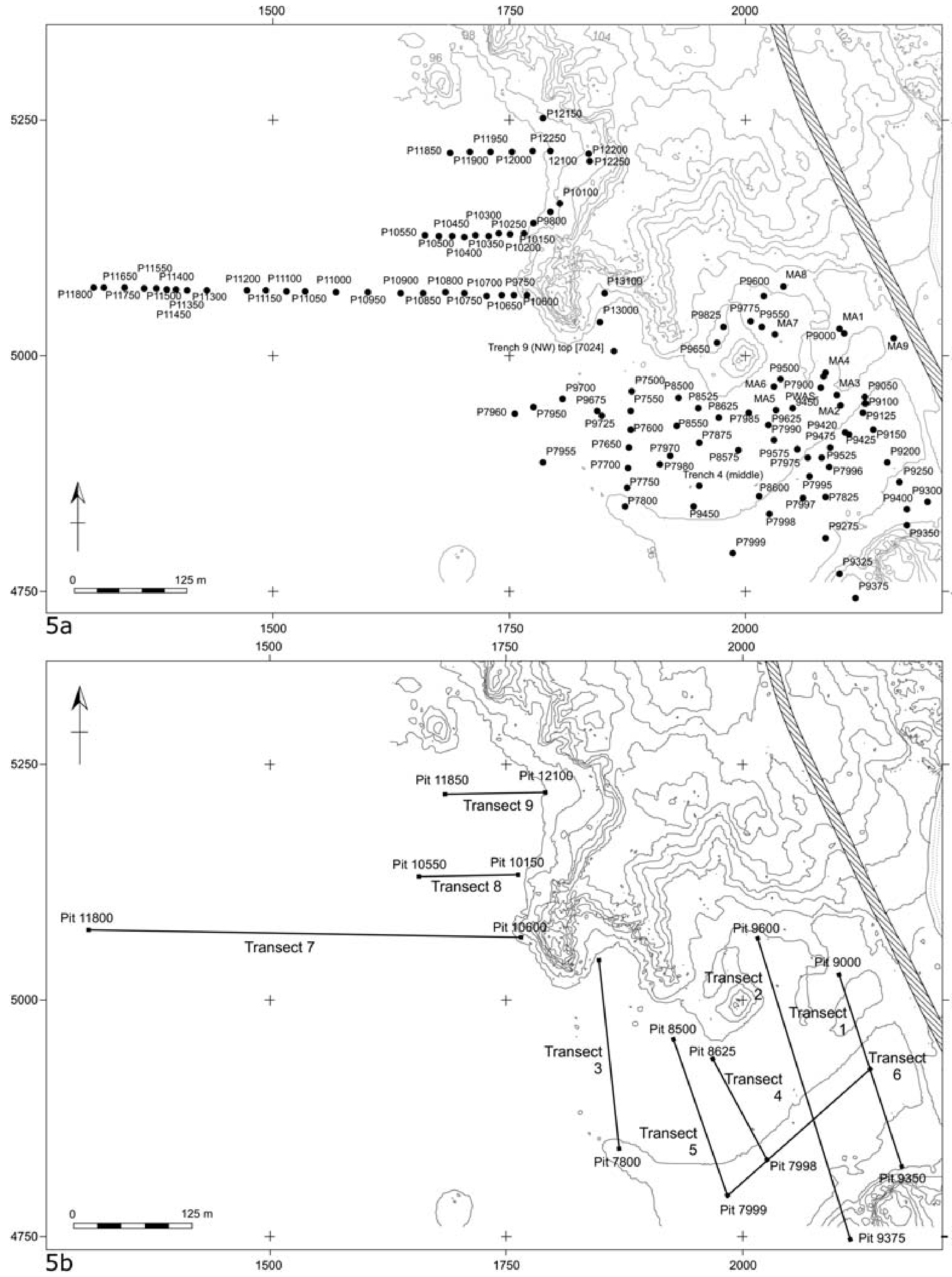

Figure 5. (a) Location of sedimentary pits and auger cores indicating irregular spacing. (b) Location of sedimentary transects 1–9.

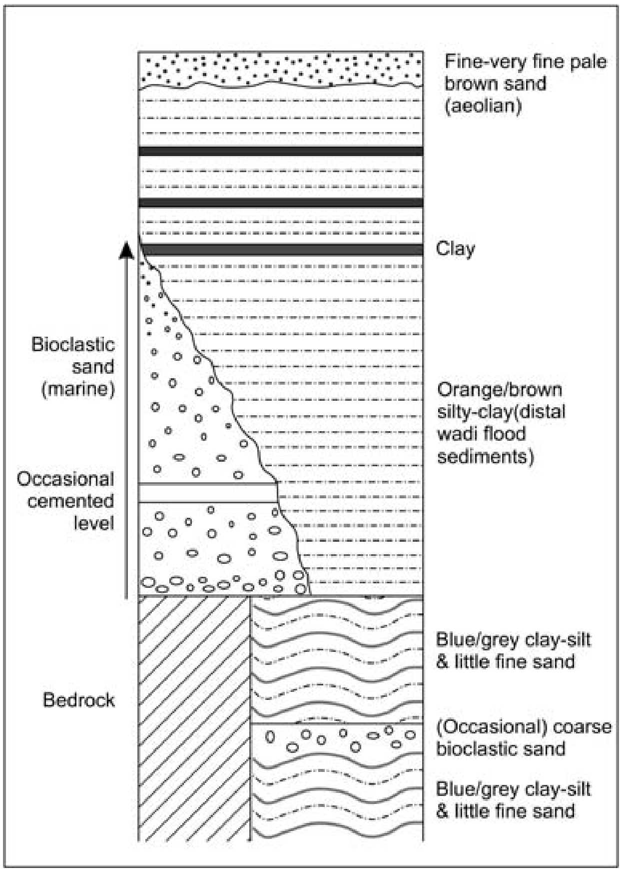

Figure 6. Generalised lithological sediment units.

appreciation of the sub-surface cross-section of the channel and inner reaches of the silted lagoon across its length, in order to map the sequence of sedimentation over time. The sedimentary record yielded two key horizons which equate to contrasting marine-lagoonal environments (Fig. 6); bioclastic beach sand and marine silts and clay (Blue, 2006b). The latter was the key unit to dominate the inner silted lagoon to the west of the main site, and was indicative of a low-energy, marine lagoonal environment. It was the investigation of these low-energy sediments that ultimately led to the identification of the site of the Roman harbour.

Identification of the Roman harbour

Excavations conducted to the west of the site on the lower reaches of the inner lagoon, in an area where a marshy mangrove swamp had once flourished, were to reveal part of a late-1st century BC to early-3rd century AD Roman waterfront (Peacock and Blue, 2006b: 65–94). The lower blue/grey silt and clay horizons contained fragments of mangrove wood, *Avicennia marina* (pers. comm. M. Van der Veen), and bivalve shells commonly associated with mangrove environments (pers. comm. S. Hamilton-Dyer). The development of the harbour extended from the edge of a narrow strip of the Late-Pleistocene coral bedrock that levelled out after sloping steeply from the main site above, and extended westwards towards the water's edge. Initial development of the harbour involved reclamation of the mangrove swamp, presumably in order to extend the working area of the harbour-front. This was undertaken by placing amphoras along the water's edge and packing them into the shallow inter-tidal muds. On top of the amphoras a surface of trampled earth was observed, forming an artificial extended foreshore which facilitated and extended access across the waterlogged sediments at the margins of the lagoon.

This feature took a different form depending on its location within the harbour. In the south (Trench 7A; Blue and Peacock, 2006: 68–74), a series of small stone walls (Figs 4, 7 and 9 [10009]) and lines of amphoras (Figs 4, 7 and 9 [10028]) were packed with broken amphoras and lagoonal silts and supported a surface (Figs 7 and 9 [10021]) that similarly extended from the bedrock

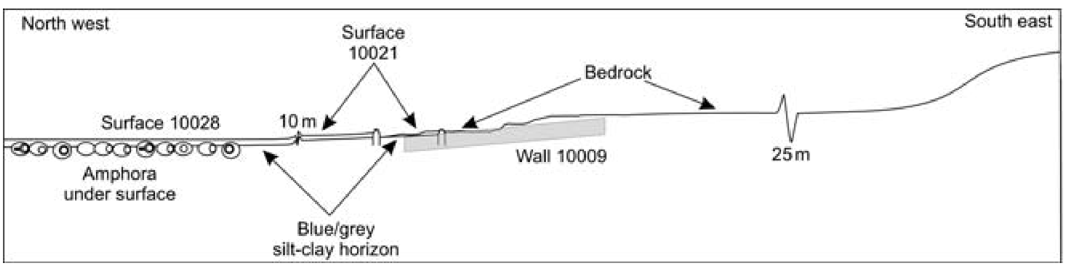

Figure 7. Generalised cross-section of the waterfront in the area of the jetty. (Trench 7A)

Figure 8. View of the amphora foundation of the jetty ‘hard’ in the silted lagoon, from the north. (Trench 7A)

out into the lagoon as a form of land-reclamation or a ‘hard’. In this area the amphora ‘hard’ extended further out into the lagoon in a northerly curving jetty or mole, again consisting of an amphora base covered with a packed-earth surface (Fig. 8). This has been interpreted as a rudimentary jetty which is believed to have facilitated access from ship to shore. The top of the amphora jetty, embedded in the blue/grey silt-clay and covered by the packed-earth surface, is located at 95.5 m LD, effectively MSL. The walls to the south-east are located at 96.1 m LD (0.6 m above MSL). The amphoras within it date the feature to the late-1st BC to early-1st century AD, although activity in the area may have continued into the early-2nd century AD (Fig. 9). Therefore, if this did function as a jetty in the early Roman period, the indication is that the MSL has changed little in the intervening 2000 years. The interface of bedrock and blue/grey, silt-clay sediments, combined with the presence of the Roman waterfront, is therefore indicative of a former shoreline during this period, and offers one of many clues as to the nature of the Roman waterfront in this area.

Immediately in front of the harbour landing-place, blue/grey, silt-clay lagoonal sediments were excavated to a maximum depth of 94 m LD (1.5 m below MSL), while a maximum excavated depth of 89.1 m LD (−6.4 m relative to MSL) was reached a short distance offshore into the inner lagoon harbour, indicating that the bed-rock drops off sharply relatively close to the former shoreline. This gives the impression of an inner anchorage with deep enough water to accommodate Roman vessels at anchor (Milne, 1985: 96–9). Figure 10 shows the sedimentary stratigraphy of Transects 7–9 located to the west of the Roman harbour and reveals the depth of blue/grey, silt-clay within the inner lagoon (Fig. 5).

A further harbour-like feature was noted to the north of the ‘jetty’ (Trench 15; Fig. 4) (Thomas, 2006: 87–94), again in an area where mangrove reclamation is evident, above which a levelled raised working surface was created backed by a stone sea-defence wall. This arrangement appears to have soon needed to be replaced by a second surface constructed on a line of amphoras laid in front of the former sea-wall, apparently in order to consolidate the earlier surface that had been damaged by inundation. A similar arrangement was noted in surrounding satellite trenches, although no associated wall was identified. Like the ‘jetty’ to the south, these features date to the late-1st century BC and early-1st century AD. Between this area and the ‘jetty’ to the south, a similar feature was uncovered (Trench 12; Fig. 4) (Blue, 2006c: 81–4). A line of amphoras, acting

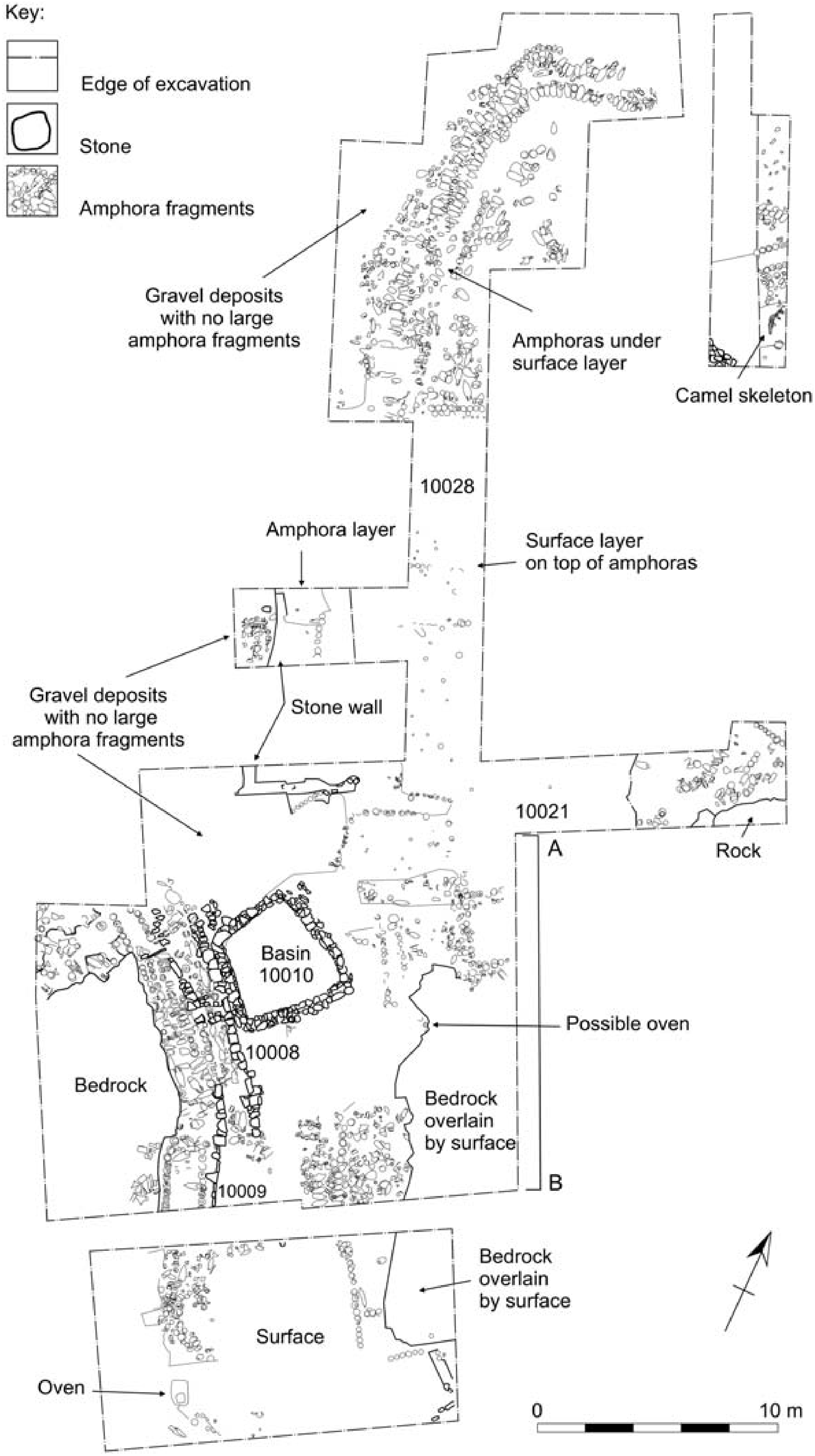

Figure 9. A plan view of the extent of the jetty in the harbour and the amphoras.

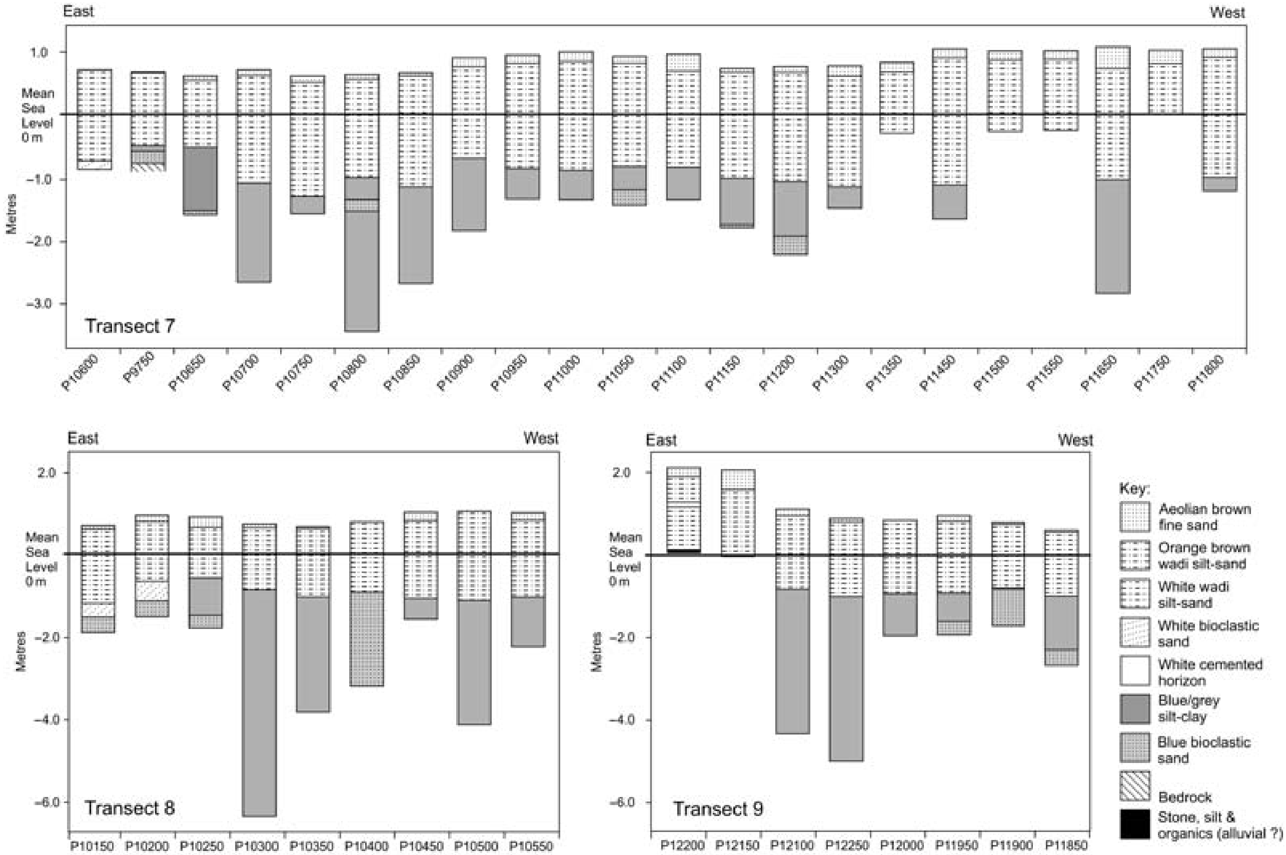

Figure 10. Sedimentary sequence of transects 7–9.

more as a retaining wall or gabion, was sealed by a surface and backed inland by a stone wall. Although this feature is similar in form to the others identified, its date is more ambiguous, possibly relating to a mid-to-late-1st century AD period of construction. Despite this apparent discontinuity in the dating of these features, it does appear that they equate to a continuous waterfront feature, inland of which is an open area. This has been interpreted as a working area to beach boats for repair and to unload goods from lighters serving larger vessels moored in the lagoon offshore. The interpretation was supported by evidence for a series of workshops and industrial units, large numbers of nails and pitch were also recovered, relating to boat repair (Blue, 2006c: 84).

In the subsequent phase of activity dating to the late-1st to early-2nd centuries AD, rebuilding and consolidation of the former sea-defence walls was identified in response to inundation and silting along the foreshore (Thomas, 2006: 87–94; Blue, 2006c: 81–4). To the north, a stone wall was rebuilt by placing stone blocks in a series of headers and stretchers consolidated with mortar. The continued use of the 'southern jetty' is, however, less evident in this later period, although some ceramic remains from the early-2nd century AD were recovered.

Informed by the geophysical and sedimentological survey, excavation has confirmed that an extensive area of the northern reaches of the inner lagoon was used as a harbour from the late-1st century BC to at least the 2nd century AD, backed by a sea-defence stone wall and flanked at least towards its southern extent, by a jetty that was founded on amphoras and extended in a northerly curve into the former lagoon. However, by the beginning of the 3rd century AD the harbour had been abandoned. There are indications that as early as the beginning of the 1st century AD the harbour-front was being subject to episodes of siltation, but at this stage it does not appear to have been serious enough to have caused its abandonment. Further sedimentological investigation was needed in order to establish the cause and sequence of subsequent siltation of the lagoon and the ultimate decline of the Roman harbour of Myos Hormos.

Sedimentary analysis

Nine transects were determined and over 100 sediment cores extracted in order to map the sequence of the siltation of the harbour. Samples were retained and a number were subject to grain-size and foraminifera analysis to determine the nature of the lagoon in which the sediments were deposited, and thus the chronology of the harbour morphology (pers. comm. E. Reinhardt and J. Treutlein). Radiocarbon accelerator mass-spectrometric dating of wood-samples extracted from secure stratigraphic horizons (Fig. 11) helped date the silting process, as did *in situ* ceramic evidence from secure horizons within the sedimentary sequence. The key unit to dominate the inner lagoon was the blue/grey silt-clay lithofacies. Analysis of foraminifera samples taken from blue/grey silt-clay lithofacies confirmed that they had been deposited in a low-energy marine/hypersaline lagoonal environment (pers. comm. E. Reinhardt and J. Treutlein; Murray, 1991: 397).

The sequence of subsequent siltation of the harbour was then mapped through stratigraphically-dated horizons from a number of pits. From the south-westerly limit of the inner lagoon (Pit 7960) (Figs 5 and 11) a wood sample taken from the top of the blue/grey silt-clay horizon (indicative of the final stages of the low-energy marine environment) provided a radiocarbon date of 1249 ± 31 BP (calibrated 680–880 AD). From Transect 3, the most westerly transect within the channel, a wood sample taken from the top of the blue/grey silt-clay horizon (Pit 7650) has an uncalibrated date in radiocarbon years BP of 969 ± 29 (calibrated 1010–1160 AD). A second wood sample was taken from Pit 7750 (also in Transect 3) from an occupation horizon within the upper orange/brown silt-sand horizon, implying this was deposited in a period when the lagoon had already silted up in this area. The sample indicated activity dating to 890 ± 45 BP (uncalibrated; 1020–1250 AD calibrated) (Fig. 11). This evidence indicates a gradual silting process, in sequence, from the inner, western reaches of the lagoon towards the western end of the channel entrance of the lagoon, from at least *c*.700 AD to 1160 AD (Figs 5 and 11).

The second horizon that is clearly identifiable in this sedimentation process is the large amount of bioclastic beach sand that becomes increasingly evident towards the entrance of the former lagoon. These bioclastic sands, made up of coral fragments, shell, lithics and large-grain sands, are indicative of a high-energy environment. They dominate the entrance to the lagoon, particularly to the north of the channel (Figs 5 and 11). Analysis of cores from the northern edge of the channel entrance (Transect 1) (Figs 5 and 11), reveals that the upper margin was bound by a bioclastic sand horizon up to 3 m deep. Foraminifera from sediment samples (MA7 and MA2, Transect 1; Figs 5 and 11) below the upper bioclastic sand horizons indicate a previous marine lagoonal environment (pers. comm. E. Reinhardt and J. Treutlein; Murray, 1991: 397). At depth (Transect 1, MA2) (Figs 5 and 11) sediments indicative of the harbour base at around 68 m LD (27.5 m below MSL) were identified, which provide some indication of the maximum channel depth. To the north of the channel (Transect 1, MA1 and MA4) (Fig. 11) it would appear that bioclastic sand characterised the entire sequence, indicating accumulation of beach material along the coastline.

It is likely that the bioclastic sands were deposited as a process of southward longshore drift, a product of the northerly winds which prevail along the Red Sea coast, together with storm activity and tidal action (Dalrymple *et al.*, 1992; Davies and Morgan, 1995: 26). This sedimentary pathway crossed the entrance to the lagoon, creating sand-bars at the lagoon entrance and infilling its northern margin. The restriction caused by the deposition of bioclastic sand is thought to have been the major catalyst for the gradual siltation of the harbour. This process of sedimentation has been noted at a number of *mersas* or bays along the Red Sea coast, and the impact was more noticeable due to the cessation of sea-level rise which occurred at the end of the Holocene just prior to Graeco-Roman activity in the region (Davies and Morgan, 1995; Plaziat *et al.*, 1995; Komar, 1998: 25–38).

The presence of the bioclastic sand in this area only serves to confirm the hypothesis presented by Whitcomb and Johnson, that the occupants of Myos Hormos were experiencing increasing problems with harbour siltation and a build-up of bioclastic sands in the area of the 'island', problems which resulted in 'Roman dredging operations' (1979: 37). It is difficult to imagine how this material could have been deposited on the 'island' spoil-heap by natural means. The 1st-to-2nd-century AD pottery found at the base of the heap confirms that it was deposited no earlier than this period and no later than the Mamluk houses which were found on top of this 3 m high

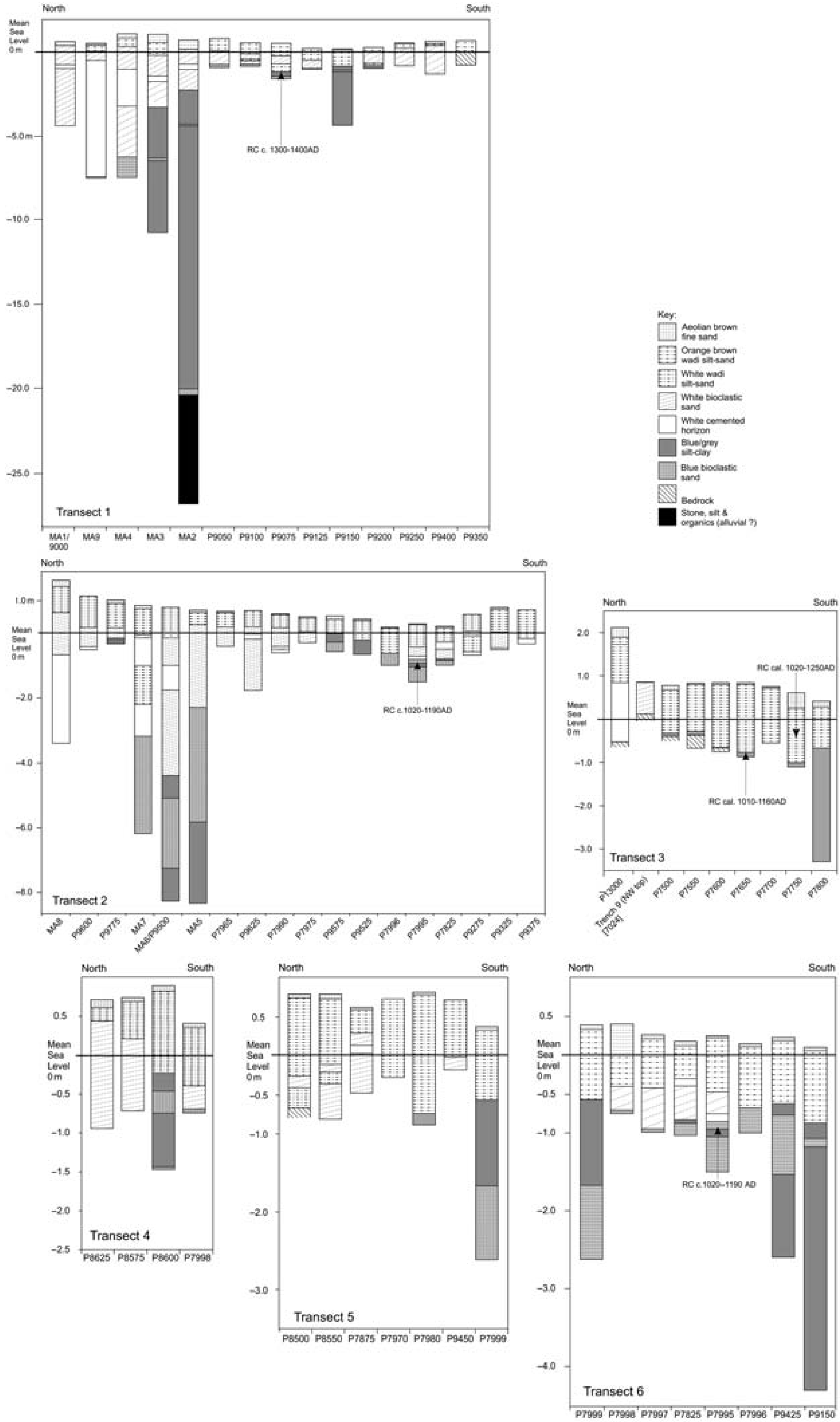

Figure 11. Sedimentary sequence of transects 1–6.

pile (Whitcomb and Johnson, 1979: 37). This interpretation reinforces this hypothesis, and suggests that the Roman occupants were therefore obliged to dredge the bioclastic sand in an attempt to prevent the narrowing of the entrance and limit the silting process that was ultimately to disable the harbour of Myos Hormos. By the Islamic period it would appear that as a consequence of the build-up of bioclastic sand and siltation of the channel, a smaller *mersa* or embayment eventually emerged towards the outer reaches of the channel entrance some 200 m back from the current shoreline, possibly a product of storm overwash across the barrier. This small embayment was to house the Islamic harbour.

At 94.75 m LD (0.75 m below MSL) in Pit 7995 (Transect 2 and Transect 6) (Figs 5 and 11) a cemented horizon was identified sealed by *c.*0.3 m of bioclastic sand and sealing a blue bioclastic sand horizon. At the base of the blue bioclastic sand, a wood sample was recovered which has an uncalibrated date of 942 ± 34 BP, *c.*1020–1190 AD. This dated horizon from a pit located towards the middle of the former channel indicates that by this period the sand-bar had built out some considerable distance across the width of the channel entrance. This would therefore imply that some time prior to the 12–13th centuries AD the entrance of the lagoon was finally blocked and had stabilised as a shoreline. This theory is supported by the presence of Islamic buildings within the channel of the former silted lagoon (Trench 4 and Trench 16; Fig. 4), located on bioclastic sand deposits and above and within the orange/brown distal wadi sediments.

Deposition of bioclastic sand also appears to have continued throughout the period of Islamic occupation, as indicated by, among other examples, the excavation of Trench 3 (Fig. 4) located to the north of the channel entrance, where the earlier phase of Islamic occupation is divided from the later Islamic occupation phase by *c.*0.4 m of bioclastic sand. This would indicate that sand was still accumulating along the shores of the Islamic anchorage throughout the period of occupation. This is not to suggest however, that the situation was always stable. We only have limited dates to pin our interpretation on, and while the overall picture seems fairly certain, there is no reason to assume that during past periods of higher wadi flow the barrier may not have been temporarily removed. Likewise, winter storms can have a similar effect. However, the general implication is that some time prior to the 12–13th centuries AD the entrance of the lagoon was finally blocked and stabilized as a shoreline (Blue, 2006b: 43–61).

Description of the Roman harbour

On entering the channel to the Roman harbour of Myos Hormos, the northern shores would have been characterised by bioclastic sands that dominated the area between the channel and the southern slopes of the site (Fig. 11, Fig. 12). The sediment cores indicate that the channel was deep but relatively narrow, restricted by bioclastic material to the north and bedrock to the south, leaving a maximum width of 150 m. The restricted width of the harbour entrance concurs with textual accounts that describe it as being extremely narrow, crooked or winding (Strabo 16.4.5; Diodorus Siculus 3.39.1–2; Peacock, 1993), ships being guided towards the entrance by two separate landmarks; a conical hill to the south-west of the site, clearly visible from out at sea and referred to by Burton as a 'look out point' (Burton, British Library MSS 25,624–5 and 628, in Peacock, 2006a: 5); and by a smaller hill that lies directly in line with the back of the harbour to the west of the lagoon. This hill has a small path leading up to its summit where Roman pottery was evident (Fig. 2; Peacock 2006a: 5).

Inland towards the western end of the channel, to the south of the main upper site, excavation revealed an open Roman surface leading down to the former water's edge (Trench 9, Fig. 5) (Blue *et al.*, 2006: 100–102). The southern extent of this surface was defined by bedrock which sloped away into a subsidiary channel that fed into the main east-west channel to the south (Fig. 11, Transect 3). This subsidiary channel may have facilitated a secondary mooring for ships in the Roman period. Immediately to the west, on a promontory which defined the western limits of this channel, an area of Roman smelting furnaces, sand extraction and evidence for ship repairs, has been identified (Whittaker *et al.*, 2006). In order to approach the Roman waterfront it would have been necessary for vessels to negotiate around this promontory and hence proceed to the north. The inner reaches of the lagoon provide one of the most sheltered points on the site, particularly when the northerly winds are at their most ferocious. It was also the landward entrance to the site, located at the end of the route across the Eastern Desert from Coptos (Fig. 2) (Peacock, 2006b: 9).

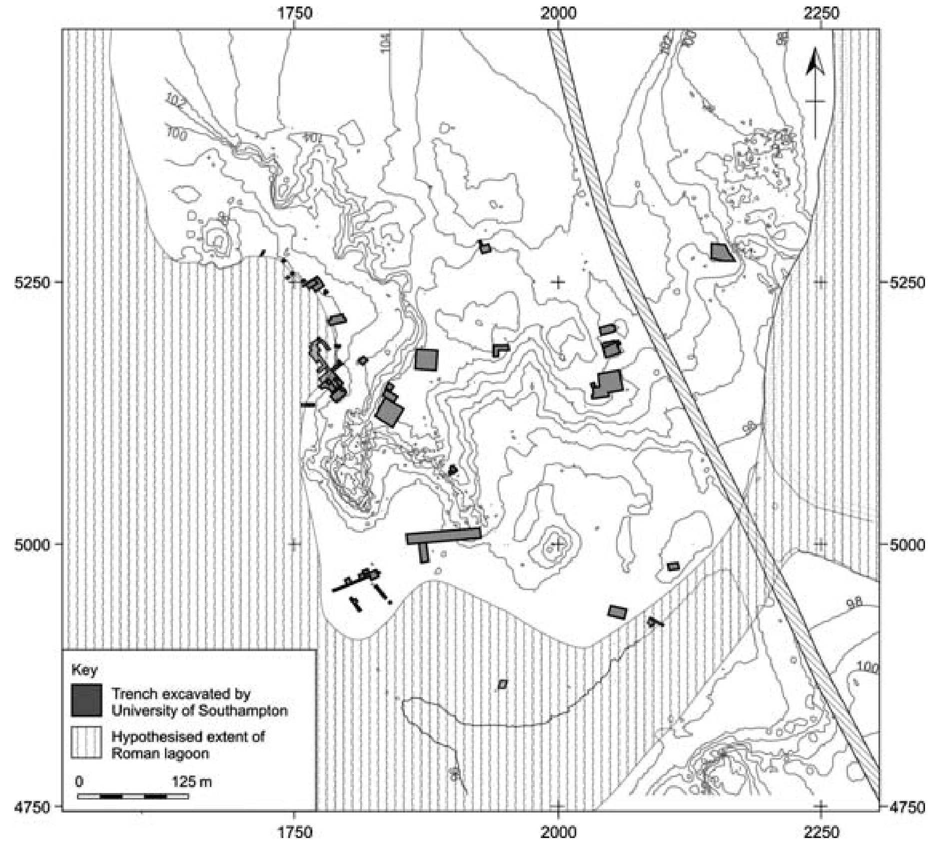

Figure 12. Approximate interpretative reconstruction of the Roman waterfront.

Description of the Islamic harbour

During the 1000-year interval between the end of Roman occupation at the beginning of the 3rd century AD and reoccupation in the 12th century AD, bioclastic sand continued to accumulate in the channel entrance, which caused further constriction of the entrance and invariably accelerated the siltation process. The inner reaches of the lagoon gradually migrated southwards and eastwards, to the point of the accumulating sand-bar at the entrance, disabling the harbour and causing the abandonment of any harbour installations that may have been functioning at the time. To date no Islamic harbour installations have been discovered. However, due to the nature of Islamic harbours, the likelihood of locating any constructed harbour works is extremely slim. The general practice of the period was to beach boats or moor offshore (pers. comm. D. Agius).

The location of the Islamic anchorage towards the east of the site also corresponds with the main concentration of Islamic waterfront structures (Fig. 13). Evidence for workshops, shipbuilding and repair have also been identified in association with the waterfront in this region (Blue, 2006e: 104–15), and to the west of the harbour beneath the southern slopes of the main town, a long building, with small rooms, linked to a second enclosed building with an open central courtyard, is interpreted as a *wikalet* or caravanserai, emphasising the importance of Quseir as a trading centre in the Islamic period (Trench 9) (Blue *et al.*, 2006: 100–102) (Fig. 5).

Maritime finds

The precise nature of the vessels which operated in the harbour of Quseir al-Qadim has yet to be identified. In fact, it is still a subject of much debate for the region in general in both the Roman and Islamic periods (Casson, 1971; Hourani, 1995: 87–114). However, some clues have been revealed through the excavation. Re-used timbers have been recovered from the only two mud-brick graves excavated within the Islamic necropolis on the shore to the east of the site (Macklin, 2006: 157–8). Two sets of timbers covering the

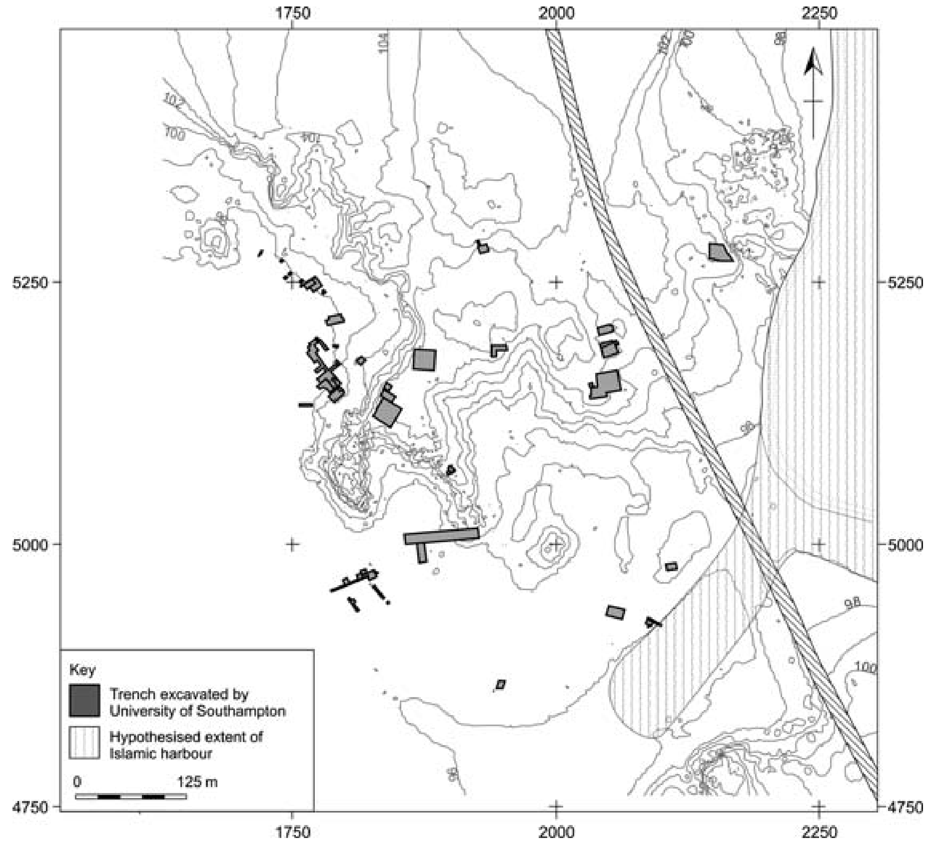

Figure 13. Approximate interpretative reconstruction of the Islamic waterfront.

cist-type graves appear to be re-used ship timbers, one fastened by iron nails, and the other sewn planks with coconut-coir stitches and wooden dowels still *in situ* (Blue, 2006a). The nature of these timbers would suggest that they might have originally been used in the construction of Indian Ocean/Arabian type vessels in the early Islamic period.

The discovery of a wooden deadeye, sheaves and rigging-brails of wood and horn, provide clues as to the operation of square-rigged vessels at Myos Hormos in the Roman period (Blue *et al.*, in press; Whitewright, 2007). However, we have yet to establish whether lateen or square-sails were the predominant type of rig, or what method of construction was used to build the vessels and how they fared against the strong prevailing northerly winds of the region. Further analysis of the maritime artefacts will no doubt provide some clues to a more detailed interpretation of the nature of vessels that operated from Quseir al-Qadim in both the Roman and Islamic periods.

Conclusions

Sedimentological analysis, in combination with excavation, geophysical survey and radiocarbon dating of organic material and pottery extracted from secure horizons, has provided us with a clear indication of the harbour morphology of Quseir al-Qadim from the late centuries BC through Islamic occupation and up to the modern era. The early Roman harbour was located in the inner, more sheltered reaches of the now silted lagoon which was then open water and approached by ships along a deep-water channel. The Roman harbour was a rudimentary affair, a far cry from the sophisticated installations of contemporary harbours in the Mediterranean, being distinguished by a series of ‘hards’ made of old amphoras packed with sediment. However, even during the Roman period the harbour was experiencing problems of siltation, as well as a build-up of bioclastic sand material at the channel entrance. As a result, by the time of Islamic reoccupation in the 12th century AD, the harbour would have been substantially reduced in area, restricted to a small bay or *mersa* that continued to function until it was eventually abandoned in the 15th or early-16th century AD. Finds from both the Roman and Islamic periods provide a wealth of evidence supporting extensive trade in exotic goods with the East. Besides the enormous quantities of Roman pottery, particularly amphoras from the Nile valley and the Mediterranean, ceramics from India have also been discovered, as well as textiles and foodstuffs imported from the East, including coconuts and peppercorns.

Despite acquiring a more comprehensive appreciation of the harbour of Quseir al-Qadim, there are still many questions outstanding, not least the precise morphology of the Islamic harbour. However, what is sure is that the port at Quseir al-Qadim was a significant point of trade in both the Roman and later Islamic periods, situated in a unique location to facilitate exchange between the Orient and the West. We can only hope that future excavation will continue to qualify the role and function of this important port site.

Acknowledgments

This work is indebted to the generous support of the Arts and Humanities Research Board, to David Peacock for giving me the initial opportunity to work at Quseir, to Justin Dix for his guidance with respect to the sedimentology, and to my dear friend the late Nick Bradford with whom I co-ordinated the fieldwork. I am extremely grateful to Ed Reinhardt and colleagues at McMaster University, Canada who conducted the foraminifera analysis. Finally, many thanks to all the Quseir al-Qadim team, particularly Penny Copeland, Graeme Earl and Jill Phillips for all their help with producing images, data and editing text.

References

Bard, K. A. and Fattovich, R., 2003–04, Mersa Gawasis: a Pharonic coastal site on the Red Sea, *Bulletin of the American Centre in Egypt* **184**, 30–31.

Blue, L. K., 2006a, Sewn boat timbers from the Medieval Islamic port of Quseir al-Qadim on the Red Sea coast of Egypt, in L. K. Blue, F. Hocker and A. Englert (eds), *Connected by the Sea. 10th International Symposium of Boat and Ship Archaeology, Roskilde, Denmark*, 277–83. Oxford.

Blue, L. K., 2006b, The sedimentary history of the harbour area, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 43–61. Oxford.

Blue, L., 2006c, Trench 12, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 81–4. Oxford.

Blue, L. K., 2006e, Trench 16, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 104–15. Oxford.

Blue, L. K. and Peacock, D., 2006, Trench 7A, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 68–74. Oxford.

Blue, L. K., Beadsmoore, E., and Phillips, J., 2006, Trench 9, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 100–104. Oxford.

Blue, L. K., Whitewright, J., and Thomas, R., (in press), Roman Imperial Ships—An Eastern Perspective, in H. Tzalas (ed.), *8th International Symposium on Ship Construction in Antiquity, TROPIS 8*. Athens.

Braithwaite, C. J. R., 1987, Geology and palaeogeography of the Red Sea region, in A. J. Edwards and S. M. Head (eds), *Red Sea*, 22–4. New York.

Bülow-Jacobsen, A., Cuvigny, H., and Fournet, J-L., 1994, The identification of Myos Hormos: New Papyrological Evidence, *Bull. Inst. Franç. Arch. Orient*. **94**, 27–42.

Casson, L., 1971, *Ships and Seamanship in the Ancient World*. Princeton.

Casson, L., 1989, *The Periplus Maris Erythraei*. Princeton.

Dalrymple, R. W., Zaitlin, B. A., and Boyd, R., 1992, Estuarine facies models—conceptual basis and stratigraphic implications, *Journal of Sedimentological Petrology* **62**.6, 1130–46.

Davies, S. and Morgan, E., 1995, *Red Sea Pilot*. London.

Earl, G. and Glazier, D., 2006, Site Survey, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 34–42. Oxford.

Garcin, J. C., 1976, *Un Centre Musulman de al Haute-Egypt Médiévale*. Qus.

Hourani, G., 1995, *Arab Seafaring*. Princeton.

Komar, P. D., 1998, *Beach processes and sedimentation*. Upper Saddle River, New Jersey.

Macklin, A., 2006, Trench 1A, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 157–60. Oxford.

Milne, G., 1985, *The Roman Port of London*. London.

Murray, J. W., 1991, *Ecology and Paleoecology of Benthic Foraminfera*. London.

Peacock, D., 1993, The site of Myos Hormos: a view from space. *Journal of Roman Archaeology* **6**, 226–32.

Peacock, D., 2006a, Previous work, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 3–6. Oxford.

Peacock, D., 2006b, Regional Survey, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 7–16. Oxford.

Peacock, D. and Blue, L. (eds), 2006a, *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*. Oxford.

Peacock, D. and Blue, L., 2006b, The Roman harbour, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 67–94. Oxford.

Plaziat, J-C., Baltzer, F., Choukri, A., Conchon, O., Freytet, P., Orszag-Sperber, F, Purser, B., Raguideau, A., and Reyss, J-L., 1995, Quaternary changes in the Egyptian shoreline of the northwestern Red Sea and Gulf of Suez, *Quaternary International* **29/30**, 11–22.

Qalqashandi, Al, 1913, *Subh al-A'sha*, vol. 3. Cairo.

Said, R. (ed.), 1990, *The Geology of Egypt*. Rotterdam.

Siddall, M., Rohling, E. J., Almogi-Labin, A., Hemleben, Ch., Meischner, D., Schmeizer, I., and Smeed, D. A., 2003, Sea-level fluctuations during the last glacial cycle, *Nature* **423**.19, 853–8.

Sidebotham, S. E., 1986, *Roman economic policy in the Erythra Thalassa 30 BC–AD 217*. Leiden.

Thomas, R., 2006, Trench 15, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 87–94. Oxford.

Van der Veen, M., 1999, The Plant Remains, in D. Peacock, L. Blue, N. Bradford, and S. Moser (eds), Myos Hormos—Quseir al-Qadim: A Roman and Islamic Port Site. Interim Report 1999, 40–43. Unpublished circulated report, University of Southampton.

Van Regen, W., 2000, The Written Material, in D. Peacock, L. Blue, N. Bradford, and S. Moser (eds), Myos Hormos—Quseir al-Qadim: A Roman and Islamic Port Site. Interim Report 1999, 40–43. Unpublished circulated report, University of Southampton.

Whitcomb, D. S. and Johnson, J. H., 1979, *Quseir al-Qadim 1978. Preliminary Report*. American Research Centre in Egypt, Cairo.

Whitcomb, D. S. and Johnson, J. H., 1982a, *Quseir al-Qadim 1980. Preliminary Report*. American Research Centre in Egypt, Vol. 7. Malibu.

Whitcomb, D. S. and Johnson, J. H., 1982b, Season of Excavation at Quseir al-Qadim. *American Research Centre in Egypt, Newsletter* **120**, 24–30.

Whitewright, J., 2007, Roman Rigging Material from the Red Sea Port of Myos Hormos, *IJNA* **36**.2.

Whittaker, P., Walsh, M., and Blue, L., 2006, Trench 10A, 10B and 10C, in D. Peacock and L. Blue (eds), *Myos Hormos—Quseir al-Qadim: Roman and Islamic Ports on the Red Sea. Volume 1: Survey and Excavations 1999–2003*, 74–81. Oxford.

Yaqut al-Hamawi Mujam al-Buldan, 1228, *Dar al-kutub al-allmiyya, nd.* Vol. IV: **417**. Beirut.

